Shared Photonarratives in an Online Master's Course: Reflection, Context and Community

Lauren Madden
The College of New Jersey

M. Gail Jones and **Margaret Blanchard**
North Carolina State University

Abstract

Distance education has potential to reach teachers from diverse areas, but the challenges of building community and promoting reflection in these settings can be considerable. In this study, photonarratives were used as an assignment in a distance education course to promote reflection on science teaching. Twenty science teachers (half from rural areas) produced photonarratives that included photos and descriptions of helping and hindering factors related to their science teaching. Analysis of the photonarratives showed that two primary categories of factors were both helpful and hindering and included geographic factors (proximity to a community college or facilities) and available technologies (such as probeware or document cameras). A third category, colleagues, came across as a theme among the helping factors alone. The photonarratives served as a tool to empower the teachers by giving them the control to identify and document issues related to their unique science teaching context while also promoting insight into shared issues across the group. The power of photos embedded in personal narratives as a tool for teacher reflection and developing community is discussed.

One of the goals of science teacher professional development is to create supportive communities of practice. When professional development is offered via distance education, this task of creating community is a particular challenge (Beldarrain, 2006). Synchronous online courses help to bridge the distance by allowing students to interact with one another and their instructors in real time (Hines & Pearl, 2004). Yet, helping teachers connect with one another in meaningful ways is still a challenge when they are physically distant and unable to see one another during class interactions (An & Kim, 2007). Without this sense of community, teachers may have difficulty reflecting on their practices and meaningfully sharing these reflections with their peers.

An, Kim, and Kim (2008) suggested that participants in online courses may feel emotionally isolated from classmates and less likely to work collaboratively in groups as a result of the types of virtual communication used in distance education courses. One pedagogical strategy to decrease this perceived isolation and help science teachers reflect and interact with one another is through creating and sharing photonarratives of their science teaching. This study used photonarratives to engage practicing science teachers enrolled in an online graduate course in reflecting on their teaching.

Photo-Based Research Methods

Over the past several decades, the use of photographs as research tools has become more prevalent (Harrison, 2002). Harrison suggested that photographs allow participants to share their perspectives, make meaning of imagery, and tell stories to link or map ideas. Several methodologies have emerged from this trend, including photovoice (e.g., Newman, 2010; Wang & Burris, 1997) and photonarrative (e.g., Goldston & Nichols, 2009). Though both of these methods use photographs as data sources, the terms are somewhat different by definition.

Photovoice is defined by as "the process by which people can identify, represent, and enhance their community through a specific photographic technique….It uses the immediacy of the visual image to furnish evidence to promote an effective, participatory means of sharing expertise and knowledge" (Wang & Burris, 1997, p. 369).

In contrast, photonarrative is a technique that focuses less on the immediacy of the image and more on the use of both images and words together to tell a story. When using photonarrative, "photographs bring the complex connections between voice, memory, and identity to the foreground of narratives where they are inextricably linked" (Goldston & Nichols, 2009, p. 183).

Photo-based research has been used across many fields, including healthcare (Bell, 2002; Bender, Harbour, Thorp, & Morris, 2001; deLange, Mitchell, Moletsane, Stuart, & Buthelezi, 2006; Newman, 2010), natural resource management (Beckley, Stedman, Wallace, & Ambard, 2007), art (Chaflen et al., 2007), and education (e.g., Allen et al., 2003; Wang, Anderson, & Stern, 2004; Wang & Burris, 1997; Wolsley & Uline, 2010; Wyra & Lawson, 2008). In each of these fields, these methodologies engage participants in either (a) *responding* to photographs by providing a narrative, or (b) asking participants to use photographs to *share* information. When photo-based research is used in a sharing context, the participants use their photographs to document issues from their own perspectives, allowing them to reflect on their experiences and become part of a greater community.

Educational research includes many examples of photo-based research methodologies being used in both responding and sharing contexts. Generally, studies involving teacher participants are set in the responding context. For example, Wyra and Lawson (2008) asked teachers to respond to photographs of student interactions on a schoolyard as part of a photovoice study. These authors found that teachers in their study were able to make sense of their experiences through group conversation and develop strategies for improving children's schoolyard behavior as a result of discussing photos as a group.

Likewise, Feldman and Weiss (2010) asked teachers to respond to certain photographs by incorporating them into their instruction as pedagogical tools as part of an action

research professional development project. They found that repeated exposure to the professional development led to changes in the teachers' practices, such as using photographs to demonstrate scientific processes that change over time (e.g., moon phases or plant growth).

On the other hand, studies using student participants are often situated in a sharing context, asking participants to use photographs to share issues from their own perspectives. For example Wolsey and Uline (2010) asked middle school students to describe their school settings using photographs, and these photographs helped the children to organize and describe their conceptions of their sense of place within their schools. Settlage (2004) used photos with students to document their scientific experiences, and these photographs illuminated the children's scientific conceptions for the author.

Similarly, Cook and Buck (2010) used photovoice as a tool for middle school students to describe socioscientific issues, concluding that the use of photography fostered strong socioscientific and pro-environmental attitudes in their students. Furman and Calabrese-Barton (2006) used student-created photo and video documentaries to provide a voice for students and found that creating these documentaries helped students develop more positive attitudes about science. Finally, Norman and Hayden (2002) analyzed multiple studies and concluded that educators can use photographs as a way to connect across science, technology, and writing domains. In sum, photo-based methods can be used in a variety of ways to both respond to and share information in educational research.

However, even though photo-based methods have been used in a sharing context previously, a dearth of research exists in which science teacher participants are asked to use photographs in a sharing context. In a sole example, Goldston and Nichols' (2009) unique study examined photonarratives created by a group of science teachers from the same middle school, created in an effort to understand the sociocultural factors that help and hinder their abilities to teach science within their school community:

Teachers' photographs re-present and bring to the forefront an awareness of the complexities of culture and community as it influences the teacher, students, and teaching. The process of engaging in-group storying around images created a space for understanding cultural referents and community funds of knowledge identified in conceptualizing culturally relevant practices. (p. 182)

The authors concluded, "Teacher photographs of cultural referents acted as provocateurs....As the teachers' photographs were reviewed, first individually and then collectively, memories found their way from the images into the conversations" (p. 194), emphasizing some of the benefits in using photography in this way. These results begged the question of whether photonarratives could be used in a similar way with science teachers, not only from different school settings but also working together as peers in a distance education course, as a tool for helping them reflect on their practices.

