Research Article

MODESTUM

Discourses and pedagogies of informal science educators at a nature-based summer camp

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ARTICLE INFO	ABSTRACT
	Out of school learning happens in many different contexts. This paper aims to focus on the educators at a nature based summer camp and how they learn to teach and implement various teaching practices. Little research in the informal science education field focuses on the educators themselves, especially those without a background in education, and this interpretive case study explores how educators in a camp context think about and discuss teaching and learning and what successes and challenges they face when teaching. Similar to novice classroom teachers, the educators at this camp had to negotiate competing ideas about what good teaching and learning is and a multitude of challenges that prevented them from being able to teach in ways that they wanted to. However, they also had several successes in student-led teaching moments that showed a responsiveness to student interests and ideas that is impressive for inexperienced educators. **Keywords:** informal science education, educator learning, outdoor education, nature based education, outdoor pedagogy

INTRODUCTION

Young people learn about the natural world through science experiences both in the classroom and out of the classroom. Although these different contexts of science learning can have many different names, for the purpose of this paper I am defining formal education as that which occurs inside schools and informal education as that which occurs outside of schools. While formal education is beholden to standards, test scores, and administrative barriers, sites of informal learning often allow for free-choice exploration of the natural world and are seen by youth as more engaging (Braund & Reiss, 2004; Falk & Dierking, 2018). Research also suggests that informal education is important for science identity formation (Braund & Reiss, 2004) and increasing science literacy (National Research Council, 2009).

Informal science learning (ISL) occurs in the home, with families, and in informal science programs at places such as zoos, museums, nature centers, summer camps, etc. This study focuses on an American Camp Association (ACA) accredited nature-based summer camp. According to ACA, accredited camps serve over 10.3 million children and employ 1.6 million camp professionals per year (ACA, 2019). Approximately 12% of ACA accredited camps offer nature-based or environmental education programs (ACA, 2019). Research has shown summer camp-based experiences can positively influence science

identity, including increased confidence in doing science (Riedinger, 2015; Riedinger & Taylor, 2016), increased STEM understanding (Khanaposhtani et al., 2018; Williams et al., 2007), greater interest in science (Ayar, 2015; Khanaposhtani et al., 2018), and in a future science career (Joyce & Farenga, 1999; Kong et al., 2014). Summer camps also often have repeat participants, which provides an opportunity for building on learning over a longer time period.

Much past research on ISL focuses on youth outcomes (both increased content knowledge and positive affective outcomes) and the design of ISL environments (e.g., museums, zoos, and aquaria; Dierking & Falk, 1992; Falk & Dierking, 2010; NRC, 2009; Plummer & Small, 2013). However, fewer studies focus on the practices of informal science educators (ISEs). If we know that there are positive outcomes for youth in ISL spaces, it is critical that we investigate what factors contribute these outcomes. One possible factor could be the practices of the educators themselves and the discourses that they promote around science learning. This paper is intended to identify these practices and discourses and does so through an interpretive case study (Dyson & Genishi, 2005) of ISEs at a nature-based summer camp. The ultimate goal is to identify ways to best support them in their work as educators.

I observed ISEs during their training period, while planning to teach, and while teaching to investigate the development of their views of teaching and learning and enactment of pedagogical practices. For my analyses, I used a framework of

pedagogical and contextual discourses (Thompson et al., 2013) and a framework for outdoor teaching practice modified from work by Lavie Alon and Tal (2017), both described below. The research questions that guided this work were:

1. What are the ISEs' and camp administrators' beliefs about teaching and learning?
2. What teaching practices do the ISEs use during educational workshops at the camp?

Pedagogy in Informal Science Settings

Although the literature about ISEs is limited, there are some studies that have explored ISE practice in particular contexts. For example, Plummer and Small (2013) found that planetarium professionals described their beliefs and goals for their practice in learner-centered, constructivist ways: their primary goal was for learners to leave interested in astronomy and with a desire to learn more on their own. They also had goals around astronomy content knowledge and providing engaging and/or visually appealing programming (Plummer & Small, 2013).

There has been more extensive work exploring the pedagogical actions of museum educators. Tran (2006) explored how museum educators facilitated learning as well as their goals for their teaching and student learning. Like Plummer and Small (2013), Tran (2006) found that the primary goal of the museum educators was to promote increased interest in science. Yet they also found that despite wanting to provide a unique and engaging science experience, lessons museum educators taught were often educator-centered lectures. Overall, the research suggests that museum educators often use didactic instructional methods with little or no accounting for learners' prior knowledge or interests (Tran & King, 2007).

A recent study on museum educators' challenges around climate change communication to their visitors suggested that educators found certain barriers getting in the way of effective communication, including having too little time and too many tasks in their positions, lack of content knowledge, and difficulties lesson planning (Henry & Carter, 2021). The authors suggest that strong partnerships, particularly with those that can provide expertise in outreach and communication might be key in the museum educators' ability to provide effective science communication (Henry & Carter, 2021).

Museums and planetariums are very different contexts than nature-based informal education experiences. In previous research, it has been suggested that teaching in the outdoors may require a specific set of skills and pedagogies and that educators who work in the outdoors may have different goals for their students than classroom educators. Research focused on nature interpreters, specifically parks employees who provide nature experiences for visitors. Ham and Krumpe (1996) found that nature interpreters' goals were mainly affective rather than cognitive, or to provide enjoyable and engaging programming in order to "capture and maintain attention" (p. 13). One goal that differentiates park interpreters from other nature-based educators is the aim to promote specific behavior that might support conservation

efforts of their park (Ham & Krumpe, 1996; Powell & Ham, 2008).

