

## ESERA 2019 Pre-Conference Workshop

### Understandings of Scientific Inquiry; Learning to Score and Administer Valid and Reliable Instruments (Views about Scientific Inquiry and Young Children Views about Science)

**Workshop Facilitators:** Judith S. Lederman, Illinois Institute of Technology, ledermanj@iit.edu;  
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**Participants Maximum:** 40

#### Background of the Facilitators:

Judith S. Lederman is a Professor of Science Education at Illinois Institute of Technology, Chicago, Illinois. She is a member of the Board of Directors of the National Association for Research in Science Teaching, a former board member of the National Science Teachers Association and a former Editor of the *Journal of Science Teacher Education*. Her research focuses on Scientific Literacy and the teaching and learning of scientific inquiry and nature of science in both formal and informal settings.

Norman G. Lederman is Distinguished Professor and Chair of Mathematics and Science Education at Illinois Institute of Technology. He is former President of the National Association for Research in Science Teaching and the Association of Science Teacher Education. He is a former Board Member of the National Science Teachers Association and former Editor of the *Journal of Science Teacher Education* and *School Science and Mathematics*. His research focuses on teachers' and students' conceptions of nature of science and scientific inquiry.

Selina L. Bartels is an Assistant Professor in Science Education at Valparaiso University, Valparaiso, Indiana. She is an experienced primary and secondary science teacher and was a co-founder of urban middle school. Dr. Bartels was the managing editor of the *Journal of Science Teacher Education*. Her research focuses on teaching and learning K-12 scientific literacy and STEM education.

Juan Jimenez-Pavez is a research assistant in science education at Illinois Institute of Technology in Chicago, Illinois. He has been a Fulbright scholar and has had K-12 science teaching experiences in Chile, France, and USA. He serves as an academic adviser to the science division of the Chilean ministry of education. His research interests lie in teaching evolution, and nature of science.

#### Abstract:

Helping students, teachers and pre service teachers develop informed views about scientific inquiry (SI) has been and continues to be a goal of K – 12 science education, as evidenced in various reform documents. This workshop will (a) describe the development of the Views About Scientific Inquiry questionnaire (VASI) (Lederman, J. et. al., 2014) and the Young Children's Views of Science (YCVS) (b) outline the framework of scientific inquiry that undergirds the VASI and YCVS; (c) provide training on how to score both the VASI and YCVS; (d) discusses the use of the VASI and associated interviews to

elucidate views of the specific aspects of SI that it attempts to assess; and (e) discuss the utility of soliciting rich-descriptive views of SI that the VASI and YCVS provides for informing research efforts.

### **Proposal:**

Helping students, teachers and pre service teachers develop informed views about scientific inquiry (SI) has been and continues to be a goal of K – 12 science education, as evidenced in various reform documents. Nevertheless, research focusing on understandings of SI has taken a perceptible backseat to that which focuses on the “doing” of inquiry. Being able to understand students (of all ages) understandings of SI will provide a key building block for science teacher education.

This workshop will (a) describe the development of the Views About Scientific Inquiry questionnaire (VASI) (Lederman, J. et. al., 2014) and the Young Children’s Views of Science (YCVS) (b) outlines the framework of scientific inquiry that undergirds the VASI and YCVS; (c) provide training on how to score both the VASI and YCVS; (d) discusses the use of the VASI and associated interviews to elucidate views of the specific aspects of SI that it attempts to assess; and (e) discuss the utility of soliciting rich-descriptive views of SI that the VASI and YCVS provides for informing research efforts.

The VASI is a paper and pencil assessment that measures students’ understandings about SI. This instrument is appropriate for grades six and above. The YCVS is an oral protocol that measures students’ understandings about science, scientists and how they do their work. This instrument is designed for students who do not have the ability to read and write. The YCVS can be used for students who; are very young, or possess developmental, or physical issues, or English is not their native language (Lederman & Bartels, 2018).

