

Running head: EXPLORING ATTITUDES TOWARDS FISHH INSTRUCTION

Title: Exploring Science Teacher Attitudes Towards Foods, Investigations, Soils, and Healthy  
Habits (FISHH): A Case Study

Authors: Christopher D. Murakami<sup>1</sup>, Parker E. Stuart<sup>1</sup>, Stephen B. Witzig<sup>1</sup>, and Anna M.  
Waldron<sup>1</sup>

<sup>1</sup>MU Science Education Center

## **Abstract**

Weaver-Hightower called on education researchers to consider food issues in their research because of their impact on student learning, environmental sustainability, and public health. One way for science and environmental educators to address food issues and improve science achievement, environmental attitudes, physical activity, and student food-choice behavior is through learning garden education. Researchers have explored teacher attitudes towards school gardening and found that there are positive attitudes toward gardening programs but a perceived dearth of teacher knowledge, relevant curricula, and training experiences. The current study was conducted to address the gap in garden teaching knowledge and to further explore teacher belief systems and attitudes related to food education. The sociocultural model embedded belief system was used to inform this case study exploration of pre-service science teachers' attitudes towards teaching through Foods, Investigations, Soils, and Healthy Habits (FISHH). Teachers shared internal knowledge barriers and external economic and structural barriers towards FISHH instruction. Perceived barriers, attitudes, and intentions seemed to be influenced by previous learning, teaching, and informal experiences with food and agriculture education.

Running head: EXPLORING ATTITUDES TOWARDS FISHH INSTRUCTION

*After three years of teaching 8<sup>th</sup> grade science in Los Angeles, CA, I (Murakami) wanted to pursue a PhD in science education to connect science instruction and food issues through education that emphasizes sustainability and social justice. During my first year of work as a graduate student, I tried to envision classroom practices and research that were driven by food and food related issues. In my work with a non-profit urban agriculture organization, I wrote a grant to fund materials to teach garden issues in public schools for their outreach programming. I developed the Foods, Investigations, Soils, and Healthy Habits (FISHH) concept to introduce teachers and students to a science education experience that embedded public health and sustainable resource management. On campus, I worked with faculty members to create a professional development program to train teachers how to use these materials with students in a summer camp setting. For lunch, we sourced local, seasonal foods and collaborated with farmers and restaurants in the area to serve elementary age students. Much to my dismay, no teachers enrolled in this program. However, because of budget cuts, summer school was cancelled in the district and pre-service intern teachers in the University's alternative certification science education program could not find field experiences in local classrooms. My assistantship advisor (Dr. Waldron) asked if I was willing to conduct a field experience using the FISHH program. Willing to teach anyone about using FISHH to teach science, I quickly accepted. With other colleagues (Stuart and Witzig), we conducted this case study research to find out more about how pre-service teachers viewed science instruction through FISHH.*

## **CONSTRUCTING THE PROBLEM**

### **Why teach science?**

In the introduction of *Science For All Americans* (AAAS, 1991), the authors present several justifications for providing quality science education experiences. Some of these motivations are driven by technological innovation as a way to compete in a global marketplace and ensure economic prosperity. However, the global problems identified in *Science for all Americans* also suggest that issues of equity and responsible stewardship of the earth's resources are part of the reason for the nation to teach science. It suggests that:

*By emphasizing and explaining the dependency of living things on each other and on the physical environment, science fosters the kind of intelligent respect for nature that should inform decisions on the uses of technology; without that respect, we are in danger of recklessly destroying our life-support system. (p.1)*

This position establishes an irrevocable connection between humans and nature and acknowledges that understanding science could prevent the demise of our global and

technologically driven society.

Unfortunately, though, this vision of an interconnected environmental education and science education outlined in this, now historic, reform document is marginalized in the standard K-12 curriculum (Hart, 2007). Researchers that are critical of the relationships between science education, capitalism, and technology driven education assert that the marginalization of an environmental ethos in pursuit of increased exploitation of human and natural resources is dangerous (Barton, 2001). One key part of humanities connection to nature, whether admitted or not, is our food system. In an industrialized food society, we may not realize that the food we eat is associated with resource extraction and human exploitation. Weaver-Hightower (2011) suggested that the schools and education research is also void of attempts to explicitly teach, learn, and understand our own food system and how it influences schools and students. In other words, students might very well learn about the interaction of living and non-living factors through constructs of ecosystems and food webs, but the American food web is not critically examined. Further, education researchers have not problematized the issue of equitable access to school food and the lack of food education that extends beyond the food pyramid or plate.

