Surveying Instruments on the Views of Science

Physics Education Group Seminar
September 20, 2006

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Expectations and School Performance
• Prior achievement vs. Academic Self Concept (House)
• Teacher-Student Gender Matching (Sadler and Tai)

Research Question
• Why would most pre-service elementary education students not specialize in science?
• What influence does Concepts of Physics (a reform class) class have on their decision to specialize or not specialize on science?

Instruments
Can Relate to Physics
MPEX - Maryland Physics Expectations Survey (1992)
VASS - Views about Science Survey (1995?)
EBAPS - Epistemological Beliefs Assessment for Physical Science (1998)

Relates to Pre-Service Teachers
VNOS - Views on the Nature of Science (1990)

VOSTS
114 Multiple Choice items
Categories
Interaction of Science, Society and Technology
School Characterization of Science
Characteristics of Scientist
Construction of Scientific Knowledge
Epistemology of Science

Content Validation
Criterion Validation (non-reported)
Construct Validation (empirically produced)

MPEX
34 item Likert-Scale (Agree-Disagree)

Dimensions
Independence
Coherence
Concepts
Reality Link
Math Link
Effort

Criterion Validation
Construct Validation (non-reported)
Construct Validation (?) (factor analysis wasn’t done)

VASS
Forced-Choice 30 items

Scientific Dimensions
1. Structure
2. Methodology
3. Validity
4. Learnability
5. Reflective Thinking
6. Personal Relevance

Content Validation
Criterion Validation (correlating FCI scores with VASS scores)
Construct Validation (?) (factor analysis wasn’t done)
## EBAPS
Likert-scale (agree/disagree), Multiple choice items, Debate items.

**Subscales**
- Structure of Scientific Knowledge
- Nature of Knowing and Learning
- Real-Life Applicability
- Evolving Knowledge
- Source Ability to Learn

Content Validation
Criterion Validation (non-reported)
Construct Validation (?) (factor analysis wasn’t done)

## CLASS
42 item Likert Scale (Agree-Disagree)

**Categories**
- Personal Interest
- Real World Connection
- Problem Solving General
- Problem Solving Confidence

Content Validation
Criterion Validation (Con-current and predictive)
Construct Validation (Rigorous Statistical Analysis)

## CLASS cnt’d

### Raw Statistical Categories
Emergent from Exploratory Factor Analysis

### Predetermined Categories
Consist of researcher classified statements.

**Reduced Basis Factor Analysis**

Principle component analysis performed. One potential category at a time.

Remove statements which do not fit or analyze as two (or more) separate categories.

Add additional statements that are highly correlated with current set of statements.

Repeat – until a robust (defined below) group of statements (a minimum of 3 - preferably more) has been created.

### “What would Physicist Say?” “What would you think?”

**Women**

**Men**

## TSSI
35 item Likert-scale (Agree-Disagree)

**Categories**
- Epistemology
- Science and Religion
- Science and the Economy
- Science and Aesthetics
- Science, Race and Gender
- Science for All
- Public Regulation of Science
- Science and Public Health

Content Validation
Criterion Validation (non-reported)
Construct Validation

## TSSI cnt’d

**Consistent with Model**

**Inconsistent with Model**
VNOS
Version 3, 10 open-ended questions
Dimensions
- Empirical Nature of Scientific Knowledge
- Observation, Inference, and Theoretical Entities in Science
- Scientific Theories and Laws
- The Creative and Imaginative Nature of Scientific Knowledge
- The Theory Laden Nature of Scientific Knowledge
- The Social-Cultural Embeddedness of Scientific Knowledge
- Myth of the Scientific Method
- The Tentative Nature of Scientific Knowledge

VNOS cnt’d
Why qualitative?
Forced-choice item problems:
- respondents may not view questions as the developers intended (context)
- instruments reflect the developers’ nature of science and biases
- philosophical stances
Open-ended item advantages:
- justification of answers is inherent
- contextualized answers
- assessing small changes

VNOS cnt’d
Content and Construct Validity:
- arts vs science professors
- an ongoing process

Data Interpretation:
- Reaffirm validity of instrument
- Separate analysis of questionnaire and interview
- Check congruency -----> reliability
- Interpretation of all questionnaire

Thank You!
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