In contrast, Lavie Alon and Tal (2017) found that outdoor educators (OEs) guiding field trips for school groups spent most of their time explaining phenomena and concepts rather than developing attitudes and values. Looking at what methods OEs used, the authors found that they used more didactic rather than experiential methods while teaching. The OEs discussed the potential for what the authors call "unstructured teaching" (p. 243), or time for exploration and discoveries, but utilized more "structured teaching" (p. 243) methods. This differed based upon the experience of the OEs; more experienced educators provided more unstructured teaching time than less experienced educators.

The above studies reveal variability in the goals and practices of ISEs depending on their contexts and experience. These studies provide a starting point with which to compare the findings of this study. Looking across studies, ISEs in various contexts seem to be navigating a tension between what their stated goals for science learning and what they actually do in practice.

Pedagogical and Contextual Discourses

I am drawing on a framework of contextual and pedagogical discourses (Thompson et al., 2013) to explore how the ISEs negotiate different messages about what it means to teach and learn. The authors describe pedagogical discourses as "personal theories about 'what counts' as productive teaching and learning" (p. 5-6). They refer to outside influences such as institutional and societal messages as contextual discourses. This includes both explicit and implicit messages. Educators often have to negotiate competing ideas about good teaching as their ideas and societal or institutional ideas may not align. In particular Thompson et al. (2013) use this framework to think about novice science teachers who have been taught in university methods classes to teach in learner-centered ways and who might move into schools or districts where views on teaching and learning do not align with their own. Actual teaching can be influenced by a combination of pedagogical discourses and contextual discourses.

METHODS

To explore my questions of pedagogical discourses, contextual discourses, and teaching practices, I conducted an interpretive case study (Dyson & Genishi, 2005) of ISEs at a small nature-based summer camp in a rural town in the United States. The background of the ISEs (i.e., young, with limited or no teaching experience) and the one-week long "staff training" is representative of many informal science programs. A detailed, contextualized explanation of ISEs' perspectives on teaching and teaching practices at this specific site may inform how similar sites of informal learning might interrogate the supports they provide their ISEs while learning to teach (Stake & Trumbull, 1982). It will also illuminate the limitations and constraints in ISE preparation at sites such as this one.

Research Site

I observed a one-week staff training session and a two-week long camp session. Campers ranged in age from 11 to 15-year-old and were primarily from a large urban and suburban area approximately two hours away. When compared to other ACA-accredited camps, attending the camp costs less than most other private summer camps but is more expensive than public (e.g., YMCA, scout) camps, which are subsidized. Approximately 10% of campers received financial aid to attend.

During the camp sessions, staff and youth stay in open-air, plumbing-free, rustic cabins every night, aside from a one- or two-night backpacking trip during the session. The camp day was split into morning, afternoon, and evening activities. Mornings were designated for natural history workshops and afternoons consisted of a range of activities campers can choose from such as hikes and art projects, as well as free time. Evening activities were varied, but some examples include team building games, night hikes, a square dance, and sing-outs. The morning natural history workshops are the main focus of this study because this is when staff most considered themselves to be acting as educators. Workshops were typically named after the topic of the lesson, such as "birds," "ferns," "reptiles," and "stream life."

The camp is located on a wildlife sanctuary in the Appalachian Mountains. One staff member described it as follows: "It's just like a building. It's like a building and a pond and a bunch of land. That's like basically it. And everything else we just like generate by doing stuff." Other than the cabins, there is one main building without heating or cooling, so most often youth are outdoors, exploring the many ecosystems represented on the campus. The main area of the camp is located in a wooded valley that was formerly a farm, surrounded by ridges and rolling hills. The over 600 acres are made up of a mix of forest and meadow ecosystems. The buildings of the camp are located beside a spring-fed stream and pond, providing aquatic ecosystems to explore.

Participants

Camp staff served as both counselors and educators. There were 29 who attended training week and 13 working the session that I observed. They were all high school- and college-aged without any other experience teaching. Although their job title is "staff," and they play many roles, I will refer to them as ISEs for the remainder of this paper because my focus is their specific role as educators. In addition, the two administrators (Director Vee and Assistant Director Emily) were participants in the study.

At the beginning of the summer season, the ISEs all participated in a "staff week" where they covered a huge range of topics from search and rescue protocols to how to teach. In terms of preparation for teaching, the director and assistant director led a few sessions with the ISEs where they modeled an ideal workshop, talked about planning, and had ISEs think about pedagogy. The ISEs also had time where they sat down with coworkers teaching specific topics and brainstormed lessons.

In addition to observing the ISEs during training and teaching, I also interviewed five ISEs after the two-week camp session. I will provide a brief description of each of these five ISEs who serve as embedded cases within the larger case study. These five individuals were chosen because I had observed them teaching and had field notes and recordings of their participation in the staff training week; they also volunteered to be interviewed.

Nick

Nick was a 19 year-old ISE who had been coming to the camp since he was 13. He had attended as a camper for three years and this was his fourth year working at the camp. His primary passion in natural history was birds and he could name most of the birds at the camp by sound almost immediately. During the session that I observed, he taught four bird workshops and one workshop on stars. Nick and Reggie, who I will introduce below, had been planning and leading the bird workshops at the camp for several years and planned each year's workshop around a new bird phenomenon. This was distinctly different from how most of the other workshop topics were planned. This year they planned the bird workshop around observing and recording bird breeding behaviors.