Agriculture is an intimate connection between humans and other living resources from which we gain sustenance. Scholars from diverse fields have told complex stories of the development of our *Fast Food Nation* (Schlosser, 2001), the role of *Food Politics* and how that influences public health (Nestle, 2007), and *The Omnivore's Dilemma* in an industrial food society (Pollan, 2006), and attempts at *Closing the Food Gap* between the wealthy and poor (Winne, 2008). This history has been heavily influenced by political, economic, and technological developments. In brief, food is, and will continue to be, a controversial culturally

Running head: EXPLORING ATTITUDES TOWARDS FISHH INSTRUCTION

relevant scientific issue. Because of the widespread influence of food on social justice and sustainability issues, critical science and environmental educators should continue to explore this confluence of science, agriculture, and environmental education in the K-12 setting.

### **WHY FOOD EDUCATION RESEARCH?**

The traditionally underemphasized food issues in our schools should be explored because of their broad effect on human health, environmental sustainability, and academic achievement (Weaver-Hightower, 2011). Weaver-Hightower takes a critical approach to the school lunch and the role that it could and should play in education researcher inquiries. He argues that researchers in education should research food issues in schools for several reasons:

*These include the confounding influences of school food's impact on health and on academics, its effect on teaching and administration, the role schools play in teaching about food, implications for the environment and for other species, the large sums of money involved, the window that food provides into identity and culture, food's influence on educational policy and politics, and the social justice concerns around food. (p. 15)*

This call for research has motivated this present study into food issues in science and environmental education. Food education in public schools is implicit in the food served and the commercial environment in which students are immersed.

Critical science and environmental education researchers have described how teachers and students use foods (Tan & Barton, 2009), and urban gardens (Fusco, 2001) as central curricular tools factors to understand and form scientific identities as well as create science learning experiences that are “driven by its consumers, rather than being imposed on them, and that provides opportunities for the integration of science, work, and community” (Rahm, 2002, p. 164). These learning experiences value more local knowledges and generate agency for marginalized individuals and underrepresented and underserved populations in science education

Running head: EXPLORING ATTITUDES TOWARDS FISHH INSTRUCTION

(Barton, 1998; Fusco, 2001). Mallya et al. (2012) used decisions in the food system to provide cultural context to drive relevant school science instruction. This research in critical urban science education suggests that food issues can be used to ground science instruction and form positive scientific identities.

In urban and rural settings, researchers have empirically documented the positive impact of schoolyard gardening on science achievement in Texas (Klemmer, Waliczek, & Zajicek, 2005), food-choice behavior (Morris & Zidenberg-Cherr, 2002; Ozer, 2006; Ratcliffe, Merrigan, Rogers, & Goldberg, 2009; McAleese, 2007), and environmental attitudes (Waliczek & Zajicek, 1999). While this research includes methodologies with design limitations, altogether it represents attempts to create learning environments that support stewardship of human and natural resources through garden-based science education and meeting some of the concerns highlighted by Weaver-Hightower.

Unfortunately, researchers positive orientations towards garden or food-based science and environmental education instruction do not explain or change much about learning experiences in K-12 classrooms. Blair (2009) conducted a review of garden literature to summarize the prevalence and impacts of garden education and highlighted the findings previously mentioned as well as indicating that teachers with more knowledge in horticulture had more positive orientations towards garden instruction.

Knobloch and Martin (2000) surveyed a seven county region of northeast Iowa was to understand elementary teachers attitudes towards teaching agricultural concepts. Interestingly, 80% of their respondents suggested that they taught using agricultural examples and overall had positive views of these instructional practices. It is not clear, though, what qualified as teaching

Running head: EXPLORING ATTITUDES TOWARDS FISHH INSTRUCTION

agriculture in an elementary school setting in this mail-in survey study. These researchers called on further exploration of potential barriers to instruction as well as an evaluation in other geographic regions. Kim and Fortner (2006) conducted a survey study at an environmental education conference to explore teachers' attitudes towards specific environmental issues. They found that perceived barriers to instruction were issue specific. Further, teachers wanted to teach more environmental concepts than they were able to.

