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Teaching Science Methods Online During COVID-19: Instructor's Segue into Online Learning

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ABSTRACT

With the onset of the COVID-19 pandemic, the nation's universities and colleges required online learning and shelter-in-place/stay-at-home protocols for the end of Spring 2020 semester. This new reality resulted in the fact that my undergraduate elementary science methods course would not be held in our Title 1 urban elementary professional development school (PDS); so unfortunately, March 3, 2020 was the last time elementary science methods students (SMSs) and I met in person. Moving immediately from a class environment where SMSs were able to co-plan and co-teach several science lessons in the PDS classrooms to an online learning environment was a challenge I embraced. This paper reports on three different learning management systems employed during two specific life science class sessions. Initial coding of the 30 SMSs' video experiences indicates content learning with exploration of outside environments as doable during pandemic shelter-in-place conditions. Initial findings suggest repeated, purposeful observation and exploration of outdoor environments lessen fears of the natural world. Findings also suggest continuing positive outdoor exploration and research experiences in face-to-face or online learning environments to increase future teachers' abilities to conduct experiences in their future classrooms.

With the onset of the COVID-19 pandemic, the nation's universities and colleges required online learning and shelter-in-place/stay-at-home protocols for the end of the Spring 2020 semester. This new reality resulted in the fact that my undergraduate elementary science methods course would not be held in our Title 1 urban elementary professional development school (PDS); so, unfortunately, March 3, 2020 would be the last time I would connect with the elementary school and science methods students (SMSs) in person. Another reason this suspension of in-person classes was particularly difficult was because two classes of third graders at our PDS were anticipating the SMSs' visit to explore live crayfish (*Procambarus clarkii*) that had just arrived in their classrooms. Fortunately, prior to COVID-19 protocols, the SMSs were able to co-plan and co-teach six lessons in the PDS classrooms; those lessons included teaching concepts of light to first graders, properties of solids to second graders, exploration of seeds to third graders, soil composition and physical weathering to fourth graders, and physical separation of mixtures to fifth graders.

Navigating the new reality to ensure a productive learning experience for SMSs was my new focus. Even though I had never taught an online science methods course, I was not immediately fearful because I had ongoing systems in place for routine communication and detailed assignments that utilized *Blackboard*™ (*Blackboard tools* are italicized herein). SMSs were familiar with using *Blackboard* for submitting *Journal* responses to textbook chapters, reviewing *Course Content/Schedule* for detailed agendas, receiving weekly *Emails* for updates, accessing *Course Documents* for content, submitting *Assignments* aligned to rubrics, and reading *Syllabus* for revisions. Although nothing could fully replicate the planning, teaching, holding, and exploring of live crayfish structures with third grade students, I was able to locate and offer SMSs the opportunity to explore crayfish content by (1) observing a video (Virginia Tech University, 2016) with embedded questions I authored via free edpuzzle™ and (2) reading the *Background For the Teacher* content pages from the *Structures of Life Module–FOSS™ Next Generation Investigation 3: Meet the Crayfish*. After reviewing the content information, SMSs then completed specific pedagogical questions related to the four separate segments of Kim Nickerson's *Meet the Crayfish Lesson* (University of Santa Cruz, 2017). The resulting answers to the reflection questions regarding these online experiences were overwhelmingly positive as SMSs were able to observe and critique pedagogical methods (e.g., using a plastic model of a crayfish to show correct holding, effectively using a KWL chart to formatively assess student knowledge, and implementing strategies for English language learners to showcase their understandings) and explore their own crayfish content knowledge.

I know that several of the SMSs were relieved (even happy) that we were not able to teach the crayfish lesson in the classroom. I say this because of observed SMSs' verbal and non-verbal fearful reactions to the introduction of the content in class. In fact, before COVID-19 protocols were in place, I was able to visit the third grade classrooms to check on the habitats for the crayfish. I photographed myself holding the crayfish by the carapace with my fingers and sent the pictures to the SMSs with the caption that the third graders were excitingly anticipating the visit. These photographs enticed additional fearful responses. Research has shown that elementary SMSs are fearful of teaching science due to their own lack of content knowledge or experiences and this can negatively affect their science teaching efficacy (Bursal, 2010; Menon & Sadler, 2016). Sultan (2020) found preservice elementary teachers report the highest self-efficacy level in biology, over earth science, chemistry, and physics contents, respectively. However, from teaching SMSs for over 20 years in several informal settings (e.g., park, forest, and zoo), I have witnessed the interest in learning about mammals, insects, and plants via reading, but not necessarily willingness to engage with the natural world itself. For example, several inservice and preservice elementary teachers have asked me how to explore and transport crayfish, bess beetles, sow bugs/pill bugs/isopods, and earthworms without touching them. When planting seeds in prepped planter beds outside of the PDS, SMSs often requested garden gloves so they could avoid touching the soil.

