

Designing a Third Space Science Methods Course

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Abstract

The third space of teacher education (Zeichner, 2010) bridges the academic pedagogical knowledge of the university and the practical knowledge of the inservice K-12 teacher. A third space elementary science methods class was taught at a local elementary school with inservice teachers acting as mentors and allowing preservice teachers into their classes each week. Preservice teachers applied the pedagogical knowledge from the course in their elementary classrooms. The course has been revised constantly over six semesters to improve its logistics and the pre-service teacher experience. This article summarizes how the course has been developed and improved.

Introduction

Science methods courses for preservice teachers (PSTs) can be redesigned not only for the benefit of these university students, but also for inservice mentor teachers (MTs). Embedding a methods course at a local elementary school creates a hybrid or “third space” (Zeichner, 2010) in teacher education with the opportunity of helping guide both preservice and inservice teachers toward inquiry-based teaching practices and three-dimensional science instruction as envisioned by the Next Generation Science Standards (NGSS Lead States, 2013). Three-dimensional science instruction involves designing lessons and units around disciplinary core ideas from science content, scientific and engineering practices that these fields of inquiry use, and crosscutting concepts that are themes found in all of science. This article will describe how this model was implemented and revised over six academic semesters with a vision of improving science education for both current and future teachers.

The Third Space of Teacher Education

The traditional model of preservice teacher education in the United States consists of methods courses in which PSTs learn pedagogy in university classes. Then, PSTs apply what they have learned in field experiences in schools (Cochran-Smith, & Lytle, 2009; Korthagen & Kessels, 1999). Thus, the first two “spaces” of teacher education are the academic college classroom and the field practicum/student teaching site. A “third space” approach to teacher preparation seeks to break down the divide between the practical knowledge of the K-12 school and the academic knowledge of the university during the early and mid-stage “methods courses” (Zeichner, 2010).

Zeichner argues that third spaces in teacher education move away from the view of academic knowledge as the authoritative source of knowledge. He states that in the traditional college classroom, academic knowledge is privileged over practical knowledge. A third space reduces this privileging. One of Zeichner's categories of third spaces includes *mediated instruction and field experiences* in which methods courses can be taught in an elementary or secondary building in such a way as to leverage the practical knowledge of the inservice teachers. An effective third space methods course requires that university faculty develop collaborative relationships with teachers so that university faculty also engage in learning (Taylor, Klein, & Abrams, 2014). Also, the course schedule needs to be designed for the benefit of PSTs being in classrooms rather than convenience of scheduling the activities and discussions led by the university instructor (Sanderson, 2016).

Third space methods courses have been shown to have positive effects on PSTs and MTs. Examples of third space methods courses were found in the literature related to math methods more than examples of science methods. These examples guided the work of the university-school partnership being studied in this paper. While from math education research, the focus on reforming the instructional practices of preservice and inservice teachers toward methods that engage students in understanding concepts more than procedural knowledge make them relevant to the design of a third space science methods course.

Bahr, Monroe, and Eggett (2014) argue for the importance of structural interweaving and conceptual interweaving when designing a third space course. The five structural elements are (1) an immediate application of methods in clinical settings, (2) gradual increase in teaching responsibility in clinical work, (3) methods instructor supervision of clinical work, (4) relationships between inservice and preservice teachers that enhance mentoring, and (5) partnering preservice teachers with each other in shared clinical placements. Conceptual interweaving involves ensuring that the inservice teachers understand and use methods that preservice teachers are taught in their methods coursework. These elements have all been used in the design of the science methods course for this paper.

PSTs showed significant positive change in their beliefs about reform-based mathematics instruction in a third space methods course (Bahr & Monroe, 2008). PSTs also showed positive changes in their beliefs toward teaching math with reform practices when taking the course alongside inservice teachers (Bahr, Monroe, Balzotti, & Eggett, 2009). Wood and Turner (2015) used a shared task of analyzing problem solving interviews with elementary students between PSTs and inservice teachers to create a third space with rich pedagogical conversations between PSTs, inservice teachers, and the university instructors. University instructors labeled inservice teacher statements and findings with appropriate academic pedagogy to link academic and practical knowledge.