Graham and Zidenberg-Cherr (2005) surveyed teachers in California to clarify their attitudes towards schoolyard gardening programs. The surveyed teachers believed that schoolyard gardening improves science skills, physical activity, language arts skills, and healthy eating habits. This research corroborates the garden-based education outcomes and suggests that teachers have overall positive orientations towards these instructional approaches. More importantly, though, Graham and Zidenberg-Cherr found that a lack of teacher training opportunities, curricular materials and knowledge of gardening limited teachers' likelihood of teaching through a garden.

#### **PURPOSE OF THE RESEARCH:**

The purpose of this research is to further explore the complex nature of pre-service science teacher attitudes towards using and environmental issue of food-based science education. Instead of perpetuating a marginalization of food in education research, the research process, data collection, and analysis were all intentionally conducted with an awareness of the wide-reaching impacts of foods. In the process, the subjects were able to participate in a training workshop to provide experiences teaching science through foods.

#### **CONCEPTUAL AND THEORETICAL FRAMEWORK:**

## Running head: EXPLORING ATTITUDES TOWARDS FISHH INSTRUCTION

The Foods, Investigations, Soils, and Healthy Habits (FISHH) professional development program was designed to address the deficit of teacher training and curricular support for school gardening, while meeting the goals of two grant-funded projects. The FISHH construct is based on aspects of garden education that have emerged from the surveyed. This conceptual framework begins with food, which is viewed as unifying and overarching that connects scientific investigations, soil, healthy habits, and sustainable practices. Scientific investigations include the essential features of inquiry (NRC, 1996) and science process skills (NRC, 2011). Food is irrevocably tied to soil; a resource that Williams & Brown (2012) argue is central to learning garden and sustainability instruction:

*Much more than a fanciful educational trend, learning gardens challenge mechanistic perceptions of living systems as complex machines and remind us of the interconnectedness of all life. Beyond the blossoms and bountiful harvest of the gardens themselves, though, lies the hidden living soil that sustains the entire system. (p. 40)*

The soil is described as the unifying factor of our food ecosystem. Healthy habits, are of course relative, but are intended to represent that behaviors and values that advocate for responsible human and natural resource management. In other words, healthy habits are for humans and for the planet. While the concept of sustainability is frequently associated with environmental resources, values of social justice and economic viability should also be balanced in pursuit of intragenerational equity.

Foods, Investigations, Soils, and Healthy Habits were identified as unifying themes for science and environmental education (Hart, 2007). Altogether, teaching through FISHH is one way to achieve multidimensional scientific literacy (Bybee, 1997), address concerns in public health, and pursue environmental sustainability. While there is quantitative survey research on



Running head: EXPLORING ATTITUDES TOWARDS FISHH INSTRUCTION

teacher attitudes towards school gardens, there is the need to clarify teacher beliefs towards integrating this FISHH related content into curricula through qualitative inquiry.

Jones and Carter (2007) constructed the sociocultural model of embedded belief systems that frames this research project. This model explains that teacher instructional practices depend on a teacher's motivation to adopt a particular instructional strategy. This motivation is influenced by attitudes about and toward the instructional practice. Further, attitudes towards instruction are influenced by both epistemologies and limitations. For this study, participant attitudes towards FISHH and abilities to develop ways to use FISHH instruction were investigated. We interpreted epistemologies as teacher's views of how students come to know what they know in science class, and we interpreted this through specific motivations and approaches to teaching science. Perceptions of limitations to teaching are both external and internal barriers to implementing a particular instructional strategy. According to this sociocultural theory, teacher attitudes are explained by the interaction of these factors that influence teacher belief systems and influence the likelihood a teacher implementing a particular teaching strategy. For this case study on pre-service science teachers, we sought to examine the interrelation of these factors specific to beliefs about science instruction using FISHH. While there has been previous survey research on practicing teachers' beliefs towards integrating environmental issues (Kim and Fortner, 2006) and agriculture (Knobloch & Martin, 2000) in classrooms, this study focused on pre-service science teacher orientations towards a set of science and environmental education issues united by the concept of food using a more in-depth qualitative approach.