Ryan

Ryan was an 18 year-old ISE who had been attending the camp for ten years. During the session I observed, Ryan taught workshops on spiders and fungi. He frequently expressed that camp was a special place to him where he felt safe to be himself around others who had similar interests in nature. He described it as "the safest place to be a nerd" and also said, "I can have discussions about the cool insect that's eating something… and nobody really judges you for it." He expressed that despite loving to learn about nature at the camp, he did not enjoy science in the classroom. He had just finished his first year of college and was planning to study history with the goal of attending law school.

Rebecca

Rebecca was a new ISE at the camp and had not attended as a camper. She was 17 years old and had no prior teaching experience but had found out about the opportunity from a different nature-based camp she had attended. She described the other camp as being both similar in the focus on natural history, but also said the teaching there was more similar to classroom learning and mostly occurred inside as lectures. During the session that I observed she taught workshop topics on stream life, pond life, fungi, and reptiles. Despite having attended a nature-based science camp and now working at another, she expressed to me that she did not enjoy science in school because she felt "it was boring. I just feel like it was less creative [than science outside of school]. I did not have as much opportunity for creativity."

Ben

Ben was a 19 year-old ISE who had attended the camp since he was eight years old and began working there at 16. Although he had no experience in teaching science outside of the camp, he did work as a special education swim coach and therefore had some experience working with children. Ben always loved participating in skits and other silly activities with the campers, who all thought he was hilarious. During the session I observed, Ben taught workshops on fungi, pond life, and

stream life. Despite loving science both in and out of school, Ben was majoring in classics. He said that choice was made because of a particularly influential teacher that he had who made the subject interesting and engaging.

Reggie

Reggie was also 19 years old and had attended the camp starting at age 12. Along with Nick, Reggie was an enthusiastic birder. In fact, he interrupted our interview four different times to identify birds that he heard while we were talking. During the session I observed he taught workshops on birds, butterflies, and trees. He admitted that he spent most of his energy planning for the birds workshop. Reggie was studying ecology in college and told me that as he engaged in his ecology courses during the school year, he would take notes on his phone about ideas he had for activities he could teach over the summer. Although he was not sure what his career goals would be after college, he expressed wanting a career that allowed him to be outdoors.

Data Sources & Collection

Audio recordings

I made audio recordings during both the one-week "staff week" training and one two-week camp session. During the training week, I attended, and audio recorded 13 events that included sessions that the administrators led on teaching as well as instances where the ISEs planned workshops in small groups. During 2-week camp session I attended and recorded six workshops that ISEs taught as well as conversations debriefing that occurred immediately after workshops.

Field notes

To complement my audio recordings, I also took handwritten field notes during staff training activities, staff teaching activities, as well as unexpected learning events. During staff training activities, which mainly occurred indoors and while sitting, I took notes while the activity was occurring as a participant-observer. During staff teaching activities, which were mainly outdoors, I took hand-written notes to the best of my ability, but also made sure to record further notes and thoughts in the form of memos as soon as I could after each activity was over. In these field notes I was primarily focused on recording what educators and youth were doing and how they were moving from location to location in order to supplement the audio. This was especially useful when there were long periods of time, where group was moving from one place to another or independently exploring an area, and audio recording could not capture the actions they were taking.

Interviews

I conducted one 45-minute semi-structured interview with each of the five focal ISEs at the end of the camp session. These interviews focused on what workshops the ISEs taught, how they thought those workshops went, and their ideas about teaching in general. I also interviewed the camp director for about one hour and focused that interview on her history with the camp, her thoughts about the future of the camp and changes she hoped to make. In addition, we talked about how she envisions learning at the camp, not just for campers, but for the ISEs.

Artifacts

I collected artifacts in the form of photographs as well as documents (e.g., handouts and lesson plans). I took photographs of artifacts created during staff training events or collected a copy of any handouts that were given. I also took pictures of the camp itself in order to accurately describe the spaces that the ISEs were working within. Finally, I collected any lesson planning documents that the ISEs created.

Data Analysis

I first transcribed each interview and staff training audio file and then uploaded audio data, transcriptions, and field notes into qualitative data analysis software. I will describe the analysis process for each research question below, as well as how I used the conceptual framework for analysis purposes.

RQ1: What pedagogical and contextual discourses do the ISEs have to navigate?

To explore my first research question, I engaged in two rounds of open coding of interviews (ISEs and director) and staff training events. These were all coded at the level of ideas. In the first round, I engaged in in vivo coding (Saldaña, 2016), looking for instances where ISEs or the director and assistant director revealed ideas about what they thought constituted good teaching. I then categorized those codes into larger code groups. I used these groupings in a second coding round. After this round, I looked across the data to identify themes, which became my findings. I categorized the data into pedagogical discourses (ideas coming from ISEs) and contextual discourses (ideas coming from camp administration) as I coded.

In order to explore contextual discourses (Thompson et al., 2013), I used my second-round codes in order to analyze field notes and artifacts from the training week to further explore what explicit and implicit messages were being sent to the ISEs regarding what counts as good teaching. Also incorporated into the concept of contextual discourses (Thompson et al., 2013) are logistical limitations that affect how the ISEs learn to teach. These themes emerged within interviews, recordings, and field notes. Finally, I looked for similarities and differences that existed in the pedagogical discourses (Thompson et al., 2013) of the ISEs and the contextual discourses of the camp administration.

RQ2: What teaching practices do the ISEs use during different activities at the camp?

For my second research question, I analyzed audio recordings of ISEs teaching and planning as well as my field notes. I modified an existing framework of OE teaching (Lavie Alon & Tal, 2017) in order to create initial codes with which to analyze my data (**Table 1**). However, I also allowed myself to be flexible while coding in order to find unexpected practices that differed from the framework. I chose to analyze the audio recordings of the workshops rather than transcriptions because most workshops included time walking from place to place and time for individual exploration that transcriptions would not have necessarily captured. I supplemented these recordings with field notes, where I noted what youth were doing during times of silent exploration.