Another study (Bahr, Monroe, & Shaha, 2013) compared a math methods class that was followed by a practicum against a methods course that had college-peer teaching. Both groups had statistically significant changes in their beliefs toward teaching math with a reform pedagogy, but the greatest change was by those who had the integrated practicum, even though the teachers used traditional practices. If science methods MTs teach with non-inquiry-based practices, this suggests that the placement will still benefit the PSTs.

Overview of a Third Space Elementary Science Methods Course

The methods course described by this paper is a semester-long (14-15 week) course which consists of a single meeting time each week for 150 minutes. The course meets approximately 10-12 times at a local elementary school with the other course sessions being conducted asynchronously online. There are no on-campus meetings. The online class periods are a practical measure to deal with scheduling conflicts with the elementary school (e.g. book fairs or assemblies) and student preference to reduce overall driving requirements since the site is about 35 minutes away from the college campus. Pedagogical instruction occurs in the school library, led by the university professor. PSTs spend time each week with an inservice MT in his/her classroom.

This course evolved from a traditional campus-based science methods course that consisted of two 75-minute sessions per week that included four class periods in a local elementary school at the end of the course. Groups of PSTs taught a sequence of four lessons to apply their knowledge from the methods course. The third space course balances pedagogical instruction and application-oriented fieldwork each week. The third space course readings were basically the same as the traditional methods course, given the continual updating of articles used. The assignments also began being the same as the traditional course but evolved to mostly be lesson plans that required application of different pedagogical concepts.

The principal initially recruited nine teachers to serve as MTs for the first semester of the third space methods course. Of these nine, three had served as MTs under the previous model of the course. Additional teachers were recruited so that all grade levels (five-year-old kindergarten through sixth grade) were included. The number of volunteers grew to 15 MTs collaborating in the sixth semester of implementation. MTs are volunteers and not compensated. All grades from K-6 are used for this methods course because licensure in this program's state is for general education in the elementary and middle school.

This science methods course addresses many of the structural elements of Bahr et al. (2014). There was an immediate application of methods strategies in a classroom, a gradual increase in teaching responsibilities, supervision by the methods professor of the practicum work, a natural emergence of a mentoring relationship between the preservice and inservice teachers, and the partnering of preservice teachers into pairs to teach in the elementary classrooms. When the course was beginning, PSTs were each assigned to their own MT and classroom. As enrollment grew, they teach in groups of two most of the time, but there are

some singles. The conceptual interweaving of the philosophy of the MTs and the university instructor was constructed through relationship building between the university instructor and MTs through weekly professional interactions in the building and the collaboration between the PSTs and MTs during the lessons planned and led by PSTs. The university professor would arrive early each week and stop by the teacher's classrooms to ask if there were any concerns. A basic understanding of the philosophical foundations of the methods course is shared through a meeting before the school year in which the professor shares lesson plan expectations and rubrics. Because lesson plans are required to have elements of inquiry and the NGSS, the MTs became at least aware of these elements.

Building a University-School Partnership

Before designing a third space methods course, an interested school partner needs to be identified and a relationship formed. The partnership described in this paper developed gradually. It actually began with a "cold call" email from the professor to the school principal asking if any of the inservice teachers would be willing to host groups of four science methods students to teach a sequence of four lessons. The principal was receptive as a service to the education profession. Inservice teacher volunteers were identified and matched with the PSTs. After three years of this cooperation, an outreach grant opportunity emerged. The principal collaborated with the professor to write the grant proposal which was funded. This provided funds for some professional development opportunities for the inservice teachers. The timing was also very opportune. The district was investigating new science curriculum series for adoption the following year and the professional development conversations around science instruction were hoped to guide this process.