**RESEARCH QUESTIONS:** Our research goals are to clarify pre-service science

Running head: EXPLORING ATTITUDES TOWARDS FISHH INSTRUCTION

teacher beliefs towards integrating instruction through foods, investigations, soils, and healthy habits and measure their intent to teach through FISHH. To achieve these goals, there are two research questions: 1) What are pre-service teachers perceived internal and external barriers towards food-based environmental education in secondary science? 2) What is the nature of pre-service science teachers' beliefs about instruction using FISHH?

## **METHODOLOGY:**

### **DESCRIPTION OF THE CASE:**

The study was framed using a case study approach (Creswell, 2007). The case is bound by the eight participants in the from a cohort of pre-service science teachers during their summer intern field experience requirement for an Alternative Certification Program (Boone, Abell, Volkmann, Arbaugh, & Lannin, 2011).

These interns reflected throughout the weeklong field experience while receiving training and resources for teaching science through FISHH (Table 1). The study sample had an average age of 24 years with a range of 22-29 years. Seven of the participants were female (Allison, Millie, Darlene, Stacey, Kelly, Sally, and Rebecca) and one participant was male (Richard). All of the participants were Caucasian. Seven participants received bachelor's degrees and one earned a master's degree in Biology (Millie). All of the degrees earned were in the sciences. Two participants majored in Chemistry (Kelly and Sally), three majored in Biological Sciences (Darlene, Stacey, and Richard), one majored in Biological Science with a minor in Chemistry (Karen), one majored in Animal Science (Rebecca), and one majored in Agriculture (Allison). None of the participants had any experience in K-12 teaching; however, three had experiences as a college teaching assistant or tutor.

Table 1: Demographic information on the case

<b><u>Pseudonym</u></b>	<b><u>Age</u></b>	<b><u>Sex</u></b>	<b><u>Race/ethnicity</u></b>	<b><u>Degree(s) Held</u></b>	<b><u>Major (minor)</u></b>
Allison	22	F	Caucasian	B.A.	Agriculture
Millie	25	F	Caucasian	B.S. & M.S.	Biology (Chemistry)
Darlene	29	F	Caucasian	B.S.	Biology
Stacey	22	F	Caucasian	B.S.	Biology
Kelly	23	F	Caucasian	B.S.	Chemistry
Sally	23	F	Caucasian	B.S.	Chemistry
Richard	23	M	Caucasian	B.S.	Biology
Rebecca	25	F	Caucasian	B.S.	Animal Science

Before, during, and after the FISHH program, interns responded to open-ended survey questions and participated in reflective discussions that were audio-recorded. Field notes and observations were also used to reconstruct the research and teaching context. These surveys and discussions were embedded into the field experience and included reflective process for the interns to consider how strategies related to their own professional growth.

Based on the sociocultural model of belief systems, several types of survey questions were needed to gather evidence of intern attitudes towards teaching through FISHH. Demographic information was collected before the summer program and analyzed to identify limitations of our sample of convenience and isolate the potential influence of previous experiences on attitudes. Interns were asked to describe their motivations for teaching science and their beliefs about how students best learn were identified through the group discussions. These data were open coded and collapsed into themes. During the week, interns were asked to describe perceived barriers that could limit teaching through FISHH. These responses were coded as internal or external and then organized into themes. Finally, interns were asked to explain how science could be taught using FISHH and their perception of teaching science using

Running head: EXPLORING ATTITUDES TOWARDS FISHH INSTRUCTION

FISHH. This data was grouped as positive, negative, or mixed perceptions and then coded into themes. All of the data was used to find evidence of unsolicited intent to teach through FISHH. In other words, participants were not asked directly if they were going to use the instructional approaches discussed during the week, but those that did, we considered as intending to teach through FISHH.

The thematic findings and first draft of the research was shared with the participants. To gain second-level member checking and improve the validity of our findings, the participants confirmed our themes, suggested some considerations, and discussed the appropriateness of the conclusions.

### **FINDINGS AND DISCUSSION:**

The major findings are organized into four themes: 1) Economic and Knowledge barriers to FISHH instruction, 2) reported intent or fear to teach FISHH, 3) mixed perceptions of FISHH instruction, 4) an interest in teaching science to help society. These findings are elaborated below and supported with selected quotations.