Table 1. Teaching practice codebook (modified from Lavie Alon & Tal, 2017)

Parent code	Child code	Description
		Planned instruction
Structured teaching	ISE-centered	ISE explains phenomena, asks/answers questions, uses IRE pattern.
	Student-centered	ISE encourages individual/group tasks, ISE elicit & use student ideas, structured exploration time.
Unstructured teaching		Occurs based on students' or ISEs' discoveries. Not planned ahead of time. "Teachable moments."
Affective		Lavie Alon and Tal (2017, p. 243) name this "amplifying physical dimension of environment" & describe as encouraging emotion, anticipation, excitement, & aesthetic & kinesthetic experiences.
Free time		Allowing for unplanned, free time in nature with no tasks. Breaks in learning to allow for social interaction, take pictures, walk from place to place without a task. Unfocused time.

FINDINGS

Below I outline major themes I found in the data. I first discuss contextual discourses from camp administration, then the pedagogical discourses of the ISEs. I then discuss what the ISEs did in practice and whether their ideas about teaching and learning and their practices were aligned or incongruent.

Contextual Discourses from the Camp Administration

The camp director, Vee, and assistant director, Emily, led two discussions about how to teach natural history workshops with the ISEs during the staff training week. First was an example workshop led by Vee and Emily, with ISEs acting as campers, followed by a debriefing discussion. Second was a discussion about how to plan for a workshop. Analysis of these two discussions revealed several themes regarding what the administrators thought constituted good workshop teaching.

Use of the outdoor environment

Vee and Emily strongly encouraged the ISEs to use the resources of the outdoor environment within their teaching. They modeled this by centering the outdoors in their own example workshop, and use of the outdoors was explicitly discussed while debriefing and talking about planning. For example, in the latter case, Vee and Emily encouraged ISEs to hold majority of their workshop outside and move to different locations to take advantage of various ecosystems of the camp.

In **Figure 1**, showing notes from the large group discussion on planning, you can see that the word "nature" is written in large letters with a box around it. In addition, next to "change it up" is written "location." While debriefing the example workshop, Vee asked, "What else were elements in the workshop that we just did with you?" and Reggie (an ISE) responded, "Pretty quickly got us outside walking places." This shows that the importance of teaching outdoors was privileged by camp administrators and recognized by ISEs as important.

Movement

Movement was also encouraged as a tool for engagement. In the example workshop, Vee and Emily modeled this when they had the ISEs participate in an activity that involved them standing up and holding various signs. Each ISE was called on to get up and participate at some point in the activity. While debriefing, Vee mentioned "You guys got up and got to move and you - and not only did we engage you, you moved." Movement was also discussed as in opposition to staying in the same place and lecturing. Vee told ISEs, "pretty much my pet peeve of workshops is people just sitting down with a whiteboard and start talking to students."
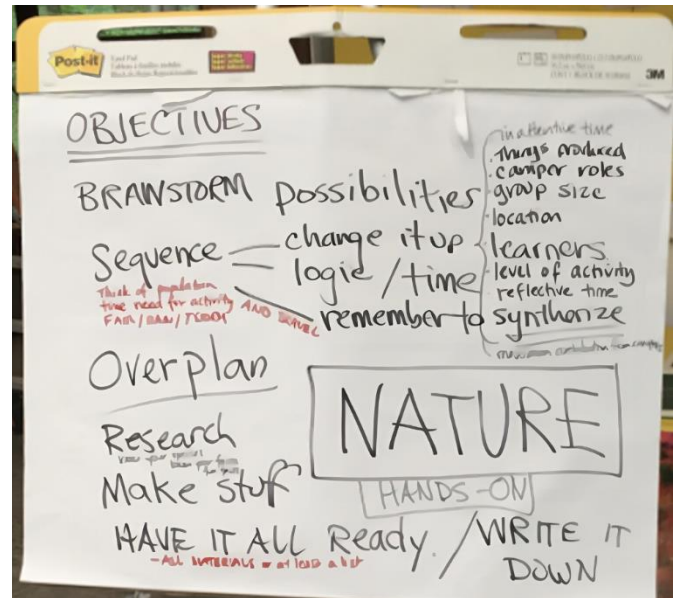
Figure 1. Photograph of chart paper notes on how to plan a workshop (Source: Author)

In **Figure 1**, next to the words "change it up," Vee wrote "level of activity." This point echoed Vee's "pet peeve" of people sitting down for an entire workshop. She felt it was important for ISEs to vary activity levels in order to give youth chances to move and to rest.

Planning

Vee and Emily also stressed the importance of taking specific steps to plan for teaching. After debriefing, Vee encouraged ISEs to think about planning before their next meeting:

> You could be thinking about what did [Emily] and I have to do to make all that work? Right? So, you can almost go back and think–what did we do in order to have a workshop … there's a certain–like a tick list sort of things.

They returned to this idea of a "tick list" in their following meeting, where they made the list pictured in **Figure 1**. The chart paper in **Figure 1** reflects the order in which ISEs were encouraged to go about planning. The first step was "overarching objectives," and Vee encouraged ISEs to start their planning meetings by thinking about what they wanted youth to come away with. Next, they were encouraged to brainstorm possible ideas for activities, and then think about the sequence of activities.

