Working
with youth
in non-formal settings
ensuring rich enrichment

Experiential & Inquiry-based Learning with Youth in Non-formal Settings

4-H Science learning for youth can be deepened by building inquiry-based learning methods into programs and curricula. For over two decades of educational reform, science education has focused on inquiry as a method for learning and doing natural science in formal classrooms. When used to make sense of the natural world from within the discipline of science, inquiry-based learning is 'scientific inquiry. ' Non-formal program designers and practitioners are faced with decisions about which scientific inquiry methods to transfer from the formal classroom to the non-formal setting, which methods to adapt to better fit the non-formal learning needs of youth, and how to best prepare adults to facilitate scientific inquiry with youth. Why is this thinking important to 4-H staff and volunteers?

Evaluation results indicate that inquiry-based methods support youth in their learning. Minner et al (2010) reviewed 138 evaluation studies and found that inquiry-based approaches in the science, engineering, technology ,and math content areas had the largest effect sizes, or made the greatest positive difference, when there was an emphasis on active learning and involvement in the investigative process (asking questions, designing investigations, collecting data, drawing conclusions, communicating findings). Hands-on experiences with natural phenomena were also found to be associated with increased conceptual learning in the science content investigated.

Experiential or Inquiry?

A youth/adult team of six Citizen Scientists meet each week during the summer to monitor monarch larvae in a field at the nature center in their community. The young people signed up to be part of the team after a presentation about Citizen Science made by one of the adult volunteers at the middle school. The group selected the animal or species they wanted to volunteer to monitor and agreed to monitor monarchs. Each member learned how to randomly sample and accurately count eggs on milkweed early in the project, and by early July they know each other and the routine well. The team members quickly move into pairs, talking about their summer plans and deciding who will take which role in the monitoring – recorder or counter. A monarch scientist is visiting the group, as she does once a month, to talk about her research and help them learn ways to improve their counting methods. Their adult leaders works alongside them and, as a large group, they spend time talking about their experiences in the field, they think about the contribution that they are making to the ongoing research of monarch butterflies, and two of the youth have expressed interest in becoming biologists . Is the learning that the youth are involved in "experiential?" Is it "inquiry-based" learning?

Key Concepts

Experiential learning: Constructing learning through hands-on experiences that are highly social in nature.

Inquiry-based learning: Constructing learning through hands-on experiences that provide evidence about phenomena in the world.

Scientific Inquiry: How scientists investigate the natural world and construct explanations based on evidence.

Science Process Skills: include observing, measuring, recording, interpreting, generalizing data, and communicating results.

Types of Scientific Inquiry:
Structured: Facilitator provides scientific questions, and methods for youth to follow to answer the questions, youth are expected to reach the same outcomes.
Guided: Facilitator provides one or more questions, youth design investigations in order to answer questions, results may be different.
Open: Youth form their own questions, design investigations to answer their questions, reach their own outcomes or results.

Experiential learning and inquiry-based methods are based on similar thinking and practice, but have important differences. The intentional design of curricula is based on understanding these differences and making choices in the design that support the intended learning for youth in non-formal programs.

How are Experiential Learning and Inquiry-based Learning Similar?

Meaningful learning occurs when learners make connections between prior knowledge and new experiences and skills within real world contexts (Brooks & Brooks, 1993). This "construction of knowledge" view is that learners do not merely memorize the disciplinary content that needs to be learned. Rather, learners construct their own learning by selecting the information that is most meaningful to them. Constructivist approaches see young people as holding the key to the learning that is meaningful to them through active thinking, organizing information, replacing of existing knowledge, and social interaction (Minner, 2010). Non-formal learning programs, and the adults who work with youth in the programs, use methods to guide youth through experiences, process their experience, reflect, generalize, and then apply the learning to other situations in their lives with the aim to heighten or ensure opportunities for experiential learning. The process of facilitating experiential learning can look and sound a lot like inquiry-based learning but there are key differences. The methods to facilitate learning about the experience and inquiry about the natural world can occur in the same settings with similar resources but the focus of learning attention, the type of facilitation called for, and whether the process is adult-directed or youth-directed range depending on the goals. While there is overlap between the two learning methods, at its core experiential learning broadly supports **youth constructing their own learning about their collective experience** and scientific inquiry at its most authentic supports **youth constructing their own learning about the phenomenon** using science process skills to gather evidence about the phenomenon.