*Research Question 1 - What are pre-service teachers' perceived internal and external barriers towards food-based environmental education in secondary science?*

**BARRIERS TO FISHH INSTRUCTION:** Interns were asked to describe the barriers that they thought kept teachers from using FISHH concepts in the classroom. These perceived barriers to instruction were knowledge limitations, economic scarcity, and school policy concerns. Half of the responses indicated that a deficit in teacher knowledge was a barrier to using FISHH. Millie explains, “most teachers don't know how to incorporate these into their own classrooms. Or they are strictly textbook instructors.” This suggests that teachers simply are not equipped with the instructional tools to teach environmentally related food issues or are bounded

Running head: EXPLORING ATTITUDES TOWARDS FISHH INSTRUCTION

by the prepared curriculum. Richard explains that there are also economic and structural barriers to this instructional approach:

*I think that the money to teach these lessons is not always there. I think teachers don't want to take the time to teach real applications of these ideas because they reach outside the realm of everyday teaching (even though it shouldn't be). I think administration is not always supportive of fostering FISHH investigations because people don't consider it to be important or necessary (sadly, though) – Richard.*

Here, Richard alludes to scarce resources, time and money, that teachers might not have access to. Especially for a new teacher, concerns over time are particularly relevant. Further, he continues that structures within the school could limit teachers' attitudes towards teaching through FISHH. Sally presented similar concerns that teachers are limited by "resources and availability of knowledge" and continues that "composting is not an extremely popular subject that lots of people have background knowledge in and many teachers may not wish to spend the time learning about it." This suggests that there are gaps in previous experiences and that it would take time to learn concepts. Understandably, this might not be a priority for teachers unless they are motivated in other ways.

**REPORTED INTENT OR FEAR TO TEACH THROUGH FISHH:** To measure the interns' intent to teach through FISHH, the data were reviewed for situations in which interns said they intended to teach one of the FISHH themes. For example, Allison stated that, "my perception is that [soil] is very applicable to middle school science and agriculture and I would love to try and implement these concepts into my curriculum." Three other interns stated they would use food to teach science in their classroom. Here, Stacey explains the need for more support to teach using food, "I would like to explore further into how I can use food to teach science. It is a fun and interesting way to get students involved and to also learn in a different

Running head: EXPLORING ATTITUDES TOWARDS FISHH INSTRUCTION

way.” None of the teachers openly declared that they would teach investigations, but expressed positive views, in terms of student ownership of science material following inquiry-driven instruction:

*“It is a great idea. I have been taught the inform, verify, practice and the new concept of investigations is hard for me to grasp. However, I see the many benefits of this style of teaching by having students construct and own their own knowledge” (Darlene)*

This shows that there is a disconnection between this pre-service teachers experiences in education and the approaches that are embraced by inquiry and garden instruction. In other words, learning experiences in a garden are open-ended and experiential. Teachers with positive orientations towards less structured learning environments might be more likely to try food-based science education.

Kelly explains that she is, “ very passionate about teaching healthy habits in science class and will try to incorporate these ideas as much as possible in my classroom.” Four other interns also indicated they would teach healthy habits for the planet through environmental responsibility, and four interns said they would teach healthy living habits.

*Research Question 2 - What is the nature of pre-service science teachers’ beliefs about instruction using FISHH?*

**MIXED PERCEPTIONS OF FISHH:** The interns suggested that food was a universal theme for engaging students in science instruction. As Sally explains, “I love food, and I think it is very important to use food to teach science. Everyone loves to eat and analyzing foods helps students learn more about certain concepts (such as minerals, vitamins, and amino acids).” Here, the connection is made to nutrition and molecular biology. Furthermore, the interns suggested that food could be used to teach larger sociological and environmental issues related to science. Here, Millie explains that, “along with food comes all the processing, pesticides and packaging.

Running head: EXPLORING ATTITUDES TOWARDS FISHH INSTRUCTION

Science explores the effects on the environment.” Overall, the data suggest that the interns saw food as a common application for teaching science content connected to the real world.

Three of the interns indicated that investigations allow students to construct their own understanding of nature. A majority of the examples described by interns stated that investigations create experiences with authentic, real world scenarios:

*For instance, maybe the students read about a small field of corn next to a small pond and the result of this ecosystem is that all the fish in the pond are dying. We may ask the students to investigate, based on several factors, what is causing the fish population to die. –Allison*

The intern teachers suggested that investigations engage students in knowledge creation experiences that are relevant to this type of environmental concerns. By embedding concepts of eutrophication and drawing connections between food production and ecological influences, this teacher envisioned using real applications for science in her future classroom.