In thinking about the latter, ISEs were encouraged to consider timing and logistics, as well as weather conditions, and remembering to leave time to synthesize their workshop. Finally, Vee wrote on the chart paper that ISEs should research their topic (making sure to know common species and fun facts), make any materials they might need, and have everything ready prior to the day of the workshop.

This discussion suggests that camp administrators placed high value on workshop planning. Incidentally, ISEs were actually given less than an hour per workshop topic to plan as a group during the staff week. The night before campers arrived, ISEs got a block reading time, where they were encouraged to do research to re-familiarize themselves with the content they were teaching. This was often not enough time for ISEs to have a finalized plan. Therefore, this discourse around the importance of planning was not supported by the actions of the camp administration.

Student needs

Vee and Emily also discussed with ISEs the importance of considering individual student needs in their teaching. For example, there was a group of older students (mostly 14 and 15 year olds) who were placed together for workshops as well as one group of younger students (mostly 11 and 12 years old). ISEs were told to plan different activities depending on the age of their students, especially considering if they have attended the camp previously and might have already done certain activities.

Finally, the ISEs and the administration also discussed providing a variety of types of activities in order to attend to what Vee and Emily referred to as learning styles. Specifically, Vee and Emily emphasized providing a mix of verbal information and visual information. When debriefing what they did during the example workshop, Vee said "Yeah, so verbal, reinforced with visual. So you got to call out stuff, but then we recorded your ideas … some people may not be able to read, they might listen, some people do not listen so well once they hear it." The camp administrators also encouraged the ISEs to provide variety in group size (**Figure 1**). In the example workshop, Vee and Emily modeled this when they had ISEs do activities as a whole group and in small groups.

ISEs' Pedagogical Discourses

Analysis of the interviews with ISEs revealed several themes about what they thought constituted good teaching during workshops. These included the following:

(1) it is important to incorporate the outdoors,

(2) good teaching is varied for different learning styles, and

(3) teaching should address both cognitive and affective goals, including encouraging fun.

Some of these overlapped with the camp administration's discourses, but some were different (**Figure 2**). In this section I will discuss each of these discourses.

Use of the outdoor environment

Similar to the camp administration's discourses, when asked what an ideal camp workshop looks like, Nick stated, "I think an ideal workshop instantly heads outside. I like putting materials aside and doing our first activity relatively far away
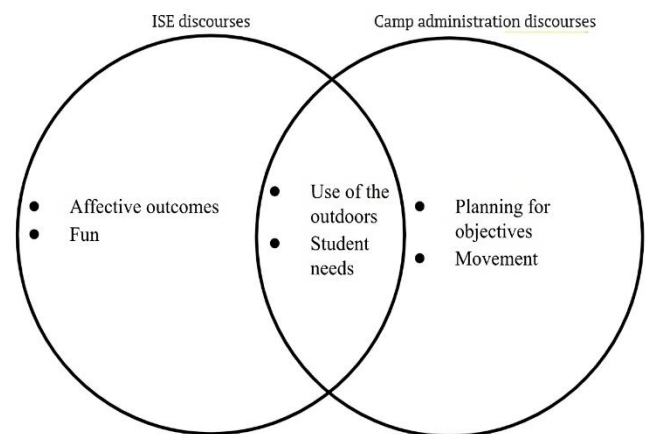

Figure 2. Venn diagram of ISE's discourses & camp administration's discourses about teaching (Source: Author)

from the [main building]." Getting outside was also viewed by the ISEs as a way to see the animals and plants that they were talking about in person. When asked about a spider workshop that he taught, Ryan said "we actually *went out* and looked for spiders" [emphasis added]. Ryan was specifically contrasting this to learning about spiders from a book, which you could do anywhere. Similarly, while describing a tree workshop that he taught, Reggie said "we focused on the White Oak, Black Oak and Red Oak … I had found a place up the [name] trail where there was all three of them … showed them on a whiteboard how the acorn caps differ. And then set them out into a small area to try to find all three." ISEs emphasized not only teaching about the focal subject, but also making sure that they went out to find those plants and animals in person. These quotes show that, similar to the camp administration, ISEs thought getting outside was important. However, the ISEs were more specific, explicitly saying that the purpose of getting youth in the outdoors was not just to be in that space, but also to interact directly with the subject of the workshop.

Engaging all students

Similar to the camp administration, the ISEs also expressed a desire to teach to what they referred to as different "learning styles." Nick connected this idea to the camp administration's discourses when he said, "I've come to really appreciate the focus on different learning styles during staff week. A focus on switching up learning methods has certainly made my workshops more complete and rewarding." Similarly, Ryan said "Everybody learns in very different ways. And everybody, not everybody cares about the same thing. So you really have to work a little harder to make sure that everybody is engaged at some point during the lesson." All workshops that I observed included a large variety of activities, especially switching between sitting and talking to playing more active games. Notably, ISEs did not mention getting to know or addressing individual student needs and often had the same lesson plan for each group that they worked with.

Cognitive and affective outcomes

When discussing what they want youth to get out of workshops, the ISEs discussed both cognitive and affective outcomes. In terms of specific knowledge that they wanted youth to gain from the workshops, the ISEs had different goals

for different workshops. Rebecca, for example, wanted youth to understand the difference between a reptile and an amphibian in her herpetology workshop and stated that they "talked about what makes a reptile a reptile, because a lot of kids do not know that, and a lot of kids think amphibians are reptiles."