Historically, one challenge to teaching in online settings is creating communities of practice and collaborative learning environments (Tsai, Laffey, & Hanuscin, 2010). Several strategies have been recognized as helpful to collaboration in online settings, such as using structured guidelines for interactions during class activities (An et al., 2008; Branon & Essex, 2001; Hines & Pearl, 2004), interacting with classmates in group settings (An et al., 2008; Branon & Essex, 2001), and fostering teachers' social presence within the online community through frequent teacher-student interactions (Beldarrain, 2006). These strategies tend to be audio and text based.

Distance education is often limited in the degree to which teachers and students can see and talk to each other in formal (in-class) and informal (out-of-class) contexts. Although distance education software often allows several people to see and talk simultaneously, when bandwidth is limited (as is the case in many distance education programs), the degree to which participants can see each other may be severely restricted. Given these challenges, photonarratives were explored as a tool for providing visual context for teacher reflection and as a mechanism for promoting teachers' social presence.

Study Goals

The purpose of this study was twofold: (a) to provide evidence on ways photonarratives can be used to enhance science teachers' understanding of influential contextual factors, and (b) to provide evidence on ways teachers perceive the process and usefulness of creating photonarratives about science teaching.

Using photonarratives in a distance education science methods course with middle and high school science teachers, we explored the following questions:

1. Which contextual features do teachers illustrate as being helping or hindering to their science teaching when they develop a task-structured photonarrative?
2. What are teachers' perceptions of the usefulness of creating photonarratives?

Theoretical Perspectives

Our theoretical frame, Community-Based Participatory Research (CBPR), has been defined as a

> collaborative approach to research that equitably involves all partners in the research process and recognizes the unique strengths that each brings. CBPR is connected to place-based research, as it begins with a research topic of importance to the community with the aim of combining knowledge and action for social change. (Kellogg, 2011)

CBPR is said to help the "researched" become the "researcher," as the study participants are responsible for identifying themes and constructing knowledge of and about their communities (Israel, Schulz, Parker, & Becker, 1998). This methodology allows the participants to become actively involved with the research process, as their personal reflections provide data on the trends within entire community (Wallerstein & Duran, 2006). Historically, CBPR is used in healthcare research, but can be highly applicable to educational situations where teachers are best fit to provide insight and information on needs within their own contexts, especially when using a social constructivist approach to teacher development.

CBPR is built on a constructivist framework as participants work as a community in a system of overlapping social contexts. If teacher professional growth is viewed from Vygotskian and CBPR frameworks, then other teachers are seen as serving a critical role in teacher education (Vygotsky, 1978). According to Vygotsky thought, language, and culture are bound together and that teaching and learning are, by definition, social processes. From a Vygotskian perspective, teachers assist one another's development by explaining, reflecting, and discussing experiences and ideas, as well as providing encouragement (Carter & Jones, 1994; Jones & Carter, 1994). Vygotsky argued that activities and experiences become internalized only after a series of transformations take

place first between people (interpsychological) and then within the individual (intrapsychological; as cited in Wertsch, 1985).

Rogoff (1995) argued that Vygotsky's theories of socially negotiated learning also included participatory appropriation and cognitive apprenticeship. According to Rogoff, cognitive apprenticeship involves learning contexts with the purpose of engaging people who are more experienced with those who are less experienced. Rogoff's participatory appropriation is a dynamic developmental process involving multiple people in examining each other's perspectives and contributions, much like Israel and colleagues (1998) described taking place through CBPR.

In a science methods class, both participatory appropriation and cognitive apprenticeship are likely to take place, as teachers with different levels of experience share ideas, argue perspectives, and reflect on their own and other teachers' instruction. Figure 1, based on Rogoff's work, shows a model of teacher reflection that represents the range of contexts from an individual reflection (intrapsychological) to a class refection (both intra- and interpsychological) to a group reflective discussion (interpsychological).

The first representation shows the individual's idealized reflection from a personal stance that would be an integral part of the selection of photos for the photonarrative and the construction of the narrative component of this task. As teachers share their helping and hindering factors with their instructors, they may begin the interpsychological processes of semipublic reflection.

Finally, as teachers engage in discussion as a group within a synchronous online class setting, the teacher reflective process has the opportunity to move to more of Rogoff's concept of participatory appropriation, where multiple individuals make sense of their own practice in conjunction with other teachers.

Methods

Study Context

Twenty teachers enrolled in an online graduate Advanced Methods in Science Teaching course agreed to participate in the study. Nineteen of the teachers were female; 1 was male. Three teachers were African American and 17 were European American. Eighteen participants were practicing middle or high school teachers, 1 was a former high school teacher, and 1 was a former community college instructor. Nineteen of the teachers taught in science disciplines, and 1 was a technology and business teacher. Half of the teachers worked in rural schools. Two of the authors served as instructors of the course; Jones was a professor of science education, and Madden was a doctoral candidate in science education. Both instructors were European American females.

Course Information

The Advanced Methods for Science Teaching course objectives were as follows:

1. Read educational literature critically, including theoretical, philosophical and research materials by comparing and contrasting the positions of authors, critiquing the applicability of the literature to different educational contexts and various populations, and by examining the design and/or argument of various authors.
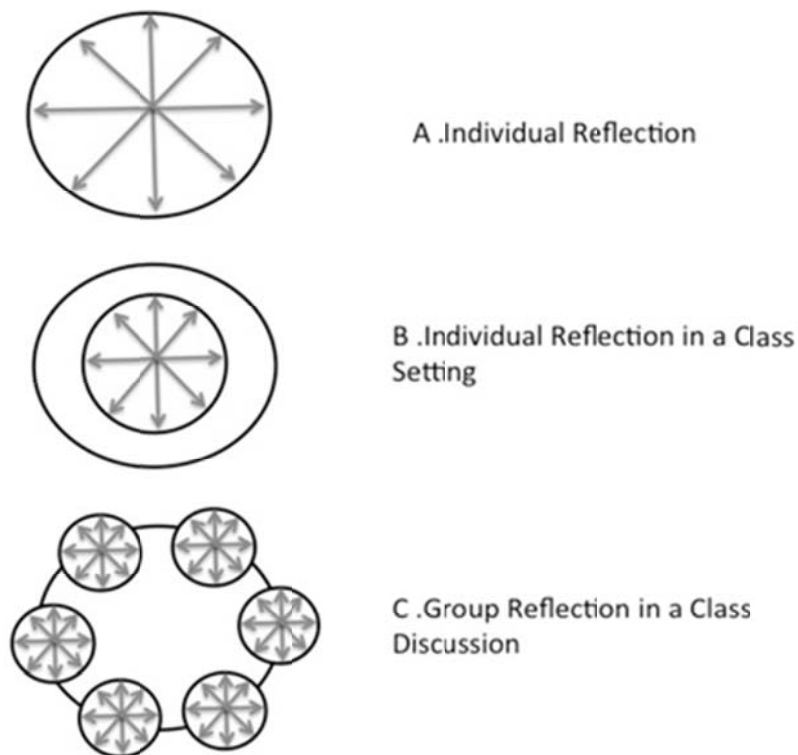
Figure 1. Model for individual and group reflection within an online classroom setting.

