

SCIENCE LITERACY: WHAT IT IS, HOW TO ASSESS IT, AND A WAY TO ACHIEVE IT



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A FUNDAMENTAL QUESTION: WHAT IS SCIENCE LITERACY?

- The main goal of science teaching
- A detailed definition is needed for assessing progress
- Toward a detailed definition (AAAS, 1989):
 - Read and understand science articles
 - Read and interpret science-related graphs
 - Intelligently discuss contemporary issues
 - Apply scientific information to decision making
 - Locate valid scientific information

VARIOUS TYPES OF SCIENCE LITERACY

- Cultural or nominal (students recognize terms)
- Functional (student use scientific and technical terms)
- Conceptual/procedural (students understand concepts and processes of science)
- Multidimensional (above definitions plus students understand the nature of science, its social context, and can distinguish ways of knowing)

MULTIDIMENSIONAL SCIENCE LITERACY

- **Knowledge**
 - content of the disciplines
 - nature of science
 - history of science
- **Skills**
 - intellectual skills (scientific reasoning, problem solving, and critical thinking)
 - scientific inquiry skills
- **Dispositions**
 - values, beliefs, assumptions, attitudes, and actions

ASSESSING SCIENCE LITERACY USING STANDARDIZED TESTS

- An absolute measurement of science literacy is both complex and difficult.
- Changes in the degree of science literacy are easier to measure.
- A spectrum of tests is necessary to fully assess this complex subject.
- NOSLiT, ScInqLiT, and iStar are three standardized tests based on detailed, validated definitions.

ASSESSING UNDERSTANDING OF THE NATURE OF SCIENCE

- To what does “nature of science” refer?
 - Science terms
 - Intellectual process skills
 - Rules of scientific evidence
 - Postulates of science
 - Scientific dispositions
 - Major misconceptions about science

ASSESSMENT USING THE NATURE OF SCIENCE LITERACY TEST

- Nature of Science Literacy Test (NOSLiT)
- Test available at the following web address:
<http://www.phy.ilstu.edu/pte/publications>
- Password protected PDF
- Password is ISUPTE

ASSESSING SCIENTIFIC INQUIRY SKILLS

- What constitutes the skills of science inquiry?
 - Identify a problem to be investigated
 - Formulate a hypothesis and generate prediction
 - Design and conduct an experimental test
 - Collect and interpret meaningful data including the use of numerical and statistical methods
 - Explain unexpected results
 - Report and defend conclusions based on evidence

ASSESSMENT USING SCIENTIFIC INQUIRY LITERACY TEST

- Scientific Inquiry Literacy Test (ScInqLiT)
- Test available at the following web address:
<http://www.phy.ilstu.edu/pte/publications>
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ASSESSING SCIENCE REASONING SKILLS

- Work by Lei Bao at Ohio State University
- iStar test with eight target areas:
 - Proportional reasoning
 - Probabilitistic reasoning
 - Ability to identify and control variables
 - Correlational reasoning
 - Ability to identify and formulate hypotheses
 - Ability to design an experiment to test hypothesis
 - Ability to conduct an experiment to test hypothesis
 - Ability to make judgments and decisions based on experimental evidence

A WAY TO ACHIEVE SCIENCE LITERACY

Levels of Inquiry Method of Science Teaching

Discovery Learning	Interactive Demonstration	Inquiry Lesson	Inquiry Labs	Real-world Applications	Hypothetical Explanations
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- Each level has associated with it progressively more sophisticated intellectual and scientific process skills.
- See *Levels of Inquiry Method of Science Teaching* articles at <http://www.phy.ilstu.edu/pte/publications>

POSSIBLE FUTURE RESEARCH AREAS

- Preparation of standardized tests for other components of multidimensional science literacy (history of science, critical thinking, problem solving, values, beliefs, assumptions, attitudes, and actions).
- Curricular and instructional development based on the *Levels of Inquiry Method of Science Teaching*.
- Testing of the effectiveness of *Levels of Inquiry Method of Science Teaching* to achieve the goals of multidimensional science literacy.