



## Applying Educational Science to NGSS Assessment and Evaluation

### *Workshops for the Master Science Teachers Program of NY State*

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#### What is Educational Science?

Although the best teachers are already artists in their respective disciplines and subject matters, they also can become educational scientists. The NGSS Educational Science Workshop provides an avenue to becoming a scientist in the everyday realm of teaching and learning.

Teachers have been severely criticized for a lack of discipline and objectivity in the realm of classroom assessment and evaluation. In 2013 Cynthia Campbell presented the following research findings:

1. Teachers have little or no preparation for designing and using classroom assessments.
2. Teachers' grading practices are idiosyncratic and erratic.
3. Teachers have erroneous beliefs about effective assessment.
4. Teachers make little use of the variety of assessment practices available.
5. Teachers do not spend adequate time preparing nor vetting classroom assessments.
6. Teachers' evaluative judgments are generally imprecise.

*"Campbell, C. (2013). Research on teacher competency in classroom assessment. In J. H. McMillan (Ed.), SAGE handbook of research on classroom assessment (pp. 71–84). Los Angeles: SAGE*

The workshop is designed to address many of these issues. To do so, we must first have a clear understanding of the proper role of assessment and education in educational programs.

*Curriculum, assessment, instruction, and evaluation* can be considered essential elements of educational practice. What we have found from our own teaching experience and research is that these essential elements are inconsistently defined hence poorly understood. This makes it difficult for educators to communicate and collaborate with clarity and precision. Our first goal will be to address this problem.

We begin by offering a clear experience and understanding of what the essentials of any educational process are and subsequently developing a way to communicate this understanding clearly and precisely. By setting such a foundation in this workshop, we will be able to apply scientific principles productively to planning, implementing, and improving instruction.

At the end of the 20<sup>th</sup> Century, Mauritz Johnson laid a critical foundation for educational science. Upon his retirement, Johnson, a former math teacher, guidance counselor, supervisor and ultimately Dean of the School of Education at Cornell University, returned to the University at Albany, where he had done his teacher training, seeking to solve what he viewed a persistent problem in education: why was the field of education not able to establish cumulative knowledge in the way that the other arts and sciences could?

As he saw it, fads followed fads. Ideas were adopted and abandoned in relatively short periods of time. Innovations did not work their way into the mainstream educational system. Most significantly there was

no record of what was learned and what was not. After much research and investigation, Johnson identified a central unit of thinking and action in education: the *intended learning outcome* — a statement of what we intend the student to learn.

With this simple concept he laid the foundation for systematic approaches to designing, implementing, and improving everyday educational practice. At this same time, there were also many other educators working with similar insights: Robert Mager developed a program based on instructional objectives; Benjamin Bloom and his colleagues developed the taxonomies of educational objectives. In the end these combined efforts culminated in the standards-based educational reform movement.

But what, after all, are instructional objectives, learning goals and standards, but intended learning outcomes? Already you may be beginning to see what Johnson recognized as a cause of chaos in educational thinking — that there were too many different terms for the same object! His solution to this problem was simple and elegant. If we are to make progress in education, if we are to be able to work productively together, we must have common terms for the critical elements of the educational process.

For the **Applying Educational Science to NGSS Assessment and Evaluation** workshops we will be defining the critical elements of the educational process with the following terms:

- Learning goals* (what Johnson called *intended learning outcomes*)
- Instruction*: any endeavor to engage students in a way that will help them attain *learning goals*.
- Assessment*: information on how well *learning goals* have been attained. That includes the collection, analysis, and presentation of learning outcome information.
- Evaluation*: The application of assessment information along with other variables to make decisions about how to enhance the value of educational activities.

We will show that conventional testing and grading, whether it is based on standardized or teacher designed tests, does not provide the information needed to plan and evaluate educational programs. Moreover, information from conventional testing and grading is often used in ways that become destructive to the relationship between the teacher and the student. Misuse of information is, in part, what gives *evaluation* such a bad name. Whether one is a teacher, a student, or an administrator, the thought of being *evaluated* arouses fear rather than anticipation of a path to improvement.

In these workshops, we will present solutions to these persistent problems based on the constructive use of educational information. We will discover that a simple focus on *learning goals* can give us the power to objectively define *curriculum*, *assessment*, and *instruction*, as well as develop a productive notion of *educational evaluation*.

We will learn to collect, analyze, and present data on educational outcomes that is precisely the critical information needed for practical educational decision making. We will also learn how to establish and enhance the validity and reliability of that information. In short, we will be practicing a science of education. We believe that this practice can lead to powerful transformative experiences for both the teacher and the learner.

Prepared by Jason Brechko and Paul Zachos, Oct 2020