2. Reflect upon, diagnose, and prescribe instruction that fosters student learning.
3. Develop an understanding of diversity and strategies to address the needs of diverse students.
4. Design and modify instruction that is responsive to differences in learners that are influenced by development, exceptionalities, and diversity.
5. Examine the classroom environments in which all learners feel welcome and can be successful.
6. Evaluate best pedagogy for teaching science within the context of a specific educational setting.

Specific topics covered in the course included constructivism and social constructivism, social justice in science education, conceptual change theory, cooperative learning, formative assessment, and metacognition. Each week, the students participated in one synchronous online class meeting, created and responded to asynchronous discussion board postings, and read several articles or book chapters focused on one of the class topics. All participants in the course were practicing or former teachers enrolled in a grant-funded program providing online graduate level courses for rural teachers in the state. All course participants learned at a distance; none were onsite or in-person participants. Most of the course participants were seeking a master's degree in science education, and had varying levels of teaching experience from 2 to more than 20 years.

Photonarrative Assignment

Participants read Goldston and Nichol's (2009) study, which described teachers creating photonarratives to reflect on their practices and form a community of science educators. Participants then responded to the following prompt:

> For this assignment, you will create a photonarrative specific to your own school and teaching, keeping in mind that our goal is to engage students in meaningful science learning. You should take 6 digital photographs in/around your school and community: three that depict factors that *help* your science teaching and three that *hinder* it. With each photograph, include a 0.5-1 page description of its significance, referring to other topics discussed in our course. Include a 0.5-1 page introduction and conclusion to provide context and connections between your six photographs.

Each participant created a photonarrative and submitted it to the two course instructors, who provided written feedback using a rubric. Rubric categories included style, connection between photographs and course content, and richness of the rationale for each photograph chosen. Next, participants each selected two photographs from their photonarrative (one helping and one hindering factor most representative of their teaching) to share with the class during an online presentation. This act of sharing their individual teaching context was done in an effort to form a more connected class community.

Data Sources, Collection, and Analyses

Data sources used in this study included teachers' photonarratives and reflection on meaning of the photos they included, their presentations of their work during synchronous class time, and survey and course evaluation feedback.

The participants were given grading criteria for the photonarrative assignment in advance, and one of these criteria was to make connections between the selected photos and content covered in our course. Though we hoped that participants would include connections to course content in the written photonarratives and oral presentations, we chose to use a more grounded approach in coding data, rather than doing so based on specific strategies for science teaching.

Our analyses of the photonarratives were based on a constructivist/interpretive qualitative framework (O'Connor, Netting, & Thomas, 2008). In this inductive approach, the data are collected prior to analysis and are based upon foreshadowed questions. In our study, the images in the photonarratives were first divided into two categories based on the question asked of the teachers in the study: What do you see as helping and hindering factors in your teaching?

One researcher independently read and identified themes in all the photonarratives in order to understand any potential patterns. We established initial codes for the themes, making constant comparisons to already-coded photonarratives to enrich, refine, and better interpret patterns within the codes (as in Hallberg, 2006; O'Connor et al., 2008). The teachers' written text that supported their images was examined and used to explain and expand upon the pictorial data in the images.

O'Connor and colleagues emphasized the importance of constant comparison into meaningful categories so that the end product of the analyses is a structure to understand

the phenomena in context. "Until the results can be displayed in a descriptive graphic illustration or table, or until the results can be stated in no more than a paragraph, neither the degree of empirical grounding has been established nor has meaning been constructed from constant comparison" (p. 42).

To ensure that our categories used to understand the photonarratives were meaningful and valid, a second researcher coded 20% of the photonarratives using the codes developed and refined by the first author. On this sample, the interrater agreement was 96%, suggesting that the codes were sufficient for describing trends in the data. The top categories among the helping and hindering factors were then subcategorized to help us better understand the trends (as in Newman, 2010).

The participants presented two exemplar images (one helping factor and one hindering factor) that best represented their teaching. All of the class discussion of the presentations was recorded by the online course software and transcribed verbatim. The participants' selected images were also coded using the coding scheme developed for their written photonarratives, and trends in the teachers' selected exemplar photographs were compared to trends that emerged from their larger dataset.

Finally, at the conclusion of the semester, the participants were asked to complete an anonymous survey regarding the course as a whole, including the photonarrative assignment. Seventeen of the 20 teachers enrolled in the course completed the survey. Their survey comments related to the photonarrative assignment were used to supplement the data collected on the written photonarratives and oral presentation.

Findings

In this section we present a short vignette of one of the teacher participants, Amy (pseudonym) to contextualize the trends in the findings. Next, we discuss the trends in helping and hindering factors cited by the participants in their written photonarratives and class presentations and describe the participants' commentary on the usefulness of creating photonarratives.

Photonarrative of Amy's Science Teaching

Amy taught in a unique learning situation: a one-room school. Amy taught science in an alternative school for students with behavioral problems in grades 6-12. As such, her teaching assignments could change daily without notice. Her biggest challenge was limited access to resources, though she worked creatively to make the best use of what science materials she had.

> Since we are located on a separate campus we cannot access materials and supplies from the feeder school, in addition we have a very small budget for these items. However, there are positives for working on a separate campus. We have space for a garden, composting and will be experimenting with vermicomposting this spring.