Before the FISHH program, three of the interns expressed negative views of using soil to teach science because they felt it was boring or they had little experience with soil science. Stacey explained, “eh.. Soil. It’s a little boring.” After the program, these three interns had mixed views of teaching about soil but acknowledged that it could be beneficial for some students or in some science classes. Following the FISHH PD, Stacey said, “I think that there are a few instances when using soils could be fun and informative. I don't see it as a common experience though.” Kelly expressed concern that soil does not connect to the chemistry discipline, “I think soils can be incorporated a little bit in chemistry, but I can still see more applications for other areas of science.” Interestingly, two of the three interns without entirely positive views of soil science majored or minored in Chemistry.

All interns supported teaching healthy habits for the body and healthy habits for the

Running head: EXPLORING ATTITUDES TOWARDS FISHH INSTRUCTION

planet. Here, Stacey describes why she will teach healthy habits in her classroom: “I think it is important to give students the tools to think abstractly about how we impact the world and how it impacts our lives.” Kelly and other interns also reiterated that teaching healthy habits as a way to make science relevant to students, “I feel like these are topics that students will care about because they really pertain to their own lives.” These findings connect to half of the interns’ socially driven motivations for teaching science, and the intern’s perspectives towards teaching through investigations and foods.

**INTEREST IN TEACHING SCIENCE TO HELP SOCIETY:** In their responses to open-ended survey questions, interns reported that their interest in teaching science started from their experiences as scientists. Half of the interns indicated that teaching science was a way to serve society and also meet their interests. Allison explains that she is interested in teaching science because, “to [her], science is so important to society and is at the forefront of what kind of technology and advances we can offer for people, animals, and the earth in the future.” Here, Allison directly associates society with science and suggests that technology will improve the quality of life on the planet. The results show that the interns view science teaching as a way to support society with their strengths and experiences in science. While this orientation would be conducive to supporting FISHH instruction, it could also support more technocratic views of science and progress.

**DISCUSSION:** This exploratory research into pre-service science teacher attitudes towards FISHH instruction provides several interesting points of discussion. As mentioned in the opening vignette, the study and professional development program was originally intended for in-service science teachers interested in learning strategies for teaching about gardening. While it



Running head: EXPLORING ATTITUDES TOWARDS FISHH INSTRUCTION

is definitely a limitation that most of the teachers in our study did not have prolonged experiences in formal or informal education contexts. In a case study with elementary educators, Cheng and Monroe (2010), found that teachers with more experience were more receptive to environmental education curriculum. Similarly, in this study, the pre-service science teachers that had positive orientations towards FISHH, Millie and Richard, also had the most teaching experience. During the daily reflection conversations, many of the interns were worried about immediate concerns of classroom management, not engaging in discussions related to garden education or environmental education.

In an email conversation after the training program, Richard a biology major and future middle school teacher reflected on his confidence in teaching during the summer:

*Chris,  
I feel like our discussions did focus on those subjects simply because our group had very little time in the classroom before beginning FISHH. We were all kind of panicking about our upcoming internships and did not have a very good idea of what to expect when designing curriculum or classroom activities. I think that if you held the conversation now, after we have been in the classroom for 25 weeks, you would have a much different conversation - one focused around using FISHH as curriculum fodder. Even now, I see myself reflecting on how much I did NOT know about lesson planning at that point in the summer and how my conversations are MUCH more informed at this point.  
Hope this helps! – Richard*

It would be beneficial to follow up with the rest of the participants to learn more about how their views toward the program as well see how their attitudes developed after working within the confines of school district policies.

Pre-service teachers that majored in Chemistry and intended to teach chemistry, like Stacey, frequently expressed the view that soil and chemistry were disconnected. Williams and Brown (2012) use soil as a central construct and metaphor for learning experiences in garden education. Understanding soil as a media for life starts with a foundational understanding of soil

Running head: EXPLORING ATTITUDES TOWARDS FISHH INSTRUCTION

chemistry. This suggests some division between the more applied agricultural sciences and bench sciences like chemistry. Gayford (2002) explored attitudes towards using global climate change to teach science. He found that standards and the traditional organizations of content might prevent teachers from addressing issues related to climate change in a science class. Food, like climate change, requires teachers to think about dissolving boundaries between physical, applied, and social sciences. Making this decision is inherently risking in the classroom context because of the pervasive culture of accountability, high stakes testing, and scripted curriculum. It might be useful to study teachers that have already made decisions to teach through garden education. Williams and Brown (2012) conclude their book with narrative accounts of a teacher, administrator, and superintendent in Portland that use learning gardens in their classrooms and schools. Performing theoretically driven analyses of these educational leaders would fill voids in the garden education literature (Blair, 2009).