Once the grant funding was over, both the district and the university were interested and eager to continue the partnership. It has been conducted without additional funding from either party. The district continues to provide the meeting space in the school library and the instructor teaches the course as a part of a standard teaching load. As new teachers have volunteered to serve as MTs, they have been oriented to the program with a brief, half hour session in which they are introduced to the schedule and the lesson planning rubric. Other university-school partnerships could be created without the luxury of grant funding so long as both parties realized that the relationship building between the instructor and inservice teachers will take time to develop. Also, MT knowledge of lesson planning expectations will likely develop further over time.

Design Improvements for Third Space Methods Courses

The course design was improved each semester based upon feedback by both PSTs and MTs. Each of the categories of improvement are described separately to allow for other methods course instructors to focus their instructional design on specific elements. The initial schedule of the course is presented in Table 1. Modifications to the course during the first four semesters were relatively minor because the number of students enrolling stayed small

(6-9) during the first three semesters. After 24 students (the maximum) began enrolling in the fourth semester and beyond, the course structure was modified much more taking the greater amount of PST feedback into account. The revised schedules for the fifth and sixth semesters are presented in Tables 2 and 3 respectively. The broad categories for improvements are each explored below. Table 3 displays the current format of the course.

Table 1 (Click on image to enlarge)

Initial Third Space Methods Course (150 minutes, once weekly)

Week	Class Topic(s)	Pre-service Teacher Classroom Work
1	7E Model of Science Instruction: Explore S&EP #1-2, Science Trade Books, Safety	Observations (20 minutes)
2	The 7Es: Elicit & Engage, Writing Objectives	Classroom Helper & Write an Objective on Activities Observed (20 minutes)
3	S&EP #3-4, Writing Objectives, Safety	Read a book to the class, share an "engage demo" (20 minutes)
4	Crosscutting Concepts 1-3	Pre-reading activity & read a book to class (20 minutes)
5	The 7Es: Explain, Concept Maps	Interview 3-5 students about a scientific concept and give a formative assessment probe
6	Online class: Nature of Science (readings & quizzes)	
7	S&EP #5-6, The 7Es: Elaborate	Teach an explore activity (20-30 minutes)
8	The 7Es: Evaluate	Teach an explore & explain lesson (30 minutes)
9	Online class: Community Centered Science (readings & quizzes)	
10	Online class: Knowledge Centered Science (readings & quizzes)	
11	S&EP #7-8, The 7Es: Extend	Teach a full 5E/7E Lesson (45 minutes)
12	Online class: Learner Centered Science (readings & quizzes)	
13	Crosscutting Concepts #4-7	Teach a full 5E/7E Lesson (45 minutes)
14	Classroom management & Reflection on the semester	

S&EP=scientific and engineering practice

CC=crosscutting concept

DCI=disciplinary core idea

Table 2 (Click on image to enlarge)

Revised Third Space Methods Course (5th Semester)

Week	Class Topic(s)	Pre-service Teacher Classroom Work
1	What is Inquiry? What are the 5Es?	Observations (20 minutes)
2	The Nature of Science/Three-Dimensional Instruction	Read an Everyday Science Mystery (20 minutes)
3	The Nature of Children's Thinking Online: S&EP #1-4, Writing Objectives	Read a different Everyday Science Mystery/Pass out Formative Assessment Probe (20 minutes)
4	Classroom Safety	Read an NSTA Outstanding Trade book (20 minutes)
5	Online class: Classroom Management, S&EP #5-8, CCC #1-3	
6	Instructional Strategies #1-4 from Konicek-Moran & Keeley	Share a Discrepant Event (20 minutes)
7	Instructional Strategies #5-9 from Konicek-Moran & Keeley	Co-teach a lesson incorporating an element of the Nature of Science (30 minutes)
8	Instructional Strategies #10-15 from Konicek-Moran & Keeley	Co-teach a lesson incorporating Scientific and Engineering Practice #1 (30-45 minutes)
9	Online class: CCC #4-7, DCIs-Physical Science & Engineering Design	
10	S&EP #5-8	Co-teach a lesson incorporating Scientific and Engineering Practice #2 (30-45 minutes)
11	Online class: Inclusive Teaching, DCIs-Life Science & Earth/Space Science	
12	Reflection on Classroom Teaching	Co-teach a lesson incorporating Scientific and Engineering Practice #3 (30-45 minutes)
13	Reflection on Classroom Teaching	Co-teach a lesson incorporating Scientific and Engineering Practice #4 (30-45 minutes)
14	Final class-reflect on the semester	