Figure 2 displays the images Amy chose to use in her photonarrative. Her three helping factors were a computer lab, an image of a map at a local park, and a photograph of a hiking trail alongside a local river. In her unique context, these were the things she believed made it possible for her to teach science to her students. Her three hindering factors were represented by a photo of her classroom setup, another image of her sparse science supplies, and a photo of the place where a greenhouse once stood. These images

helped her to situate her teaching context in a way that allowed her to compare and contrast her experiences with her classmates. An excerpt from Amy's written photonarrative follows:

> This is a picture of our available lab equipment (Part A of Figure 2). I have listed this as a factor that hinders our science teaching. In order to do an experiment we must borrow materials from the other schools...[and if] those materials are in use at the time we need to borrow them my students...do not have access.... In the past we were even overlooked when the departments bought books. When I arrived at the alternative program in 1999, they were using books I had used when I graduated in 1977....The next picture (Part B of Figure 2) represents my most painful hindrance. It is the footprint of our old greenhouse. When we started the program in 1999, the students did a great deal of work with community service and service learning. In 2001 they planned, obtained, and planted a 9-11 memorial garden following the 9-11 attacks [September 11, 2011, terrorist attacks in New York City]. This included writing a grant for azaleas, contacting local business for materials and digging with borrowed shovels, hoes and hand tools. The students did all this when they had finished their regular assignments. As a reward the superintendent purchased a small PVC greenhouse for the program, with the understanding the students would maintain the garden...The students obtained building permits, spoke with inspectors and built the greenhouse themselves....They were extremely proud of the pictures in the local paper and the letters they received thanking them for their efforts. They were also recognized on the county and state level with the...County Volunteerism Award in 2002 and the [Service] Award in 2003....Then disaster struck in the fall of 2003, its name was Hurricane Isabel. The greenhouse was a total loss. The students rallied and began raising funds to build a new and better greenhouse. They researched the greenhouses that were available, looked for grants that could be used to purchase the greenhouse and began a fundraising effort. In 22 months the students raised a little over 13 thousand dollars for the greenhouse of their dreams. Just as we prepared to order the greenhouse our biggest supporter [the superintendent] left the district. The new superintendent informed us we could not build a greenhouse. The students were devastated, the garden program still exists but it has never recovered the momentum it had prior to the superintendent's decision....As educators we must remember that students and their efforts must be valued. As adults we would have a difficult time working in an environment that does not value us. We have a choice to leave that job and find another; our students do not have that option.

Amy's reflections and accompanying photos exemplify the photonarratives that were created by the participants.

Influential Factors in Participants' Science Teaching

The participants listed a total of 64 helping and 59 hindering factors across their written photonarratives, and several key themes emerged among the images. Figure 3 displays the codes and results from our analyses of helping factors.

Helping Factors

Hindering Factors

Figure 2. Photographs from Amy's photonarrative.
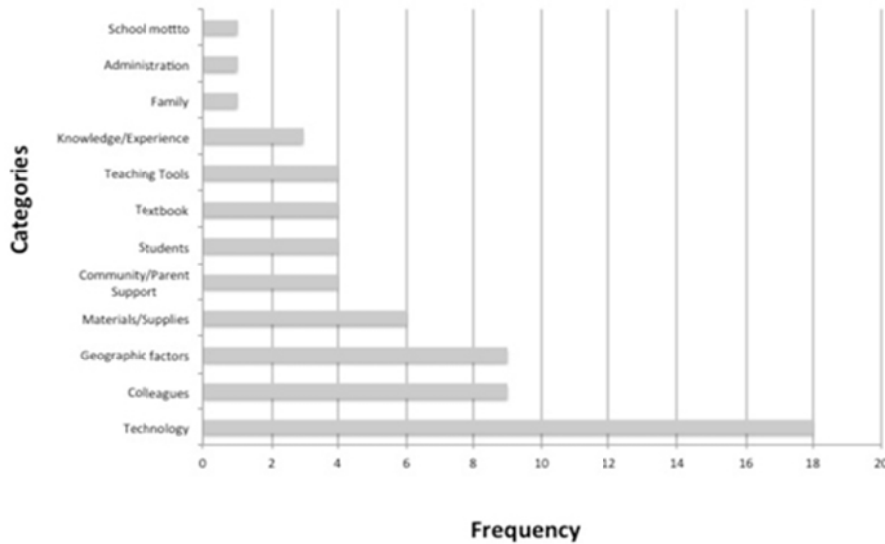
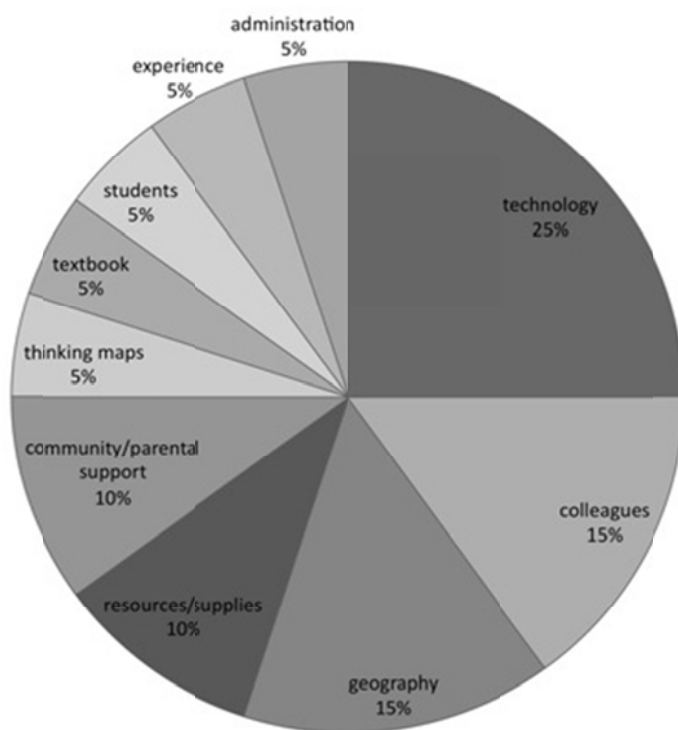**Figure 3.** Frequency of helping factors listed in teachers' photonarratives.

Across the 64 helping factors, 28% (18) were related to technology. This category was twice as large as the next two most frequent categories, colleagues and geographic factors. Geographic factors, included references to place-based factors such as access to outdoor learning areas or community resources. Nine images, or 14% of the pool, fell in the categories of geographic and colleagues.

A closer analysis of technological factors revealed trends within this category. Of the technology factors listed, most were photographs of interactive whiteboards. One teacher noted in her written photonarrative, "By using the SmartBoard®, most of my students are better engaged." Other helpful technology factors listed included computers, websites, document cameras, the Internet, and probeware. In terms of geographic factors, the helpful responses were more evenly divided. Four teachers' photographs of geography-related factors related to features of their school buildings, such as proximity to other facilities (e.g., shares a campus with a community college). As one teacher said, "The school building...set[s] the tone...that learning is about to take place." Three photos were of outdoor areas, and two highlighted the importance of classroom features.

The third largest overall category for helping factors was colleagues; and these were shown as photographs of one or more colleagues, thus, they were not subcategorized and are not pictured in this report for anonymity purposes. In one case, a teacher photographed the teachers' lounge where she was able to work collaboratively with her colleagues. As one teacher noted,

> One thing I found especially helpful was that [my colleagues] were able to anticipate the areas where students were most likely to struggle and gave me tips on how to help students avoid the misconceptions that often form. My ability to help students see their errors was aided by my colleagues.