When debriefing his bird workshop, Reggie focused more on the science skills that youth were developing and said, "I think we did a good job of focusing on the science aspect and kind of comparing it to a real scientific study." Reggie also did not believe that focusing on identifying species made for an engaging workshop. For his tree workshop, he said "I wanted to get away from tree [identification], because I do not feel like it's a great way to actually learn anything about trees." On the other hand, Ben expressed that his favorite thing to do during workshops was "walking out and catching stuff and looking at things and ID-ing things. I think that's always been the biggest part of most of my workshops." Ryan also had positive thoughts about identifying species when he said, "We mostly went on a fungi hunt and then identified it, which was really good." Although the ISEs had some different ideas about specific content or skills that they thought were important for youth to know, they all expressed that interacting with the subject of study was an important part of a workshop.

Often ISEs put an emphasis on affective rather than cognitive outcomes. Reggie stated:

> For me as a camper and a young staff, like a lot of just … the way that I am was built here and by interacting with the people here. Because the friendships at [the camp] are different from anywhere else and it's hard to be the same around people who you are less comfortable with. So I feel like making this place somewhere where the campers can do that and develop themselves as people is a big part of teaching, rather than just teaching knowledge.

Rebecca expressed similar ideas when she said, "I think campers seemed to be learning as much by just living together as through their workshops … every, every part of it is teaching you something." The night before campers showed up, all of the ISEs and the administration shared their goals for the summer (both for themselves and for the youth). The large majority of the ISEs did not mention anything about specific science knowledge when they shared their goals for campers. Some of the goals that ISEs expressed were for campers to gain confidence, build friendships, have fun, enjoy being outside, and have "woah moments" in nature.

Providing fun for campers was very important to the ISEs. Nick said, "I think the best and most memorable workshops are those that are also very fun." When I pushed some ISEs into thinking about what makes a workshop fun, there seemed to be some tension between their ideas of what was fun and what was learning. Some ISEs felt that in order to make a workshop fun and engaging, they had to include a game. Ben expressed difficulty coming up with a game for the fungi workshop that he taught. When I asked him if he thought he needed a game he said "I definitely think that raising the excitement level and getting campers moving around is good. Because if you do not play a game, you usually have to just substitute the excitement yourself."

Teaching Planning and Practice

This section will focus both on the following findings around ISE teaching practices around planning for teaching and teaching itself. First, planning time greatly affected how engaging and coherent a workshop was. Second, during structured teaching time (Lavie Alon & Tal, 2017, **Table 1**), ISEs used more educator-centered than student-centered teaching practices. However, ISEs were open to flexibility within their workshops and often utilized student discoveries for unstructured teaching time (Lavie Alon & Tal, 2017). Third, the workshops most often consisted of disconnected activities and were not coherent. Finally, inexperience with the logistics of teaching seemed to affect the ISEs' confidence while teaching.

Planning

During the staff training week, ISEs were given less than an hour to plan each workshop topic. I observed and recorded four of these meetings and out of the four, only one yielded a written plan. As Nick stated in his interview, "honestly, using planning meetings for staff week just generally involves a lot of broad ideas or possible games/activities that are not very specific or connected." This aligns with what I observed. For example, in the planning meeting for the workshop on stars, the majority of the time was spent thinking about possible individual games to play during the workshop. They did not follow the "tick list" order of planning that Vee had suggested.

Despite having these set-aside times for planning during the staff training week, often the majority of the actual planning happened the night before or the morning that ISEs were teaching. When I asked Rebecca how she thought her stream workshop went, she said "Oh, not well… we were not prepared because we did not know that we were teaching it until like an hour before we had to go to bed the night before. And we kind of just went for it." They ended up doing water quality testing by the stream, and Rebecca expressed that she thought it went okay, but only because they were lucky and ended up with a group who had not done those kinds of activities before.

In contrast, one workshop that the director, staff, and I all expressed was very engaging for youth was the bird workshop. As I explained above, Nick and Reggie, who are bird enthusiasts outside of the camp, planned the bird workshop around the phenomena of bird breeding behavior. One reason this workshop stood out was that Nick and Reggie, who attended the same university, had actually done the majority of the planning prior to the summer. They wanted it to be based off of a scientific study run at their university; they had a lesson plan written up before they arrived at staff training week and therefore were able to use the provided planning time to simply work out smaller details and gather materials.

Disconnected activities

Most often the plans that ISEs came up with consisted of lists of disconnected activities about the focal topic. Despite camp administrators encouraging ISEs to think about overarching objectives of their workshops before planning

what activities to do, most of the planning meetings began with a conversation brainstorming specific activities or specific content to cover. This led to many workshops that were not necessarily coherent, but instead consisted of many various activities or discussions that all related to the topic of study but did not lead to a specific learning objective. When I asked Rebecca about what she would change about the stream workshop she taught that she felt did not go well, she stated:

> I would spend more time on something specific and less like–doing like five minutes on the water cycle, and five minutes on soil, and … that does not make sense looking back at it. But back then it was just like, it seemed like the easiest thing to do. Because, like, I have a little bit of knowledge about all of this already. So right. Let's just throw it on them for no reason.

Rebecca realized after she taught the workshop that she and her teaching partner might have planned too many different topics and content knowledge to cover and in the future she would want to spend more time working toward a specific goal.

One of the workshop planning meetings I observed was on trees and the discussion in that meeting was similar to the issues Rebecca brought up in her interview. The ISEs began their conversation making a long list of different tree activities they had enjoyed teaching or had enjoyed as campers in the past. I wrote in my field notes that the ISEs had a lot of ideas that they were all passionate about but had trouble narrowing them down. Some of the topics and activities that they discussed and that I wrote down in my field notes were identifying trees without eyesight, "Meet a Tree" activity (which involves getting to know one tree individual tree in detail), what human resources come from trees, the tree history of the camp area, how trees compete for resources, and making a family tree of trees. Although all of these activities are fun and engaging educational activities for youth, they are disconnected and ISEs did not seem to have a set of learning goals for workshop participants.