Table 3 (Click on image to enlarge)

Revised Third Space Methods Course (6th Semester)

Week	Class Topic(s)	Pre-service Teacher Classroom Work (60 minutes each week)
0	Self-Paced Online Module (first 8 weeks): SSEPs, CCs, and DCIs (readings and quizzes)	
1	Nature of Children's Thinking	Read an Everyday Science Mystery
2	Instructional Models Science Trade books	Read a different Everyday Science Mystery/Pass out Formative Assessment Probe
3	Online class: Conceptual Change, Writing Objectives/Bloom's Taxonomy	
4	Instructional Strategies #1-4 from Konicek-Moran & Keeley	Read an NSTA Outstanding Trade Book
5	Instructional Strategies #5-9 from Konicek-Moran & Keeley	Interview 3-5 students about a science concept
6	Instructional Strategies #10-15 from Konicek-Moran & Keeley	Teach an inquiry-based lesson using a textbook strategy
7	SSEP #1	Teach an inquiry-based lesson using a different textbook strategy
8	Online class: Safety & SSEP #3	
9	Nature of science	Co-teach a lesson incorporating Scientific and Engineering Practice #1
10	SSEP #2	Co-teach a lesson incorporating an element from the Nature of Science
11	SSEP #6	Co-teach a lesson incorporating Scientific and Engineering Practice #2
12	STEM-What is technology?	Co-teach a lesson incorporating Scientific and Engineering Practice #3
13	Online class: Classroom Management/Inclusive Science Teaching	
14	STEM-What is engineering?	Co-teach a lesson incorporating Scientific and Engineering Practice #6
15	Final Classroom Teaching Reflection upon teaching science	Teach a final "mini" lesson on a fun/engaging topic

Informal Structure to Formal Structure

With the initial course only having six students enrolled, the structure was informal. Discussions about assigned readings on pedagogy were conducted with the whole group. Some model lessons demonstrating the 5E instructional model (Bybee) were also conducted by the professor with the PSTs in the role of students. The mentor teachers asked for the PSTs to come into their classrooms at a variety of times, so PSTs flexibly left the whole group activities and went into the classrooms. This allowed time for the university professor to go and observe the PST planned and led instruction and to give feedback.

As course enrollment grew to 24, the course had to adopt a more structured approach. The classroom times with the mentor teachers continued to vary due to practical limits (different prep schedules, recesses, etc.). An attempt to use online activities during the course meeting time to model inquiry and the scientific and engineering practices from the NGSS was not received well by the PSTs who felt that they should be able to do those activities on their own time. The eventual schedule that worked well in the sixth term was to work with the mentor teachers so that they agreed that to schedule their science lesson times to be at only one of two start times (9 or 10 AM) rather than a variety of times. Most of the teachers moved their normal science time (in the afternoons) into the meeting time of the methods course. The PSTs then were divided into a group that went into the classrooms at 9AM and another at 10AM. The professor then led active group activities and pedagogy discussions for the half of the PSTs not in the classroom during each hour block. This led to better results in terms of PST engagement with discussions and activities, which preserved the “methods” component of the course so that it did not become a practicum with occasionally professional development.

Role of Online Modules

The course has used a blended learning format since its beginning, in part due to the commuting times (about 30 minutes) from the campus to the participating school site. However, this was leveraged to move content that was factual outside of the face-to-face class time, similar to the flipped classroom philosophy (Educause, 2012). All online activities were created by the professor. This includes creation of question banks for low stakes quizzes. During the first few semesters, this involved pedagogical readings on the Nature of Science and articles focused on knowledge-centered science, community-centered science, and learner-centered science.

The Nature of Science module included some readings and online quizzes assessing basic understandings about how science works, the difference between a theory and law, and other related topics. The other three online class periods focused on having students create their own presentation (usually with PowerPoint) with voice over narration summarizing an article and then leading an online discussion about it. Each student read a different article. When asked, PSTs did not find these online modules productive or useful and they reported disliking the making of the narrated presentation.