When we analyzed the images that the teachers selected for class presentations, the same top three category themes we saw in their written papers emerged: technology, geographic factors, and colleagues, as displayed in Figure 4.

Figure 4. Frequencies of helping factors used by teachers during class presentations.

As in the written work, the technology category was the largest among the exemplar images presented in class, with five teachers electing to share technological factors during their class presentations. One teacher described how her course management software helped her teach science effectively: "I picked Moodle because it is awesome in every way. I upload assignments, videos, my wish list items for parents, homework, and then at the very bottom…I keep a running list of everything from August 18th [onward]."

Colleagues and geographic factors made up the next two largest categories, with three teachers electing to present information on each of these. A teacher from a small rural school described her image of colleagues as a type of family that works collaboratively:

> We do a lot of things in school and outside of school together. We work in school across disciplines doing different projects…but we also worked together to tend to different operations of the school itself like bus duty and scheduling.

One geography-related factor that Amy, a teacher from an alternative program discussed during her presentation was the proximity to natural resources.

> This is a picture of the canal trail. It's one of the parks…we can access [from our school]….There are not a lot of resources available…so using some of the other things around me is helpful [in my science teaching.]"

Unlike the helping factors in the technology category, no single hindering factor dominated participants' responses; rather, they were more evenly divided.

Two of the top three themes from helping factors were also seen in the hindering factors: technology and geographic factors (12% each). Figure 5 displays the codes and results from our analyses of helping factors.
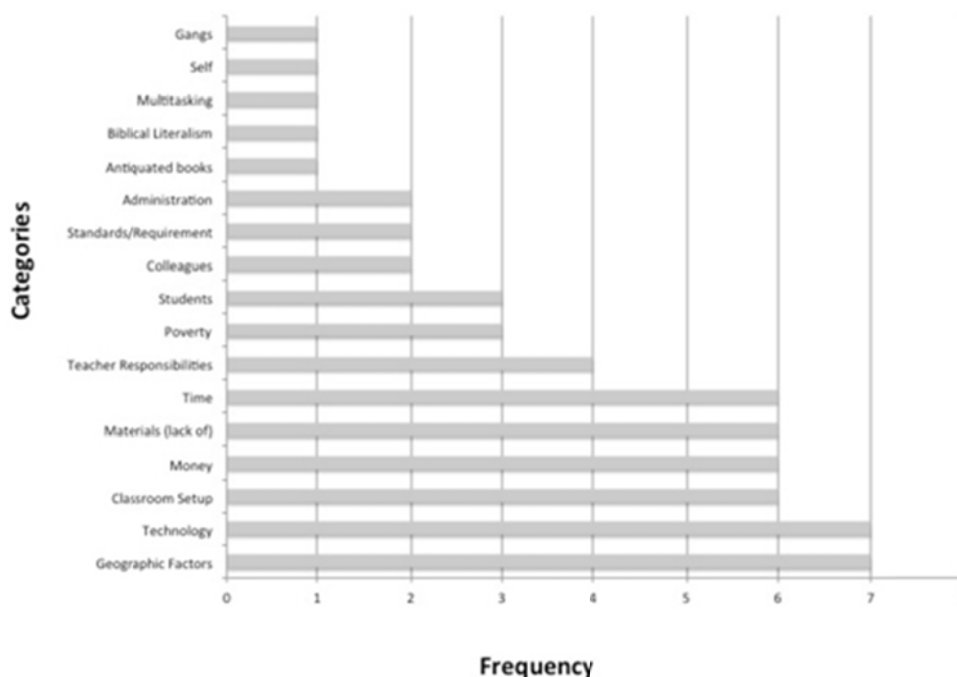
Figure 5. Frequencies of hindering factors listed in teachers' photonarratives.

Regarding technology, participants saw the lack of access to working, up-to-date technology as a great hindering factor in their ability to teach science, as they cited broken and antiquated materials and inability to use technology as hindering factors. One teacher lamented, "There are so many things that I could do if only we had reliable and updated technology." The seven geographic factors cited as hindrances also showed some commonalities. Geographic factors cited as hindrances included lack of community resources and weather. One teacher at a school that lacked a field described geographic drawbacks: "We cannot go on a field walk and find unknown samples to identify. The students learn so much more when they can see and experience the concepts [covered] in class."

When we analyzed the hindering factors teachers presented to the class, the themes were less similar to the themes in the teachers' written work than those that emerged during the presentations of the helping factors (see Figure 4). The trends that emerged from the hindering factor presentations can be seen in Figure 6.
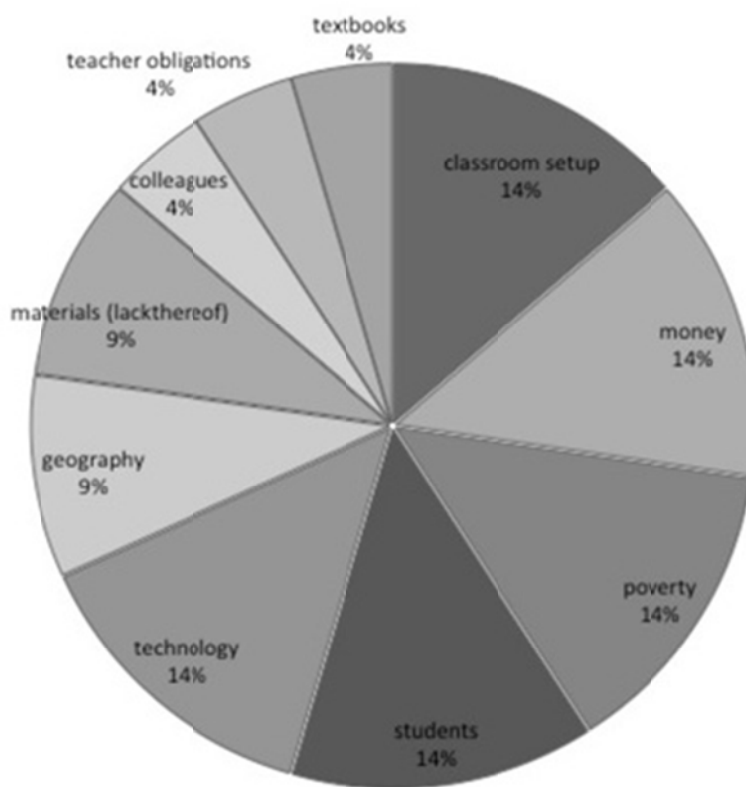
Figure 6. Frequencies of hindering factors in teachers' class presentations.