Structured and unstructured teaching

Drawing from the framework by Lavie Alon and Tal (2017) shown in **Table 1**, I am referring to structured teaching as that which was planned for prior to the workshop and unstructured teaching to refer to times that occur based on discoveries in the moment and which were not planned for. Within structured teaching, I looked for instances of ISE-centered instruction, which included more didactic practices (e.g., lecturing, sharing facts), as well as student-centered instruction (e.g., small group activities, planned exploration time). Unstructured teaching on the other hand is defined as moments that come from unexpected discoveries. For example, an exploration activity such as searching for and catching butterflies that was planned by the ISEs would be categorized as structured and camper-centered teaching, while instruction that came from a youth discovery of a dead butterfly being eaten by ants would be categorized as unstructured teaching.

Throughout all workshops I observed, the ISEs utilized both structured and unstructured teaching practices. All were willing to be flexible in their plans and let camper discoveries

lead the learning even when the discovery was not related to workshop content. For example, during a workshop that was planned around water testing at the pond, campers found a dead mouse that was being eaten by insects. Campers had questions about how it might have died and what insects were on it and the ISEs engaged campers in about 15 minutes of discussion around the phenomenon.

Although all ISEs utilized unstructured teaching in meaningful ways, the use of structured teaching differed between workshops. Workshops that both ISEs, the director, and I deemed to be more successful at engaging campers used more camper-centered teaching practices, while those that were not as successful often used more educator-centered teaching practices. For example, the bird workshop that was planned by Nick and Reggie was viewed as a very successful workshop in terms of camper engagement. The majority of the time in this workshop was spent on data collection led by campers observing bird breeding behavior. The only ISE-centered time in this workshop was a short discussion around how to record data on the spreadsheet. Even the synthesis discussion was led by students who were encouraged to discuss what they think the patterns in the data they found meant and to compare to previous groups' data.

In contrast, the stream workshop that was led by Rebecca and another ISE was not successful at engaging campers according to the two ISEs that led the workshop. The instruction in this workshop focused on water testing of the stream and was primarily ISE-centered. Rebecca and her co-leader first gave a presentation about what makes a healthy water ecosystem and then explained the different tests that they would do, including pH testing, temperature readings, turbidity, etc. Then they gave instructions for what each student was supposed to do, had them perform their test one by one, and interpreted the results of the testing for them. During the water testing activities, I observed many campers who were not actively engaged and were sitting by the stream playing with sticks or rocks rather than being encouraged to participate in the activities.

DISCUSSION

In this work I have discussed how ISEs and administration at a nature-based science camp think about teaching and learning science. I also used a modified framework of outdoor teaching practice proposed by Lavie Alon and Tal (2017) in order to look at the teaching practice of the ISEs. In some instances, ISEs were able to find alignment between their pedagogical discourses, contextual discourses, and teaching practice. However, much of the time there was misalignment between what ISEs wanted to do while teaching and what they ended up doing. Below I will discuss some of the reasons why this might have been the case.

Negotiation of Pedagogical and Contextual Discourses

According to Thompson et al.'s (2013) framework, educators, especially novice educators, are often negotiating different and competing discourses about what constitutes good teaching. As educators learn to teach, they may develop practices that align more or less with various discourses that

come both from their own individual experiences and the community and context that they are teaching in. As teachers transition from context to context, their pedagogical discourses are likely in flux as they interact with different contextual discourses.

In the case of this camp, the ISEs were negotiating their own ideas about good teaching, which had been formed from their experiences as students, campers, and camp staff, and the camp administration's ideas about teaching. As I noted above, some of these discourses overlapped and some of them did not (**Figure 2**). One of the possible reasons for some of the discourses that differed between ISEs, and the camp administration is that the ISEs, in addition to being educators during the summer, were all high school or college students as well. Their experiences as students in formal science contexts likely influenced their ideas about science teaching and learning as well. Several expressed that they did not like science in school because it was not engaging or hands-on, which could explain the ISEs' focus on workshops being fun.

The camp administration, however, likely had different experiences and goals when it came to science teaching at the camp. Vee and Emily had to keep in mind things like camp enrollment and the desire to keep stakeholders (e.g., parents, campers, employees, leaders of the school which owned the land) happy. One of the primary discourses that the camp administration had that was not taken up by ISEs was around planning for instruction which I will discuss more below.

There were some discourses that the ISEs and the camp administration both shared. The importance of being outside and exploring the natural world while teaching was important to both groups. This makes sense because the camp was described as nature-based and there was likely an expectation by all involved that the outdoors would be a large part of the experience. In addition, the ISEs I interviewed all had a passion for the outdoors and the environment, so being outside while teaching was enjoyable to them. This was a discourse easily taken up by the ISEs because it likely already aligned with their own ideas about good science teaching. The alignment/misalignment between the ISEs individual discourses and the camp administration's discourses about teaching are important to note because the negotiation of these sometimes competing discourses is how a novice educator decides what to do in practice (Thompson et al., 2013). It also is important to understand ISEs' personal theories about teaching and learning if the camp wants the ISEs to take up different discourses or strengthen discourses that they already have.