By the fifth semester, the online modules were mostly quizzes on the three dimensions of the Next Generation Science Standards and two topics that were not able to be worked into the rest of the schedule (inclusive teaching and classroom management). While PSTs reported fewer problems with these online modules, the content was artificially paced for weeks when the course could not meet at the elementary school. This made it difficult to tie knowledge of NGSS elements (such as specific scientific and engineering practices) to expectations in terms of lesson planning.

Finally, in the sixth semester, a self-paced “module 0” was created for the dimensions of the NGSS and the overall concept of three-dimensional instruction called for by these standards (intertwining disciplinary core ideas, crosscutting concepts, and scientific and engineering practices). PSTs had until spring break (about 8 weeks) to complete these modules that included both readings and quizzes with the quiz questions pulled from a question bank created by the professor. PSTs were allowed two attempts for each topic, but the questions varied each time from the bank. While PSTs were expected to include portions of the NGSS in lesson plans before the due date for the module. This requirement motivated them to complete modules before the deadline.

Time and Activities in K-6 Classrooms

For the first five semesters, mentor teachers could determine the length of time that the PSTs were in their classrooms. Topics were chosen by the MTs. Most of them asked the PSTs to teach a lesson from their current science unit (providing them with materials and planning guides). Some MTs have allowed PSTs to pick any topic. The model was for them to start by reading non-fiction science literature to the class for about fifteen minutes and to gradually build up to a 45-minute inquiry-based science lesson. As mentioned previously, a challenge

was in coordinating these teaching times to permit some time for whole class discussion and activities in the library with the professor. Additionally, PSTs made many remarks similar to this one: “I found it challenging that we only were actually in the classroom a few times. I didn’t feel as if I could really get to know the students, teacher, or classroom.”

For the sixth semester, it was collaboratively decided between the mentor teachers and the professor that PSTs would spend one hour each week in the K-6 classroom. It was acceptable if the PST helped with non-science instruction, especially in younger grades that did not typically plan on spending an hour on science. This was in response to PST feedback that they wanted more time in the K-6 classrooms in order to get to know the elementary students and mentor teachers better in order to be able to plan more effective lessons. It was received very well by PSTs and MTs during the semester.

Activities in the K-6 classroom originally consisted of a gradual process of building up planning expectations that moved from no planning to complete lesson planning. Observations were conducted during the first week. Students then acted as a helper. For two weeks, they brought science-related books into the K-6 classroom to lead a “read aloud” along with before (prediction), during (comprehension), and after reading questions (comprehension, synthesis). Using the 5E model (engage, explore, explain, elaborate, evaluate), they then added an additional “E” each week until they were up to teaching two full 5E lessons at the end of the semester. The professor modeled aspects of the 5Es during the pedagogical part of the methods course.

For the fifth semester, PSTs moved more quickly into planning full lessons. Instead of picking their own science books, they were directed to use *Everyday Science Mysteries* (Konicek-Moran, 2008) in an attempt to incorporate more questioning into their lessons. They still were to select an Outstanding Science Trade book from the NSTA list to read to the class on a different day. Each of the planned lessons required them to incorporate either an element of the Nature of Science or one of the scientific and engineering practices from NGSS. Only the final two lesson plans were formally graded.

The 5E/7E lesson planning approach is no longer the cornerstone of the course that it had been. It continues to be presented as a model of inquiry (including a model lesson on magnetism using the 5E model in the first class period). This change is in part due to practical considerations of time with the greater emphasis on NGSS and more in class teaching time, but it is also philosophically a response to the scientific and engineering practices of the NGSS which do emphasize inquiry but also other methods and skills of science and engineering such as argumentation, computational thinking, and communicating information.

In the sixth semester, PSTs followed a similar pattern as the fifth semester, but they were required to submit a formal lesson plan for each week. This was in response to mentor teacher feedback requesting a mechanism to “force” PSTs to show that they had adequately

planned before teaching their lessons. This created more grading for the professor, but it did lead to greater satisfaction by mentor teachers that their PSTs were prepared each week.