The aspects of scientific inquiry that follow are not only deemed appropriate in the context of K-12 classrooms, but can also be appropriately applied to college level students. In specific, students should develop an informed understanding of the following Knowledge of Scientific Inquiry (SI) aspects: (a) scientific investigations all begin with a question and do not necessarily test a hypothesis; (b) there is no single set of steps followed in all investigations (i.e. there is no single scientific method); (c) inquiry procedures are guided by the question asked; (d) all scientists performing the same procedures may not get the same results; (e) inquiry procedures can influence results; (f) research conclusions must be consistent with the data collected; (g) scientific data are not the same as scientific evidence; and that (h) explanations are developed from a combination of collected data and what is already known (Lederman, J, et. al., 2014).

The VASI and YCVS are essential tools in assessing students’ understandings of SI and provides both the classroom teacher and researchers a more powerful means for assessing learners’ conceptions about essential aspects of scientific inquiry.

The members of NARST that this workshop that would appeal to are methods instructors and educational researchers. Learning about and learning to score the VASI and YCVS opens up a whole world of understanding students’ understandings about SI. This tool allows methods instructors to know where to begin teaching their methods classes and allows teachers to be able to gauge their learning. Educational researchers will be able to use this tool in their research to gain access to their subjects’ understandings of SI. Capturing these understandings of SI for all ages allows preservice methods teachers and researchers to take a deep look into SI understandings and be able to work towards the ultimate goal of science education, Scientific Literacy.

The presenters for this workshop have a deep understandings of SI teaching and SI research. They all worked on the development and validation of both the VASI and YCVS. Their research sits not only in the US but around the world (39 countries/regions). They have conducted many workshops training researchers to score both the VASI and YCVS both nationally and internationally.

The objectives for this workshop are as follows;

1. Understand the framework of both instruments (VASI and YCVS)
2. Provide training on how to score the VASI and YCVS reliably
3. Discuss potential research opportunities utilizing the VASI and/or the YCVS

These three objectives will be assessed by the participants' ability to score the VASI and or YCVS reliably.

The workshop will begin with a description of the aspects of SI that are appropriate for students in grades K-12. Then the format of the VASI and YCVS will be discussed in great detail along with how to administer both instruments. Videos of the YCVS being administered will be shown so participants will be able to see how an oral protocol is delivered. The next part of the workshop will focus on scoring both the VASI and YCVS. Participants will learn to score authentic versions of each instrument. Completed versions of the VASI will be used to practice scoring. Along with the pen and paper answers to the VASI a sub section of the sample (20% or more) need to be interviewed to insure correct coding of the data. Participants in this workshop will also learn how to interview students to insure reliability of scoring of the VASI. Example audio/video recordings of the YCVS will be used for training to learn how to reliably score the YCVS. Then interrater reliability will be discussed. The results of two large scale international studies that have been conducted using the VASI will be presented (Lederman, J. et. al. 2018). At the conclusion of the workshop time will be allocated to discuss potential research projects using the YCVS, VASI or both instruments.

After the conclusion of the workshop we will continue to support attendees with their scoring questions or potential research projects via email and/or Skype. On previous research projects using the VASI we have collaborated with researchers around the world and have used a combination of Skype and email to train and determine reliability of scoring of the VASI (Lederman, J. et. al. 2018).

## References

- Lederman, J. S. & Bartels, S. L. (2018). Assessing the ultimate goal of science education: Scientific literacy for all! In Kahn, S. (Ed.), *Toward inclusion of all learners through science teacher education*. Sense Publishers, Boston, MA.
- Lederman, J. L., Lederman, N. G., Bartels, S. L., & Jimenez, J. (2019). International collaborative investigation of beginning seventh grade students' understandings of scientific inquiry. *Journal of Research in Science Teaching*.
- Lederman, J. S., Lederman N. G., Bartels, S. L. et. al. (2018, March). *High school students' views about scientific inquiry. An international study*. A symposium at the annual meeting of the National Association for Research in Science Teaching conference, Atlanta, GA.
- Lederman, J.S., Lederman, N.G., Bartos, S.A., Bartels, S.L., Antink Meyer, A., & Schwartz, R.S. (2014). Meaningful assessment of learners' understandings about scientific inquiry – The views about scientific inquiry (VASI) questionnaire. *Journal of Research in Science Teaching*, 51(1), 65-83.

