

Developing Better Instruction, Better Instructors, and New Investigators

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Goals

- Implement use of NCTM's Principles to Action Toolkit with other mathematics teacher educators by incorporating these videos into semester-long teacher preparation courses (Developing Better Instruction)
- Document our results by measuring any changes in pre-service teachers' commitments toward effective mathematics teaching practices (Developing Better Instructors)
- Involve undergraduate mathematics education majors in the analysis of the resulting data (Developing New Investigators)

Creating the Surveys

- Student (pre-service teacher) surveys
 - Administered pre-semester and post-semester
 - 42 multiple choice questions (rated on a Likert scale) addressing instructional techniques and activities students would be likely to incorporate into their classrooms
 - 2 open-answer questions (one for both pre- and post-surveys and one for only post-survey)
- Instructor survey
 - To provide a base of desired teaching practices to which comparisons of student results could be made
 - Items identical to student pre-survey

Gathering and Analyzing Qualitative Data

- Coding student responses to the first open-answer question asking students to explain how they would teach a certain lesson
 - Created a Likert scale (1-5) "continuum" from teacher-centered, transmission-based teaching to student-centered, constructivist-based teaching
 - Coded student responses according to where their answers would fall on the continuum
- Observations for first open-answer question
 - Pre-survey average response was 2.45, post-survey average response was 3.33
 - Tended to be more PSTs moving towards student-centered classrooms with constructivist views than PSTs moving towards transmission-based teaching
- Coding student responses to second open-answer question asking students how their views on teaching math had changed throughout the course of the semester
 - Likert scale (1-4) that consisted of four categories we noticed showed up in the PST's responses about how their views had changed after taking the class
 - Could only measure desire to change, not actual commitment to change
- Observations for second open-answer question
 - Category 2 "exploration and productive struggle" occurred most often, probably due to its effective use in class and the videos students watched that modeled this strategy well
 - Students mentioned on multiple occasions that their views had changed because of the videos and reflections they were assigned throughout the class

Gathering and Analyzing Quantitative Data

- Two types of statistical testing of data
 - 2-sample T-test, n=23 (students' responses considered as a whole from pre- to post-survey for each question)
 - Paired T-test, n=15 (individual students' responses paired from pre- to post-survey)
- Requirements for deeming categories "statistically significant"
 - Had to have p-values equal to or below 0.05 in both the 2-sample and paired T-tests
 - Had to approach the teacher-educator means, demonstrating desired change
- Statistically significant quantitative data
 - Category 12: "The teacher is surprised by ideas that students develop during a lesson."--showed increased commitment
 - Category 39: "Explain their reasoning or thinking in solving a problem by using several sentences orally or in writing"--showed increased commitment
 - Category 14: "The textbook or worksheets guide the instruction"--showed decreased commitment

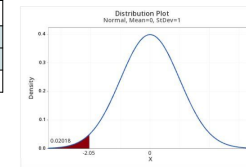
2-Sample Test Data Significant Categories (in light blue)

Category	Teacher Mean	Pre-Survey Mean	Post-Survey Mean	P-Value	Wilcoxon P-Value
(1-HW)	3	2.957	2.065	p=0.008	0.05<p<0.10
(12-Surprised)	3.25	1.391	2.022	p=0.047	0.05<p<0.10
(39 - Explain orally/writing)	3.5	2.391	3.087	p=0.010	0.001<p<0.005
(42-Analyze)	3	2.826	3.348	p=0.039	0.01<p<0.02

Surprised1, Surprised2

Test
Null hypothesis: $\mu_1 = \mu_2 = 0$
Alternative hypothesis: $\mu_1 \neq \mu_2$
T-Value Of Statistic: -2.0536
P-Value Of Statistic: 0.047

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Null hypothesis: $\mu_1 = \mu_2 = 0$
Alternative hypothesis: $\mu_1 \neq \mu_2$
T-Value Of Statistic: -2.0536
P-Value Of Statistic: 0.047



2-Sample T-test of Category 12 for quantitative data.

"There is a need for students to have productive struggle and discourse when learning math."

Paired Test Data Significant Categories (in light blue)

Category	Teacher Mean	Pre-Survey Mean	Post-Survey Mean	P-Value
(2-On own)	2.25	2.196	1.739	p=0.016
(12-Surprised)	3.25	1.391	2.022	p=0.047
(14-Textbook as guide)	0.25	1.391	0.783	p=0.005
(17-Invent)	2.75	1.587	1.913	p=0.027
(22-Topics taught separately)	0.75	2.174	1.739	p=0.045
(25-Topic Jumping)	3.5	2.565	2.978	p=0.005
(26-Watch Teacher)	1.75	2.609	2.304	p=0.007
(28-Compute)	2	2.370	2.130	p=0.041
(38-Solve non-routine)	3.25	2.261	2.630	p=0.010
(39 - Explain orally/writing)	3.5	2.391	3.087	p=0.001
(41-Estimate)	3.75	2.913	3.283	p=0.015
(42-Analyze)	3	2.826	3.348	p=0.003



Conclusions

- Quantitative data: Statistical testing showed significant evidence to suggest change and growth towards Teacher Educator Means in PSTs because...
 - The professor implemented effective practices
 - Students experienced benefit of constructivist teaching
 - Videos demonstrated correct methods and reflections allowed for analysis of those correct methods
- Qualitative data
 - We saw a general movement/trend from more teacher-centered, transmission-based teaching to more student-centered, constructivist-based teaching.
 - Pre-service teachers reported growth or desire towards implementing many of NCTM's Effective Mathematics Teaching Practices.
 - On a whole, preservice teachers frequently cited the instructor, in-class experience, and the assigned videos as the catalysts for their changed thinking.

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