Inquiry Instruction: The More You Know the Less You Think You Know

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Background

Reformed Teaching Observation Protocol (RTOP)1: 25 item classroom observation protocol.
Standards-based Curriculum Evaluation Standards and Benchmarks for Science Literacy2
Student-centered and inquiry-based

Teaching Science with Inquiry (TSI) instrument3: Designed to measure pre-service teachers’ self-efficacy in regards to teaching science as inquiry.
Based on Bandura’s work indicating that self-efficacy and beliefs strongly influence teaching practices4 and the 5 essential features of inquiry-based instruction as defined in NGSE5
Has also been used with in-service teachers participating in a Research-Experiences for Teachers (RET) program

Initial Predictions:
Teachers participating in the Target Inquiry (TI) program will reform their teaching to be more aligned with NGSE teaching standards, thus increasing their RTOP scores.
Teachers implementing inquiry-based practices will have higher TSI scores, so as teachers RTOP scores go up so will their TSI scores.

Initial Findings:
• RTOP scores increased, but TSI scores decreased

Research Questions:
• What is the relationship between TI teachers’ RTOP scores increase, their TSI scores decrease?
• Can teacher interviews provide insight into the RTOP and TSI findings?

Methods

Reformed Teaching Observation Protocol (RTOP)6:
Administered pre-program and annually for the next 2 years
Teachers chose a class that they felt was their “best” inquiry lesson
Participated class was independently selected by TI teachers
scores were negotiated if overall score differed by 5 points

Teaching Science with Inquiry (TSI) instrument6:
Administered pre-program and each subsequent June for next 2 years
Interviews:
Teachers were interviewed pre-program and each subsequent summer regarding teaching methods they used, student behavior and attributes, and perceived changes in themselves, their teaching, or their students.

Interviews were coded under two main themes: Confidence and Inquiry
Confidence statements were defined as anything teachers indicated they understood/believed or experienced things they needed to work on, or any indication of student confidence
Inquiry statements were coded using the RTOP instrument as a framework

Data and Results

Tables 1 and 2: Teacher Profiles/Results across Intervention Pre-Post

TI Program

Table 1: Teacher Questionnaire & Interview Statements - Pre/Post

Table 2: Teacher Profiles/Results across Intervention Pre/Post

Figure 1: Average TSI score for each year in the TI program YR 1

Figure 2: Average RTOP total and sub-scale scores for each year in the program. RTOP followed by post-test comparisons show significant increases from baseline to post-MA.

Figure 3: Average TSI score for select items.

Discussion

RTOP Results:
• RTOP data indicates, as teachers progress through the TI program, their inquiry instruction has become less inquiry-based.
• Teacher post-MA interview statements describing how their teaching had changed cited the following changes, which support higher RTOP scores:
  • Less teacher direction, more teacher questioning and guidance
  • More student independence for providing data and using the evidence to justify answers
  • Increased focus on conceptual understanding.
  • More student independence and ownership of activities
  • More collaboration and communication between students

TSI Results:
• Decreased TSI scores, for the instrument as a whole as well as the Teacher Self-Efficacy (TE) and Outcome Expectancy (OE) subscales, supports that the teachers are less confident in their ability to use inquiry-based methods.
• Analysis of TSI items grouped by level of student self-direction (A), showed decreases in all but the least self-directed items (D).
• Teacher interview statements, in general, indicated a greater confidence in abilities to design and facilitate inquiry, use of more inquiry-based instruction, and increased student independence.

TSI Reliability:
• TI instrument developers found increase in TSI scores for pre-service teachers after an inquiry science methods course, attributed to the inquiry experiences in the course.
• Developers also indicated that reliability decreased from pre to post administration, attributed to pre-service teachers’ realizations that inquiry instruction is not the same thing as originally thought.
• Our data suggests that the TSI instrument may not provide valid and reliable data for in-service teachers in a long term professional development setting.

Conclusion

TI Teachers’ TSI scores decrease because as they implement more inquiry instruction, confidence to generate items of inquiry instruction involves and what they need to work on. Thus, the TSI cannot be used to accurately detect changes in teachers’ use of inquiry-based instruction.

Future Work

• Presenting teachers with the TI instrument and asking why they think their year end TSI scores have gone down or stayed consistent in the participated in the TI program.
• Using a pre, post, post model where teachers complete the TI before entering the program, after their first summer experience, but before trying to implement any new materials in their classroom, and then after their second year.
• Design a student questionnaire based on the TSI instrument items to compare student and teacher perceptions of instructional practices.

References