During the class presentations, the participants each shared one exemplar hindering factor. Five different categories (technology, geography, lack of materials, money, and classroom setup) dominated teachers' presentations, each having 3 teachers electing to present factors from those categories. One teacher chose colleagues as a hindering factor to present, which was particularly interesting, as colleagues was not a major theme seen in the written photonarrative analyses. As with the analysis of all the factors listed by

teachers in their written photonarratives, colleagues made up a smaller pool of hindering factors than helping factors.

Usefulness of Photonarratives

On the written portion of the photonarrative assignment, the participants were asked to include an introduction and conclusion to provide context and connections between the six photographs. Eleven of the teachers included statements indicating that the process of creating the photonarratives helped them to reflect and make sense of their teaching. Three of the comments were general reflective statements, such as, "I think doing this assignment was a very eye opening experience for me. I was able to think about ways to fix the tools that are a hindrance and maximize the tools that are helpful."

Two teacher reflections noted the importance of working around factors that are out of their control, "As I reflected on my teaching I realized that there are a lot of factors that are beyond our control as teachers, but there are so many ways we can work around those that challenge us and create a classroom where all students can learn."

Two of the comments connected the act of creating the photonarrative with other class activities: "The helps and hindrances that I have highlighted are a snapshot of my short experience teaching...in this class, I have learned several techniques and methodologies that I think would enhance my teaching in ability in this reform environment."

Two of the reflective statements provided positive take-away messages, such as, "We must try to find ways to find the silver lining in the middle of the black cloud." Several teachers also reflected on how the helps and hinderances were specific to their school settings, such as small and rural.

Two of the teachers' reflective statements connected to the broader themes that arose in the analyses of the photographic data and included technology and colleagues, both in a helping context. For example, one teacher noted,

After completing this photonarrative, it is apparent that because of the efforts of our superintendent, some eager teachers, and a helpful area foundation, the students at [my school] are very fortunate to have technology at their disposal. With these factors we can turn the community around by opening the world of science to our kids.

The teacher who reflected on colleagues noted, "A common theme among things that make my teaching of science better, much of it has to do with teamwork and sharing ideas to make each other better teachers."

On the year-end course evaluation survey, the teachers were asked to document which assignments they found interesting or useful. Thirteen of the 17 respondents (81%) reported that they found the photonarrative assignment interesting or informative. This represented the assignment with the highest number of students agreeing that it was helpful. The survey also asked participants to identify which class assignments were most useful throughout the course. Four of the 17 responses mentioned the photonarrative. For example, "Photonarrative [was most helpful for me]—It really made me analyze what was useful to me in my class."

Discussion

Newman (2010) said that allowing participants in her study to use photographs to document their perceived helping and hindering factors, gave "them control over the issues that were photographed and discussed…[which resulted in] shared power between the traditional academic researcher and the community, fostered trust, and promoted a sense of ownership in the community" (p. 57). When we asked teachers to use both words and photographs to reflect on their teaching and identify which factors helped and hindered their science teaching, one teacher noted, "These photos remind me that each of my students is unique and each situation is full of positives and negatives." The photonarratives empowered teachers by giving them control of identifying and documenting issues related to their specific science teaching.

Despite the geographic distances between participants, the photonarratives allowed the teachers to share their struggles and triumphs as science teachers, even when those were especially unique, as was the case with Amy's alternative school setting. The sharing of concerns promoted trust and shared issues within the group, provided a mechanism for overcoming the isolation of distance education participation (e.g., as in An et al., 2008), and also allowed us to understand the commonalities among this group of teachers in the class community.

Both Furman and Calabrese-Barton (2006) and Cook and Buck (2010) used photo-based research methods with students in a way that allowed them to share their own personal contexts. These authors found that the students' photos were helpful in fostering more positive attitudes toward science. Similarly, our findings suggested that the participants were able to share their own contexts as science teachers, and this sharing resulted in discussions of contextual similarities and differences—namely concerns around technology and geography. Technology was viewed by teachers as both a helping and hindering factor in their science teaching. It is possible that this group of teachers was more concerned about or interested in technology since they had volunteered to enroll in an online course.

Many of the photographs and accompanying narratives described inventive uses of technology in science teaching, such as managing communication of grades via course management software and use of probeware in collecting data during labs. Another factor that may have piqued teacher interest in technology was that half of the teachers were from rural areas where there was both a huge need for access to technology accompanied by problems with connectivity and resources to purchase new forms of technology.

Thus, participating in an online graduate course has the potential to help familiarize teachers with novel and useful technology teaching resources while providing a network of other teachers with similar technology challenges. Many of the teachers were from very rural areas with few laboratory resources, and technology appeared to be one tool the teachers used to enrich their instructional approaches.

Through the narratives it became clear that at several of the participants' schools, significant investments had been made in purchasing new forms of technology such as SmartBoards®. Despite having new equipment, there were concerns about not being able to use or network equipment due to a lack of school-based technology personnel. The teachers expressed a desire to obtain and learn new technologies but noted that they were limited by their school system's resources to support their use. In other circumstances, the teachers were less fortunate in terms of technology investment by their school system. In these cases, the teachers were forced to make due with antiquated and broken technology. Because of these two opposing forces—lack of

technology and lack of technology support—technology was seen as a top theme among the hindering factors.

Just as the rural locations of schools may have limited technology usage or access, geographic location was seen as both a factor in helping instruction and hindering it. For example, the participants provided a number of examples of factors in which geographic location of their schools, such as proximity to natural resources and parks or sharing a campus with a community college served to enhance their abilities to teach science. On the other hand, a large portion of the participants listed things like natural disasters (and subsequent school closings) and lack of school yards as hindering their ability to teach science.

Tsai and colleagues (2010) noted that forming communities in online environments was a major challenge to distance educators and argued that structures must be put in place to assist participants in forming communities in these geographically diverse settings. In CBPR, participants construct knowledge about their community based on the data they collect and share within their communities (Israel et al., 1998).

Sharing photographs of geographic factors in the present study helped participants to share their individual communities or "tell their own story" with the class and, as a result, connected them so they could form a community of practice within the online course (as shown in Figure 1). Thus, understanding the place-based particulars of individual school geographic factors was a critical part of the participants' sharing with photonarratives. The photographs provided rich context-specific detail that might have been lost without the use of photonarratives.