The elementary teachers surveyed by Graham & Zidenberg-Cherr (2005) and Knobloch and Martin showed overall positive orientations towards garden education. In our study of pre-service secondary science teachers, the responses were more varied. The teacher that demonstrated positive orientations towards FISHH and intent to teach FISHH, Allison, was planning to teach middle school science and had a background in Agriculture. Her undergraduate experience and teaching experiences on an educational farm, and motivations for teaching likely contributed to her abilities to envision FISHH instructional strategies (pond near corn field) and initiative to use strategies like worm composting during her student teaching. It would be useful to do more in-depth analyses between previous learning and teaching experiences and how that relates to positive attitudes and FISHH instruction.

It is critical to explore these perceptions towards FISHH and science education among across different ethnicities, years of teaching experience, and levels of science background. This sample of convenience is comprised of entirely Caucasian science majors that cannot be easily generalized. Embedding data collection into the reflection processes during the FISHH PD streamlined data collection, but could have biased the participants' responses. The sociocultural model of embedded FISHH belief systems must be further developed by gathering a more diverse data sample that assesses constructs like social norms and beliefs about science (Jones & Carter, 2007).

**CONCLUSION:** This study highlights a unique field experience during an alternative certification program that emphasized explicit food education and probed the nature of pre-service science teachers' attitudes towards FISHH instruction. The FISHH program is a model of teacher development that removes traditional divisions between science disciplines to teach science issues through human health and sustainability. The study used an embedded belief system model to further fill the void in our understanding of intern teacher attitudes towards FISHH instruction, and provide a qualitative approach that builds on earlier survey-driven teacher attitudes research. The scope of teaching strategies that could fit under the umbrella of FISHH might be too broad for a socio-cultural embedded belief system theoretical application. The teachers in this study had not spent significant time in public school classrooms, but already perceived internal knowledge barriers and external limitations to FISHH instruction.

The data suggested that, for these interns, there is a positive view towards food-based science instruction amongst the participants and that these views align with their beliefs about science teaching. However, this study provides further evidence for the perception that teacher

Running head: EXPLORING ATTITUDES TOWARDS FISHH INSTRUCTION

knowledge could be a barrier to explicitly teaching through FISHH themes in K-12 curricula that are integral to garden-based education. By better understanding the nature of teacher beliefs attitudes towards FISHH and how they related to teaching and learning experiences, science education reformers will be better equipped to enhance the quality and prevalence of food-based science and environmental education.

### **REFERENCES:**

- AAAS. (1989). *Science for All Americans*: Oxford University Press.
- Barton, A. C. (1998). Teaching science with homeless children: pedagogy, representation, and identity. *Journal of Research in Science Teaching*, 35(4), 379-394.
- Barton, A. C. (2001). Capitalism, critical pedagogy, and urban science education: an interview with Peter McLaren. *Journal of Research in Science Teaching*, 38(8), 847-859.
- Blair, D. (2009). The child in the garden: an evaluative review of the benefits of school gardening. *Environmental Education*, 40(2), 15-38.
- Boone, W. J., Abell, S. K., Volkmann, M. J., Arbaugh, F., & Lannin, J. K. (2011). Evaluating selected perceptions of science and mathematics teachers in an alternative certification program. *International Journal of Science and Mathematics Education*, 9, 551-569.
- Bybee, R. (1997). *Achieving scientific literacy: from purposes to practices*. Portsmouth, NH: Heinemann.
- Creswell, J. W. (2007). *Qualitative inquiry and research design: choosing among five traditions*. Thousand Oaks, CA: Sage.
- Fusco, D. (2001). Creating relevant science through urban planning and gardening. *Journal of Research in Science Teaching*, 38(8), 860-877.
- Gayford, C. (2002). Controversial environmental issues: a case study for the professional development of science teachers. *International Journal of Science Education*, 24(11), 1191-1200.
- Graham, H., & Zidenberg-Cherr, S. (2005). California teachers perceive school gardens as an effective nutritional tool to promote healthful eating habits. *Journal of the American Dietetic Association*, 105(11), 1797-1800.
- Hart, P. (2007). Environmental Education. In S. K. Abell & N. G. Lederman (Eds.), *Handbook of research on science education* (pp. 689-726). Mahwah, New Jersey: Lawrence Erlbaum Associates, Inc.
- Jones, M. G., & Carter, G. (2007). Science Teacher Attitudes and Beliefs. In S. K. Abell & N. G. Lederman (Eds.), *Handbook of research on science education* (pp. 1067-1104). Mahwah, New Jersey: Lawrence Erlbaum Associates, Inc.
- Kim, C., & Fortner, R. W. (2006). Issue-specific barriers to addressing environmental issues in the classroom: an exploratory study. *The Journal of Environmental Education*, 37(3), 15-22.