To explore this aversion or uneasiness of the natural world, I purposefully designed an exploration of the outside environment while complying with COVID-19 *Centers for Disease Control and Prevention* (CDC) Coronavirus Disease 2020 guidelines (CDC, 2020); specifically SMSs were to practice social distancing by maintaining six-feet of distance from others and to stay out of crowded places. On March 31, 2020, I emailed the SMSs to explain that even though we were not going to be able to explore outside the classroom with the Kindergarten students on April 7 as planned, we were going to *explore our current outside environment*. The observations, documentation, and wondering research that SMSs completed was actually similar to what any teacher could do with K-5 students.

To prepare for the three to five minute outdoor exploration, SMSs observed two purposefully selected videos within edpuzzle™ that were at a higher content level than they would teach, with the idea that the content would help them prepare for Praxis™ science certification exam. The first video followed Logan Rosenberg as he discussed processes for safely exploring outdoor microhabitats; the eight-minute *Exploring Microhabitats* video prompt explained that

> microhabitats can be found anywhere, and they can lead to amazing exploration and discovery. An overturned decomposing log or the underside of a rock in a stream are excellent examples of microhabitats. Both a habitat and a microhabitat have typical abiotic (e.g., water, temperature, light, etc.) properties and biotic (e.g., plants, animals, fungi, etc.) factors. The nice thing about a microhabitat is that it is more accessible, and a diversity of life can be found in an area that is not very diverse. If microhabitats are not available locally you can create one in your classroom. A terrarium or an aquarium is a great example of a microhabitat. (The Wonder of Science, 2018, "Description" section)

Prior to sending the assignment to the students, I visited a local state park and explored microhabitats under logs, as explained by Rosenberg, and provided pictures and a brief synopsis of my termite, ant, and bess beetle findings.

Because their explorations of the natural world would incite questions, such as *what is that*, I included the basic premise of how scientists group, organize (i.e., classify), and identify living things. I underscored that they would not teach memorization of classification nomenclature (Kingdom, Phylum, etc.) in their elementary classrooms, but they would teach elementary students to look for patterns and trends in categorizing and identifying living things. Thus, SMSs observed and answered grouping/classification questions in edpuzzle™ of an appropriate, shortened eight-minute version of *Classifying Living Things* (Jerome, 2016).

To convey the importance of becoming familiar with living things in the environment, I reminded students that even if they teach in a large urban district, they will have the opportunity to explore goldfish, land snails, crayfish, mealworm/darkling beetle, bess beetles, earthworms, crickets, milkweed bug, earthworms, and sow bugs/roly polies in their future classrooms. I also provided the state content standards, which are directly aligned with the *Next Generation Science Standards* (NGSS Lead States, 2013) *K-ESS3-1 Earth and Human Activity* and *K-LS1-1 From Molecules to Organisms: Structures and Processes.* Lastly, I provided an extension idea to this exploration which would be to produce a class book (digital or paper) of common plants (trees, shrubs, flowers) or animals (birds, insects, mammals, reptiles, amphibians) that are found on school grounds. As an example, I sent them a link of their college campus trees that have been digitally mapped with a photograph to indicate type and location.

After reviewing the two content videos, the SMSs explored their local vicinity (e.g., street, yard, neighborhood, nearby park, etc.) and made a three- to five-minute video of their visit where they focused on animals and/or plants that they noticed**.** Being aware of possible uneasiness of the natural world, I relayed that they did not have touch anything if they did not want to do so; instead, they should focus on documenting their observations and wonderings. The SMSs used the *Flipgrid*™ application, which is accessible by phone, computer, or tablet. I emailed SMSs an identification number so they could post their videos to the online Science Methods *Flipgrid*™ classroom. From their initial exploration video documenting their wonderings, they elicited online, person/family, or text resources to answer their questions/wonderings (e.g., What is it? What does it eat? What is it doing?). After addressing their wonderings, they posted a second follow-up three- to five-minute *Flipgrid*™ video explaining their *research* discoveries. While they were posting their videos to *Flipgrid*™, they reviewed what their classmates were observing and discovering as well; in fact, several videos had over 30 views.

As the course instructor, I reviewed each *Flipgrid*™ post within 24 hours and made specific video comments addressing their explorations and research discovery videos. An affective objective of my video responses was to ensure that I placed no judgement on their explorations so that they felt a sense of security in being candid with their current knowledge. I began each video reply by thanking them for documenting their exploration and explicitly mentioning each of the living things they showcased. My comments also summarized a few video similarities (e.g., "your classmates and I have noticed those purple flowers in yards;" "one of your classmates also noticed the moss growing on trees;" "several also have noticed the birds chirping from trees").