Within a Vygotskian (1978) framework, teachers who share culture, community, and perspectives are likely to promote growth. Even within the rural and online communities of this professional development experience, it was apparent that teachers viewed their school-based social support networks as significant factors in helping them accomplish their goals as science teachers. In sharing the importance of colleagues at school, the teachers extended their connections to their classmates in the online course as well and began to develop an even more extensive network of support in their teaching. Overall, this group of teachers, half of whom taught at rural schools, saw their colleagues as helping factors. They saw themselves as part of the larger educational community and they reported relying on others for support and encouragement. Only one teacher reported a colleague as a hindering factor, and this participant cited one specific colleague, not colleagues in general.

These science teachers found the development of photonarratives to be a useful assignment. One participant wrote, "As I reflected on my teaching, I realized that there were a lot of factors that are beyond our control as teachers, but there are so many ways we can work around those that challenge us and create a classroom where all students can learn." This type of reflection resonates with Part A of Figure 1, individual sense-making around their practice. Once teachers shared their reflections with the class (as in Part B of Figure 1), the act of reflecting helped them situate themselves within the community of the class. Finally, when issues presented in individual teachers' reflections were discussed (as in Part C of Figure 1), common themes in struggles and successes were revealed, extending community to the online class.

This point was the *beginning* of the formation of a community. These teachers were new to distance education, and their interactions were focused on finding similarities and differences among the group. The creation and sharing of photonarratives followed a specific structure, which was designed in accord with An and colleagues' (2008)

suggestion that structuring interactions in online environments can help to create stronger and more effective online communities of practice.

On the year-end course evaluation, most teachers indicated that the act of creating and sharing photonarratives was useful in their professional development. In some cases, the reflections indicated that teachers found the creation of photonarratives helpful in understanding and applying some of the content covered in class, suggesting that reflecting on the act of creating the photonarratives allowed the teachers to make sense of their evolving teaching practices, returning to Part A of Figure 1, with a renewed focus on self-reflection.

Conclusions

One of the goals of teacher professional development is to create supportive communities of practice. The course underlying the photonarrative study was developed to use the affordances of synchronous, online sessions to develop a community of practice with teachers at a distance from one another (Beldarrain, 2006; Hines & Pearl, 2004). Photonarratives gave voice to the teachers just as photo-based research in other sharing contexts gave voice to students in prior studies (Cook & Buck, 2010; Wolsey & Uline, 2010). Teachers shared reflections that resonated for them in terms of geography and technology. Sharing provided by the online, synchronous aspects of the course helped them to connect in spite of the difficulties of doing so via technical means (Tsai et al., 2010).

In data collected following the photonarrative assignment, teachers indicated they enjoyed the process and found it enlightening for their own practices. They were also able to reflect on some of the work of their peers through group discussion, suggesting that they began to strengthen their community of practice. However, there is little data to suggest that they reflected in substantive ways on the photonarratives of their peers.

The theoretical frame of this study, CBPR (Kellogg, 2011), helped the researched become the researcher, as the study participants were responsible for identifying themes and constructing knowledge of and about their communities (as in Israel et al., 1998). Our data suggests that teachers in this online course were able to participate actively in a research process on factors that affected their teaching, either positively or negatively (Wallerstein & Duran, 2006). Their personal reflections, although shared, stopped short of becoming part of one community; teachers shared, but there was little evidence suggesting they expressed emotional concern about the specific situations of teachers at other schools.

Vygotsky argued that activities and experiences become internalized only after a series of transformations take place first between people (interpsychological) and then within the individual (intrapsychological; as cited in Wertsch, 1985). Perhaps the limited level of engagement, without physically seeing the other members of the class reduced the number of transformations possible in this environment with limited interpersonal interactions.

Rogoff's (1995) participatory appropriation is a dynamic developmental process involving multiple people in examining each other's perspectives and contributions. The teachers in this photonarrative process were receptive to others' perspectives and contributions. Certainly, the concerns of these teachers, who taught in different settings, overlapped at multiple points.

From our perspective as course instructors, we found the photonarratives gave us insight into the challenges our students faced as teachers in diverse school communities, and as a result of this insight, we made adjustments in our instruction. For example, when we saw the very limited resources that Amy had available to teach science, we altered our expectations for her use of laboratories in her lessons, and we gathered surplus glassware from local businesses for her to take back to her school. Having teachers report that they have few science resources provides instructors with some information, but the power of seeing only three small pieces of equipment in an empty cabinet to teach with communicated far more about the lack of science supplies. With further research, we may be able to better document how photonarratives have reciprocal influences on students' and instructors' perceptions in dynamic professional development contexts such as online classes.

Are shared photonarratives in an online master's course a viable way to enhance teacher reflection on their teaching context and build an online community of practice? Our findings suggest that photonarratives offer an opportunity for self-reflection and sharing in distance education classes (such as this methods course). We found preliminary evidence that the act of sharing these photonarratives promoted the initial development of an online community of practice. However, getting to a deeper developmental level of community, or participatory appropriation (Rogoff, 1995), likely takes more time interacting to develop interpsychological levels.

Future implementations of this assignment will include follow-up assignments geared toward more advanced development of community in hopes of moving students further along the continuum illustrated in Figure 1. In this figure, reflection begins (A) within the individual as the person reflects experiences in the world. Within a given classroom setting, the individual may reflect on experiences within the classroom setting (B). Within group contexts (C), the individual may reflect on individual experiences (represented by small circles), but through interactions with other individuals the reflections include perspectives of others. In the case of the present study where teachers were isolated though distance education, they began with an individual perspective as shown in A and through interactions began to reflect not only on their context but also their context in respect to those of their classmates (C). The model found in diagram C of Figure 1 represents the reflections of multiple members of the class and is not intended to show sequence or directionality.

The photonarratives provided teachers with rich contextual information about other teachers' classrooms and schools. As a result, the photonarratives promoted reflection that enabled teachers to consider not only their context but also that of their classmates.

This study documented teachers' perceptions of factors that influenced their teaching (both positively and negatively) and highlighted the geographical challenges that teachers at remote sites may face (from field trips to access to laboratories) as well as challenges these science teachers had in using technology in their teaching. The study supports the use of photonarratives as a tool for promoting science teacher reflection and for communicating contextual details about teachers' classroom environments.

References

An, H., & Kim, S.. (2007). The perceived benefits and difficulties of online group work in a teacher education program. *International Journal of Instructional Technology and Distance Learning, 4*(5). Retrieved from http://www.itdl.org/journal/may_07/article01.htm

An, H., Kim, S., & Kim, B. (2008). Teacher perspectives on online collaborative learning: Factors perceived as facilitating and impeding successful online group work. *Contemporary Issues in Technology and Teacher Education, 8*(1), 65-83. Retrieved from http://www.citejournal.org/vol8/iss1/general/article1.cfm

Beckley, T.M., Stedman, R.C., Wallace, S.M., & Ambard, M. (2007). Snapshots of what matters most: Using resident-employed photography to articulate attachment to place. *Society and Natural Resources, 20*, 913-929.