Role of Co-teaching

While co-teaching is recommended by Bahr et al., it has been implemented in this setting mostly as a practical measure to utilize the number of mentor teacher volunteers each semester. The professor does consult with the principal to make sure that teacher volunteers are good matches with the philosophy of the methods course. Co-teaching was not really used until the fourth semester when the course enrollment reached 24 students. While two PSTs were assigned to a mentor teacher that semester, they were each expected to plan and lead their own 30 minute lesson and then act as an assistant for their peer's lesson.

For the fifth semester of the course, PSTs were formally assigned as co-teachers to a mentor teacher's classroom. They were given an article from *Educational Leadership* with several co-teaching models presented (Friend, 2015-2016). Table 4 summarizes these approaches. While the professor encouraged them to experiment with different models, PSTs generally used teaming (both PSTs acted as instructors at the same time in the front of the room) and some parallel teaching (where the students were in two groups with a PST leading each group). PSTs were required to show contributions through highlighting from each person on their graded lesson plans. In the sixth semester, 15 mentor teachers volunteered for a class of 24 PSTs, so co-teaching was not used by all of the PSTs. Once again, teaming was the most common approach that those in a co-teaching situation used.

Table 4 (Click on image to enlarge)

Methods of co-teaching (from Friend, 2015-2016)

1. **Station teaching:** Elementary students are in three (or more) groups; two teachers each manage one station; independent work at a third station
2. **Parallel Teaching:** Students are in two groups; each teacher leads instruction to their group.
3. **Alternative Teaching:** Most elementary students are with one teacher; the other teacher works with a small group
4. **Teaming:** All elementary students are in one group and teachers co-instruct
5. **One Teach, One Assist:** Elementary students are in one group; one teacher leads the instruction; the other teacher assists individual students
6. **One Teach, One Observe:** Elementary students are in one group taught by one teacher; the other observes the class and collects data

Role of the Mentor Teacher

Mentor teachers have been collaborators in developing the course since its beginning. They have given important feedback in terms of projects and expectations for the PSTs. Their role has remained fairly constant in terms of being asked to give feedback to the PSTs on their initial lesson plans and after their delivery. This feedback does vary in quantity and quality. Some MTs provide emailed feedback during lesson planning while others indicate that the plan is acceptable. Instructional feedback is primarily given verbally after the PSTs teach their lesson. While more formal feedback in a written form that could be directly shared with the professor is desirable, it has not been required so as to not add a burden onto the MT volunteers.

The only large change was in the sixth semester when mentor teachers were asked to allow the PST in their classroom for one hour each week rather than between fifteen and forty-five minutes. This was not reported to be a hassle, especially since it was clear that it was OK if the PST helped with non-science instruction. This added time was reported to really benefit the relationship between the PSTs and the mentor teachers by giving them time to get to know each other (as well as the elementary students) and for PSTs to be seen as a resource in the classroom. PSTs very much appreciate their mentor teachers and have said “The greatest benefit of this course was being able to be at the school every week and being able to interact with the teachers and students.”

When the school principal first agreed to collaborate with the university on this course, it was his hope that the methods course would serve as a change catalyst and a form of professional development *in* work (Bredesen, 2003) in comparison to models of professional development *outside* of work consisting of workshops or expert presentations. The National Academies of Sciences (2015) concluded that understanding how to best teach science requires inservice teachers to alter the way they teach even though they have little experience with the instructional practices described by the NGSS. A third space methods course presents itself as a vehicle for inservice teachers to experience inquiry-based models of instruction from the lessons based upon new models that preservice teachers design and teach in their classrooms. Interviews and lesson plan analysis do show initial support for the claim that the third space methods course helps engage inservice teachers in pedagogical change, increasing rigor, and understanding of inquiry-based instruction (Vick & Reichhoff, 2017).