From my initial coding of the 30 SMSs' video experiences, I discovered commonalities that are supported with SMSs' video quoted statements. During the COVID-19 shelter-in-place protocols, one student reported that she enjoyed being outside as "it was nice to be in fresh air during the quarantine and I noticed things I haven't before." Since most of the videos (87%) were completed at SMSs' primary homes, they mentioned historical connections (e.g., "I planted this pine tree when I was in first grade" and "this tree blooms for two weeks and has the worst smell"), as well as, familial connections (e.g., "had to show this redbud tree as this is mom's favorite kind" and "mom loves her Hosta"). During the exploration video phase, all SMSs made candid predictions and then later simply corrected their predictions on camera. One student predicted an observed bird was an Oriole because of familiarity with the bird in the northern climates; however, upon research, discovered it was an American Robin. Another student smiled during the research video and said:

> Uh … dandelions … I could just be silly and didn't know this, but the dandelions I found, I didn't know that the ones you blow are dandelions too. I looked up the yellow one and the other one came up too. I was like oh my goodness this is cool; I never even knew they were both dandelions. So, I am wondering still if they go from yellow to white or white to yellow. I could be wrong.

During the research video phase, SMSs often turned the camera to their laptop to show the screen evidence of their research which included species' geographical maps, classification websites, and digital photograph examples. From assessing and responding to the videos, I was impressed with SMSs' efforts; the SMSs expressed that they enjoyed the assignment and that they learned a great deal from their initial research.

In closing, I purposefully designed an online assignment that could be shared with others via *Flipgrid*™ to regain our connectedness as a class community. Since we did not have a chance to even say goodbye, connection with each other through their environment was desperately needed. As previously stated, several Flipgrid™ videos had over 30 views and a few students referenced their peer's exploration in their videos, such as "these are similar to the purple flowers others are finding in their yards." Students took the initiative to engage others in their exploration and research. For example, during an exploration video, a student reported a bush that had baby pink blossoms and stated, "Ooh, I don't know if you can hear that, but they are soft but kind of chalky feeling to it, the leaves do, and blossoms are kind of soft. Hum, I wonder why they are chalky like that?" During the research video, this student was not able to identify the bush, so she said, "My homework assignment is for you guys [i.e., classmates] to help me find that bush with the pink flowers on it, like I said earlier, it only has had flowers for about a week now, so I want some help." I plan to improve upon the online connectedness by asking SMSs not only to watch but respond to their peers' research videos in Flipgrid™.

I also wanted to provide opportunities for SMSs to use edpuzzle™ and Flipgrid™ so they could see how easy (and free) it was to interact asynchronously with a class. They most likely noticed that I engaged the edpuzzle™ *lock feature* for the videos so that they could not fast-forward the content; they also saw that they could embed open response and/or multiple-choice questions within the video. Although this mode of instruction was not the same as exploring the schoolgrounds with the Kindergarten students, the approach was beneficial during a world-wide pandemic. Hopefully, the SMSs could use these experiences and e-learning tools with their future elementary classrooms during non-traditional instructional days (with adult supervision of course).

I will modify and use this type of online assignment in future science methods courses to learn content and support class connectedness while also completing independent place-based exploration. Since Fall 2020 is a hybrid science methods course offered mostly online, I will visit Bernheim Arboretum and Research Forest to video and research local Kentucky microhabitats. By videoing with a 360-degree camera, I will be able to share the experience for online instruction within a link or for face-to-face instruction with the available 20 Vive™ headsets. I can use such digital experience for content pre-assessment purposes as students identify what they see. For a 100% face-to-face course session, I can modify the assignment by scheduling a trip to a local venue that I have asked SMSs to explore previously; possible venues include the aforementioned Bernheim Arboretum and Research Forest, Louisville Nature Center, Parklands of Floyds Fork, or Iroquois Park. We can explore the surrounding trees and use leaf litter sifters as one tool for exploring outdoor environments (Brown, 2006). I can pre-assess their content and observational knowledge from notebook entries of drawings with labels. I can then ask the students to conduct a similar exploration of an outdoor environment of their choosing. Another modification can include allowing students to check out collection or observational tools (e.g., hand lenses, leaf litter sifters, and collection vials).

Lastly, as P-16 instructors navigate uncertainty for the end of 2020 and possibly beginning of 2021, creating place-based connections to students' homes is powerful and necessary. The previously described authentic, outdoor, exploratory assignment was comforting in some way for the SMSs as they reported that they enjoyed getting outside to note that some plants (e.g., Hosta, Daffodils) return every year. Observing the natural sequence of events of returning spring flowers and budding trees may have provided a feeling of familiarity and hope that some phenomena, even in a pandemic world, are predictable, stable, and reoccurring.

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