Inquiry is a process used by human beings to seek information and understanding (Welch, *et al.*, 1981) and is applicable across domains of knowledge. The internal work of inquiry is **learning to reason** based on evidence and it involves the ability to think about how one "knows" the subject at hand. Inquiry is often hands-on and active on the outside, but at its core is the internalization of **what one knows** or understands about the world based on **what one does** through the inquiry process. In non-formal learning settings, inquiry-based methods have an immediate resonance and alignment with the active and more flexible nature of non-formal learning design principles and experiential learning. Both learning methods are "hands-on" and "minds-on." Inquiry, as it becomes more and more youth-directed, is best facilitated with instructional skills in assessing and supporting the cognitive development of the learner.

How are these methods different?

Scientific inquiry is a subset of general inquiry (Welch, *et al.*, 1981). In the discipline of science, one way to think about inquiry is that it involves the steps by which scientists know and explain the natural world (Bybee, 2006) – or what scientists do. The *National Science Education Standards* refer to inquiry as "the diverse ways in which scientists study the natural world and propose explanations based on evidence derived from their work (National Research Council 1999: 23)." Scientific inquiry is a way of exploring the natural world, which is guided with the learner's previous understanding, their assumptions or personal beliefs. In learning settings, regardless of whether these are formal, informal, or non-formal, this learning method helps novice learners to pull apart scientists "thinking processes" into a concrete "experience" and transfer this skill, and the learning that can follow. Minner et al. (2010) suggested three categories of scientific inquiry activities – 1) learning to do what scientists do, 2) learning to think like scientists, and 3) identifying the methods that instructors (or adult facilitators) use to provoke inquiry.

How can a learner think and process as a scientist? Hogan and Fisherkeller (2000) suggested four phases of learning processes that should be included in activities; (1) forming of hypotheses, (2) designing of experiments, (3) interpreting outcomes, and (4) communicating results. In the discipline of science, this involves making careful observations, raising testable questions, conducting investigations, and using evidence to explain the natural world.

Considerations for Design and Practice.

Curriculum is the sum total of all intentional learning experiences. Is the design teams' goal to provide experiential learning about science or to provide scientific inquiry that is more focused on youth-directed questions about phenomena? Each has its place in non-formal learning programs and, in fact, could build over time for an extended learning program or across learning experiences. Curriculum designers start by identifying the intended outcomes for youth in the program. The extent to which youth as learners will direct the learning experience and the inquiry process will follow from the outcomes, and help guide learning method choices. Curriculum can be designed so that activities can be shifted toward one method or the other, with intentionality.

Experiential learning methods and inquiry-based learning methods both take practice on the part of facilitators. The extent to which the adults working with the youth have, or can be trained with, the skills to facilitate the intended learning is a key consideration for designers and in staff and volunteer development planning. See Figure 1.

Figure 1 shows the relationships between methods and types of inquiry; moving from a focus on collective experience to a focus on phenomena and toward scientific inquiry in which youth direct the questions, the methods, the investigation, and the interpretation themselves.