Future Directions

This model of third space methods continues to expand at this university. While continuing the course at its current site, an additional section of the methods course will be conducted at an additional elementary school site in a different school district in the coming academic year. Continuing challenges involve getting students to incorporate the concept of three-dimensional teaching from the NGSS in lessons. While students can connect lessons to the three dimensions, they are not yet fully connecting the dimensions in an integrated manner. For instance, the PST lesson plan may not have elementary students use a scientific practice to learn about or apply disciplinary core ideas. Also, finding better methods to engage PSTs in reflection is a high priority. Weekly reflections were required during the sixth semester of the course, but they were often reports of what happened with a few sentences stating what went well and possibly something to change in the future. This was despite a requirement to include analysis and connect the reflection to the NGSS or other pedagogical ideas. PSTs often referred to the reflections as “busy work” in their course evaluations. Finally, feedback on teaching primarily comes from the mentor teacher, which seems to be acceptable to PSTs. However, the university professor would like to be able to give some feedback on instruction rather than just planning. While video recording of lessons

is a possibility, concerns about elementary student privacy, logistics of a person moving the camera around during non-whole group instruction, and realistic workload of the professor watching the videos are initial concerns. It is possible that video clips may be utilized in the future.

Suggestions for Starting a Third Space Methods Course

Professors and instructors interested in developing their own third space methods courses should consider some of the following during their planning and implementation:

1. Begin by building a relationship with a school's principal, possibly with mini-field placements or assignments with current models of instruction.
2. Build relationships with the inservice teachers during this initial phase of collaboration. Make it clear that you value their practical knowledge in addition to your academic knowledge.
3. Discuss with the principal how to recruit volunteer MTs. Discuss how to ensure that MTs will be open to the pedagogy of the methods course. They do not need to be experts in NGSS or inquiry. In fact, the school in this paper participated in order for teachers to receive "in practice" professional development about these concepts.
4. Realize that activities and discussions from traditional methods courses may need to be modified to online activities or discussions to make time for the classroom work.
5. PSTs may try to focus on lesson planning with a peer rather than focusing on instructional activities during the portion of class led by the professor. Be sure to lay out clear expectations for participation in sample lessons and other pedagogical activities.
6. Be sure to include PST feedback and MTs in course revision each semester. Inservice teachers need a voice in planning.

Conclusion

In summary, a third space approach to elementary science teacher education has perceived benefits by both preservice and inservice teachers. PSTs praise the format with comments such as "I like being out in the schools and able to work with a teacher. I also like the aspect of teaching lessons to the class; it is a great way to practice teaching." Mentor teachers continue to volunteer in large numbers to participate and do report some indications of better understanding about modern science pedagogies (Vick & Reichhoff, 2017). Finally, the university professor also is immersed in the practical concerns of science instruction in the elementary school and continues to learn a lot of practical knowledge about the challenges faced by inservice teachers.

As this third space model is being expanded to a second site at our university, many of the same challenges remain, but the process can hopefully continue to be improved. This site will not have the benefit of grant funding to establish the relationships. The district's director of instruction has chosen the mentor teachers who will participate. The university instructor

will meet with them briefly before the school year begins to explain the goals of the course and the lesson planning expectations for the PSTs. The mentor teachers will be asked to give any preliminary feedback on the structure of the course, but with it being the first semester in this district and a dialog already started with the director of instruction, it is not anticipated that there will be too many changes until a second semester at the same site.

This course will meet in the adjoining district office boardroom for instruction by the university instructor. The elementary school is connected to this building and PSTs will go into the K-5 classrooms similar to the current model. Half will go at one time and the other half at a second time. This course was able to be scheduled in the afternoon, so it will be during the standard science instruction time. This district uses a different curricular series for science and engineering. The instructor is considering ways to engage PSTs from the two third space courses into a dialog about the different curricular choices of the two school districts.

Other methods professors and instructors are encouraged to approach local school districts about partnering to conduct a third space methods class. The concept was heartily embraced by school and district leadership not only as a service to the future of the profession, but as a method of providing experiences for inservice teachers in curricular innovation and instructional coaching in science teaching.

Supplemental Files

[Appendix-Syllabus.docx](#)

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