Running head: EXPLORING ATTITUDES TOWARDS FISHH INSTRUCTION

- Klemmer, C. D., Waliczek, T. M., & Zajicek, J. M. (2005). Growing minds: the effect of a school gardening program on the science achievement of elementary students. *HortTechnology*, 15(3), 448-452.
- Knobloch, N. A., & Martin, R. A. (2000). Agricultural awareness activities and their integration into the curriculum as perceived by elementary teachers. *Journal of Agriculture Education*, 41(4), 15-26.
- Mallya, A., Mensah, F. M., Contento, I. R., Koch, P. A., & Barton, A. C. (2012). Extending science beyond the classroom door: learning from students' experiences with the choice, control and change (C3) curriculum. *Journal of Research in Science Teaching*, 49(2), 244-269.
- McAleese, J. D. (2007). Garden-based nutrition education affects fruit and vegetable consumption in sixth grade adolescents. *Journal of the American Dietetic Association*, 107(4).
- Morris, J., & Zidenberg-Cherr, S. (2002). Garden-enhanced Nutrition Curriculum Improves Fourth-grade School Children's Knowledge of Nutrition and Preferences for Some Vegetables. *Journal of the American Dietetic Association*, 102(24).
- Nestle, M. (2007). *Food politics: how the food industry influences nutrition and health*. Berkeley, CA: University of California Press.
- NRC. (1996). *Inquiry and the national science education standards*. Washington, D.C.: National Academies Press.
- NRC. (2011). *A Framework for K-12 Science Education: Practices, Crosscutting Concepts, and Core Ideas*. Washington, D.C.: National Academies Press.
- Ozer, E. J. (2007). The effects of school gardens on students and schools: conceptualization and considerations for maximizing healthy developments. *Health Education Behavior*, 34(6), 846-863.
- Pollan, M. (2006). *The omnivore's dilemma: a natural history of four meals*. New York, NY: The Penguin Group.
- Rahm, J. (2002). Emergent learning opportunities in an inner-city youth gardening program. *Journal of Research in Science Teaching*, 39(2), 164-184.
- Ratcliffe, M. M., Merrigan, K. A., Rogers, B. L., & Goldberg, J. P. (2009). The effects of school garden experiences on middle school-aged students' knowledge, attitudes, and behaviors associated with vegetable consumption. *Health Promotion Practice*, Online.
- Schlosser, E. (2001). *Fast food nation: the dark side of the all-american meal*. New York, NY: Houghton Mifflin Company.
- Tan, E., & Barton, A. C. (2010). Transforming science learning and student participation in sixth grade science: a case study of a low-income, urban, racial minority classroom. *Equity & Excellence in Education*, 43(1), 38-55.
- Waliczek, T. M., & Zajicek, J. (1999). School gardening: improving environmental attitudes of children through hands-on learning *The Journal of Environmental Horticulture*, 17(4), 180-184.
- Weaver-Hightower, M. B. (2011). Why education researchers should take school food seriously. *Educational Researcher*, 40(1), 15-21.
- Williams, D. R., & Brown, J. D. (2012). *Learning gardens and sustainability education*. New York, NY: Routledge.

Running head: EXPLORING ATTITUDES TOWARDS FISHH INSTRUCTION

Winne, M. (2008). *Closing the food gap: setting the table in the land of plenty*. Boston, MA: Beacon Press.