



Mathematics Teacher Leadership: A Sustainable Approach to Improve Mathematics Education

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Goal

The goal of this study is to investigate *the impact* of an NSF-funded mathematics leadership institute whose goals were to increase teachers' math *content knowledge* and improve their *leadership skills* and *teaching practices*.

Methodology

Subjects:

- Seventy-nine mathematics teacher leaders (TL)
- Three years or more of teaching experience
- Two large urban school districts

Treatment:

- Two summer programs (SP) and at least two academic year (AY) follow-up meetings

| | Year 1 | | Year 2 | | Year 3 | Year 4 | Year 5 | Year 6 |
|----------|----------|----|--------|----|--------|--------|--------|--------|
| Cohort 1 | SP | AY | SP | AY | AY | AY | AY | AY |
| | Cohort 2 | | SP | AY | SP | AY | AY | AY |
| | Cohort 3 | | SP | AY | SP | AY | | |

Instruments:

- Content tests: geometry, algebra, statistics, and combinatorics
- Follow-up surveys administered to TLs, their campus colleagues, and administrators (dichotomous – agree/disagree)
- Classroom observations of TLs (21 items in a checklist format – propositional knowledge, procedural knowledge, lesson implementation, & classroom culture)

Data Analysis:

- Repeated-measures ANOVA (pre/post-test content scores)
- Effect sizes (Cohen's d) of gains in content knowledge
- Descriptive statistics of survey results (percentages)
- Descriptive statistics of classroom observation results

Results

Paired t-tests Results for TLs' Scores on Pre/Post-Content Tests

| Measure | Test | Mean | N | S.D. | S.E. | Sig. (2-tailed) | Effect Size |
|--------------------------|-----------|--------|----|--------|-------|-----------------|-------------|
| Geometry | Pre-test | 20.785 | 79 | 9.391 | 1.057 | <0.001 | 1.35 |
| | Post-test | 34.190 | 79 | 10.424 | 1.173 | | |
| Algebra | Pre-test | 14.867 | 79 | 7.635 | 0.859 | <0.001 | 1.81 |
| | Post-test | 29.506 | 79 | 8.505 | 0.957 | | |
| Probability & Statistics | Pre-test | 13.930 | 71 | 10.600 | 1.258 | <0.001 | 1.57 |
| | Post-test | 30.113 | 71 | 10.089 | 1.197 | | |
| Combinatorics | Pre-test | 10.563 | 71 | 7.365 | 0.874 | <0.001 | 2.63 |
| | Post-test | 32.662 | 71 | 9.313 | 1.105 | | |

Percentages of Respondents Agreeing with Statements about the Institutes Impact on TLs

| | Administrators (N = 27) | TLs (N = 37) |
|---|-------------------------|--------------|
| Influenced TLs' leadership skills | 68 | 97 |
| Influenced TLs' interactions with campus colleagues | 84 | 86 |
| Influenced TLs' interactions with campus administrators | 72 | 81 |

Percentages of Respondents Agreeing with Statements about the Institute's Impact on TLs' Colleagues and the Colleagues' Students

| | Administrators (N = 27) | TLs (N = 37) | Colleagues (N = 54) |
|--|-------------------------|--------------|---------------------|
| Influenced TLs' colleagues' mathematics instructional strategies | 80 | 89 | 85 |
| Influenced TLs' colleagues' mathematics content knowledge | 72 | 76 | 78 |
| Influenced TLs' colleagues' students' understanding of the importance of studying advanced mathematics | 56 | 57 | 70 |
| Influenced TLs' colleagues' students' interest in studying advanced mathematics | 52 | 51 | 57 |
| Influenced TLs' colleagues' students' mathematics content knowledge | - | - | 85 |

Percentages of Respondents Agreeing with Statements about Leadership Characteristics of Institute TLs

| | Administrators (N = 27) | TLs (N = 37) | Colleagues (N = 54) |
|---|-------------------------|--------------|---------------------|
| Showed a genuine interest in other teachers' opinions | 96 | 100 | 100 |
| Provided other teachers with relevant information | 89 | 100 | 94 |
| Interacted with teachers in an open and honest way | 100 | 95 | 100 |
| Unequivocally supported other teachers in their work | 93 | 97 | 98 |
| Expressed concerns objectively and constructively | 85 | 95 | 94 |
| Expressed expectations clearly and transparently | 89 | 92 | 96 |

"This program has empowered us as a group to collectively and cooperatively address both positive and negative issues"
- A Teacher Leader

"Without her support our students would have suffered a great loss of academic achievement and rigor in their mathematical endeavors"
- A TL's administrator

"They (teacher leaders) encouraged me to make my lessons more rigorous"
- A TL's campus colleague

Conclusions

- Rice University's Mathematics Leadership Institute
- developed strong and abiding mathematics TLs
 - improved TLs' content knowledge significantly
 - positively impacted TLs' students, colleagues, and colleagues' students
 - positively impacted TLs' classroom practices
 - helped create a professional community of practice that works towards improving mathematics education for all students in urban schools.