Beldarrain, Y. (2006). Distance education trends: Integrating new technologies to foster student interaction and collaboration. *Distance Education, 27*(2), 139-153.

Bell, S.E. (2002). Photo Images: Jo Spence's narratives of living with illness. *Health, 6*(1), 5-30.

Bender, D.E., Harbour, C., Thorp, J., & Morris, P. (2001). Tell me what you mean by "Si": Perceptions of quality of prenatal care among immigrant Latina women. *Qualitative Health Research, 11*, 780-794.

Branon, R.F., & Essex, C. (2001). Synchronous and asynchronous communication tools in distance education: A survey of instructors. *TechTrends, 45*(1), 36-42.

Carter, G., & Jones, M.G. (1994). Verbal and nonverbal behavior of ability-grouped dyads. *Journal of Research in Science Teaching, 31*, 603-619.

Chalfen, R., Faccioli, P., Grady, J., Harper, D., Losacco, P., & Suchar, C. (2007). Photographs as answers: A summer school in visual sociology in Bertinoro, Italy. *Visual Studies, 22*(1), 85-100.

Cook, K., & Buck, G. (2010). Photovoice: A community-based socioscientific learning tool. *Science Scope,* 35-38.

Coulter, C.A., & Smith, M.L. (2009). Discourse on narrative research, The Construction Zone: Literary elements in narrative research. *Educational Researcher, 38*(8), 577-590.

deLange, N., Mitchell, C., Moletsane, L., Stuart, J., & Buthelezi, T. (2006). Seeing with the body: Educators' representations of HIV and AIDS. *Journal of Education, 38*, 45-66.

Feldman, A., & Weiss, T. (2010). Understanding change in teachers' ways of being through collaborative action research: A cultural-historical activity theory analysis. *Educational Action Research, 18*(1), 29-55.

Furman, M., & Calabrese-Barton (2006). Capturing urban student voices in the creation of a science mini-documentary. *Journal of Research in Science Teaching, 43*(7), 667-694.

Goldston, M.J., & Nichols, S. (2009). Visualizing culturally relevant science pedagogy through photonarratives of Black middle school teachers. *Journal of Science Teacher Education, 20*, 179-198.

Hallberg, L.R. (2006). The "core category" of grounded theory: Making constant comparisons. *International Journal of Qualitative Studies on Health and Well-being, 1*, 141-148.

Harrison, B. (2002). Photographic visions and narrative inquiry. *Narrative Inquiry, 2*(1), 87-111.

Hines, A., & Pearl, G. (2004). Increasing Interaction in web-based instruction: Using synchronous chats and asynchronous discussions. *Rural Special Education Quarterly, 23*(2), 22-36.

Israel, B.A., Schulz, A.J., Parker, E.A., & Becker, A.B. (1998). Review of community-based research: Assessing partnership approaches to improve public health. *Annual Review of Public Health, 19*, 173-202.

Jones, M.G., & Carter, G. (1994). Relationship between ability-paired interactions and the development of fifth-graders' concepts of balance. *Journal of Research in Science Teaching, 31*, 847-856.

Kellogg Health Scholars. (2011). About Kellogg Health Scholars program. Retrieved from http://www.kellogghealthscholars.org/about/community.cfm

Newman, S.D. (2010). Evidence-based advocacy: Using photovoice to identify barriers and facilitators to community participation after spinal cord injury. *Rehabilitation Nursing, 35*(2), 47-58.

Norman, K.I., & Hayden, K.L. (2002, February). K-12 instruction in the United States: Integrating national standards for science and writing through emerging technologies. Proceedings of the 10th symposium of the International Organization for Science and Technology Education, Foz do Iguacu, Parana, Brazil. Retrieved from http://www.modelab.ufes.br/xioste/papers/xioste_paper040.pdf

O'Connor, M.K., Netting, F.E., & Thomas, M.L. (2008). Grounded Theory: Managing the challenge for those facing institutional review board oversight. *Qualitative Inquiry, 14*, 28-45.

Rogoff, B. (1995). Observing sociocultural activity on three planes: Participatory appropriation, guided participation, and apprenticeship. In J. Wertsch, P. Del Rio, & A. Alvarez (Eds.), *Sociocultural studies of mind* (pp. 139-164). Cambridge, UK: Cambridge University Press.

Scott, K.W., & Howell, D. (2008). Clarifying analysis and interpretation in grounded theory: using a conditional relationship guide and reflective coding matrix. *International Journal of Qualitative Methods, 7*(2), 1-15.

Settlage, J. (2004). The use of urban students' photographs as a data source and complexity of their elementary teachers' interpretations. *Journal of Elementary Science Education, 16*(2), 33-50.

Tsai, I., Laffey, J.M., & Hanuscin, D. (2010). Effectiveness of an online community of practice for learning to teach elementary science. *Journal of Educational Computing Research, 43*(2) 225-258.

Vygotsky, L. (1978). *Mind in society: The development of higher psychological processes* (M. Cole, V. John-Steiner, S. Scribner, & E. Souberman, Eds.). Cambridge, MA: Harvard University Press.

Wallerstein, N., & Duran, B. (2006). Using community-based participatory research to address health disparities. *Health Promotion Practice, 7*(3), 312-323.

Wang, C., & Burris, M.A. (1997). Photovoice: Concept, methodology, and use for participatory needs assessment. *Health Education & Behavior, 24*(2), 369-387.

Wang, C.C., Anderson, R.M., & Stern, D.T. (2004). Exploring professional values and health policy through Photovoice. *Medical Education, 38*, 1181-1202.

Wertsch, J. (1985). *Vygotsky and the social formation of mind.* Cambridge, MA: Harvard University Press.

Wolsey, T.D., & Uline, C.L. (2010). Student perceptions of middle grades learning environments. *The Middle School Journal, 42*(2) 4-47.

Wyra, M., & Lawson, M.J. (2008, December). *Wellbeing in the school yard: A photovoice study.* Paper presented at the annual conference of the Australian Association of Research in Education, Brisbane, Australia.

Author Information

Lauren Madden
The College of New Jersey
email: maddenl@tcnj.edu

M. Gail Jones
North Carolina State University
email: gail_jones@ncsu.edu

Margaret Blanchard
North Carolina State University
email: meg_blanchard@ncsu.edu