Collaborating with Clients to Develop Psychometric Parallel Teacher and Student Evaluation Measures

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Presentation at the Annual Conference of the
American Evaluation Association, San Antonio TX
November 2010

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Where this Idea Came from

- An Informal Science Institution (ISI) presented with a need for building their evaluation capacity in support of their current program
- Professional development program for public elementary and high school teachers in science education

Challenge

Given a modest evaluation budget with other objectives:

- Create evaluation measures that are sensitive and relevant to their program
- Offer the possibility of testing the reliability and validity of the developed attitude measures

Eventually able to build on work through additional program years

Focus of Presentation

Developed evaluation measures based on revising previous work conducted by Race (2003; 2001)

Race & Powell (2000):

- Teacher Attitudes in Science
- Student Perspectives Survey

Contractual Considerations

- How we negotiated contractual issues such as intellectual property and use of shared resources
- Caveat: Contract changes are presented as examples (review and approval by an attorney may be a good idea)

Revising the Contract: General Section

Original Wording:
Contractor hereby assigns all rights, title, interest, copyright, and any renewal rights to ISI for any work produced or by the Contractor in performance of services.

Revising the Contract: General Section

Revised Wording:

Joint copyright between Race & Associates, Ltd. and ISI will be sought for all instruments. Evaluation instruments may be used by each organization without seeking permission as long as joint copyright identification is used. Further, Race & Associates, Ltd. and authors will always be acknowledged in any reports that refer to the development of these instruments or data based on these surveys. This agreement will be reciprocal.

Revising the Contract: Intellectual Property

Original Wording:

It is expressly understood that any intellectual property rights, information or date to which the Contractor's performance under this Agreement remains the sole and exclusive property of the ISI, and if, requested by the ISI, shall be assigned to the ISI by Contractor. Such information may not be disclosed, used or cited by Contractor for any reason without the expressed written consent of the Director of the ISI.

Revising the Contract: Intellectual Property

Revised Wording:

Joint copyright between Race & Associates, Ltd. and ISI will be sought for all instruments. Evaluation instruments may be used by each organization without seeking permission as long as joint copyright identification is used. Further, Race & Associates, Ltd. and authors will always be acknowledged in any reports that refer to the development of these instruments or data based on these surveys. This agreement will be reciprocal.

Revising Other Contracts

Revised Wording:

Ownership: Consultant and XXX agree that Consultant owns all evaluation tools, techniques, strategies, systems, and methods used by Consultant in performing services under this Agreement, including by not limited to the evaluation entitled, *Teacher Attitudes in Science.*

Other contracts did not need a change in wording as ownership was expressly indicated to be that of the Contractor.

Not everyone will seek ownership of their evaluation work; depends on your particular situation and professional style. But good to know which you prefer and strive to achieve it.

Benefits to Process

- Able to meet evaluation needs of client
- Instruments were later shown to align with program model, thus sensitive to local needs
- Able to use instruments in other evaluation settings

Description of Psychometrics

- Used a classical approach to factor analysis (covariance matrix, principal components, and promax rotation)
- Compared primary solutions using Structural Equations Modeling (SEM) to select best/better models

Teacher Attitudes in Science

- 44 items rated on a 5-point Likert-type scale from 1 = Strongly Disagree to 5 = Strongly Agree
- Comprised of five attitude scales
- Negatively worded items were reversed coded for analysis
- Higher the score, the more positive attitude

Teacher Attitudes in Science

Five Scales (Four Revised and One New):

- Instructional Strategies
- Teaching and Learning
- Methods and Approaches to Teaching (Moving Away from Traditional Methods)
- Confidence in Teaching Science
- Inquiry-based Science *(new)*

Psychometric Results: Teacher Attitudes in Science

Scale	As Designed	Based on Psychometrics	Reliability Estimate
Instructional Strategies	10 items	Combined scale of 21 items	.93
Teaching and Learning	11 items		
Moving away from Traditional Methods	6 items	Original 6 items retained	.88
Understanding and Confidence in Teaching Science	7 items	Original 7 items retained	.94
Inquiry-based Science	10 items	Only 4 items retained (i.e., negatively worded)	.84

N = 213 teachers. Reliability based on Cronbach's Alpha (1951)

Student Perspectives

- 33 items rated on a 5-point event based scale: 5 = Almost Always, 4 = Very Often, 3 = Sometimes, 2 = Not Very Often, and 1= Rarely
- Comprised of three attitude scales
- No negatively worded items (Barnett, 200; Benson & Hocevar, 1985; Marsh, 1986)
- Higher the score, the more positive attitude

Student Perspectives

Three Scales (All Revised):

- Hands-on Inquiry-based Science
- Non-traditional Pedagogy
- School Learning Environment

Psychometric Results: Student Perspectives

Scale	As Designed	Based on Psychometrics	Reliability Estimate
Hands-on Inquiry-based Science	11 items	13 items (item added from non-traditional pedagogy and one from school environment)	.91
Non-traditional Pedagogy	10 items	9 items retained	.85
School Learning Environment	12 items	11 items retained	.84

N = 734 students. Reliability based on Cronbach's Alpha (1951)

How Were Measures Used: Teachers

- Teachers in the program showed a tendency to move away from traditional pedagogical practices ($p < .05$)
- Able to compare attitudes from this program to another program targeted toward preservice teachers with similar attitude patterns emerging (Race, 2009)

How Were Measures Used: Students

- Students whose teachers were participating in program reported more student-centered, hands-on inquiry based science in classes compared to non-program teachers ($p < .001$)

Lessons Learned

- Important to carefully read contracts (and carefully write your scope of work)
- May be worthwhile to revise contract to better match your individual evaluation services with client needs and retain your ownership rights if desired

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