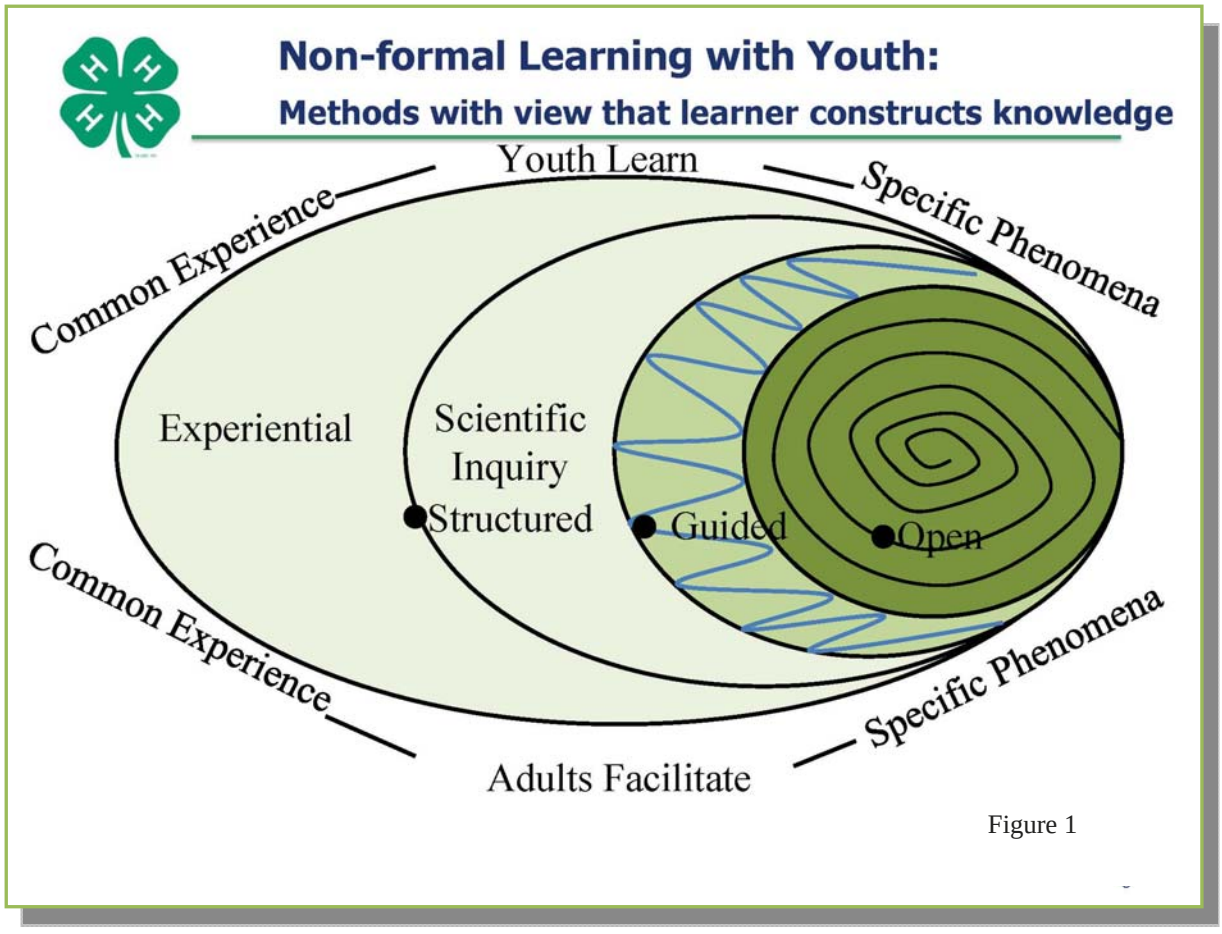

Figure 1

Designing and Preparing for Inquiry.....

In the second year of the summer Citizen Science project, the adult leaders completed a training that added to their expertise in using experiential learning methods. They were trained to facilitate inquiry with youth in the field by learning the inquiry process themselves and then learning how to facilitate this with others. Some of the youth returned for a second year to the program, while new members also joined the group. After everyone learned the monitoring protocol, the adult leaders encouraged the youth to pay close attention to their own observations about monarchs, milkweed, and larvae and some of the youth chose to form testable questions that they could investigate. The scientist visits regularly to talk about her work, and to help youth to think about their questions. After monitoring the larvae each week, the team has extended their meeting time so that smaller teams can design and conduct investigations to gather evidence related to their own questions. The scientist and the adult leaders look for opportunities to pose additional questions and to present "just-in-time" information to keep the youth moving ahead with their investigations when they are getting off course or getting frustrated. Where do inquiry-based methods best fit in the non-formal programs that you design?

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