The Importance of Planning for Educator Practice

Some of the camp administration's discourses were not always clear. Although Vee and Emily conducted a long discussion around the importance of planning and how to go about planning, the ISEs were not given enough time to actually carry out this process. Thus ISEs were unable to take up this discourse in their own practice. Planning for teaching is extremely important, especially for novice educators (Ball et al., 2007; Koni & Krull, 2018). Without the time to plan, the ISEs often made decisions to lead activities that were most familiar to them or easiest to gather materials for rather than to experiment with different activities. These activities were

Figure 3. Photograph of an afternoon activity planning tool that ISEs used (Source: Author)

often disconnected, only related to each other because they related to the topic and ISEs did not have specific objective(s) in mind for camper learning.

Supporting this point about planning time, the workshop that was deemed most successful, in terms of camper engagement and content learning, was the workshop on bird breeding behavior. However, this workshop was planned by two ISEs outside of their paid training week. This shows that if given more time to plan, the ISEs would likely be able to come up with engaging and cohesive lesson plans.

In sociocultural theories of learning, scholars often talk about mediating cultural tools for learning (e.g., Fleer & Hedegaard, 2010; Lave & Wenger, 1991). At this camp, the administration does scaffold work with the ISEs using tools in other instances. For example, while planning for afternoon activities, which were choice activities that included things like hikes, art projects, and swimming, Vee gave the ISEs a tool to plan for various weather conditions (**Figure 3**). Not only did the tool work in order for ISEs to have backup plans due to rain, but it also incorporated humor which made it a fun tool for the young educators to use.

The use of a tool for planning workshops might also be useful for the ISEs so that they are able to accomplish the goals that they have for teaching and are scaffolded to be able to do more efficiently due to the time constraints during their training week.

The Impact of Educational Experiences on Teaching Practice

According to Lortie (1975), it is very difficult to learn to teach in a way that differs from how you yourself were taught. When Vee invited me to do this research at the camp, she expressed that she felt that teaching practices at the camp had not changed much since it was started in the 1960s. She felt there was likely a better way to teach natural history, but also struggled balancing the tradition of the camp and the lack of time she had to train staff. Most of the ISEs at the camp had been campers at the camp previously. Several of them expressed to me that what they chose to do in their workshops came from the things that they enjoyed doing the most as campers. However, their observations as campers only provided a small insight into what teaching actually entails (Gray, 2020; Lortie, 1975). The ISEs not only had their experiences as campers to draw on, but also their experiences as students in formal classrooms. These experiences all likely led to them having very specific ideas about what they wanted to do while teaching, but without the knowledge of how to accomplish those ideas because as a camper or a student, they

did not see what their instructors did to plan and enact these learning experiences they had.

This could be another reason why the ISEs did not focus on planning and only realized when reflecting on their teaching that they had been unprepared. The small amount of time that they did set aside to plan was often not used very efficiently. ISEs seemed to assume that they could figure their plans out at the last minute and still have a successful workshop. However, upon reflection, several ISEs noted that they were underprepared and that they wished they had more time to plan their instruction.

Lortie's (1975) apprenticeship of observation also explains how the ISEs felt about camp learning contrasting with school learning. They may have been specifically trying to teach in a way that differed from the way they were taught in school, again possibly contributing to their belief that incorporating games and keeping things fun was important. Lortie's (1975) work has been used to discuss why teacher education programs sometimes only have a minimal effect on how novice teachers end up teaching (e.g., Gray, 2020; Lunsmann et al., 2019). If four-year programs struggle to have an impact on teacher practice, one week of training is likely not enough to have a substantial impact on the ISEs' practices.

Study Limitations

This study has a few limitations. First, as a case study this research represents the experience of educators in one particular context. More research is needed to look at educators across contexts, but the rich context-specific claims in this paper provide a starting point from which the field can then expand. Additionally, due to time constraints of the educators, I was unable to conduct as many interviews as I would have liked, which could have yielded even more information regarding their experiences as educators. In terms of study design, audio recordings of educators' workshops were often poor quality and difficult to hear due to being outside and moving. In future research in outdoor education contexts, I would collect video recordings, which would provide more contextual information, as well as better sound equipment such as microphones on the educators.

CONCLUSION

Using theoretical lenses (such as pedagogical and contextual discourses as well as the apprenticeship of observation) that come from formal science teacher education can be useful to examine ISE discourses and practices, despite the different context. In many ways, the findings in this study parallel what has been reported for novice educators in classroom contexts. Like formal teachers, the ISEs are influenced by their own experiences as well as by the context that they are in and those who are in power in that context. Their ideas about teaching and learning and what they actually do in practice were not always aligned because they did not have enough experience or support in certain aspects of teaching. However, in practice, they were flexible and often allowed for children's discoveries to lead the experience, even when the discoveries did not relate to the topic of study. The educators had experience learning in different contexts and

were able to draw on those experiences both to decide how they wanted to teach and how they did not want to teach.

This research has implications for the continued study of ISE practices and for ISE training and practice. As stated in the background literature, research has shown some positive outcomes for youth who participate in informal science experiences like ACA accredited camps, which serve about 10.3 million youth per year (ACA, 2017), however there is even greater potential for these spaces to be meaningful spaces of science learning. The staff in these contexts are professionals and are often taking on many roles at the same time, including that of an educator. In camp contexts like the one this research took place at, with limited training time for staff, more tools to scaffold teaching planning and practice might be useful, especially for new informal educators.

This study leads to more questions, particularly around the ISEs' use of the physical environment in teaching and connecting to place- based education ideas. Using the outdoors and providing nature experiences for youth was an important discourse both to the ISEs and the camp administration. Future research might investigate how the ISEs' knowledge and familiarity with place and the physical environment may impact how and where they choose to teach and how they promote a strong connection to place, which was something that both youth and ISEs expressed.

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