

EXECUTIVE SUMMARY
Vermont Mathematics Initiative Program Evaluation
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Dedication

This report is dedicated to the memory of Dr. Marc E. Hull, the Vermont Commissioner of Education at the founding of the Vermont Mathematics Initiative (VMI). The VMI owes its existence to his dedication to the children of Vermont.

Acknowledgement

This evaluation was made possible through the generous support of the grant *Improving Teacher Content Knowledge in Mathematics* funded by the U.S. Department of Education. Special thanks are extended to the Principal Investigators Dr. Douglas Carnine and Dr. James Milgram for their ongoing support of this work and mathematics education in general.

Brief Summary of the Vermont Mathematics Initiative Program

The Vermont Mathematics Initiative (VMI) is a comprehensive, statewide, three-year, master's degree granting mathematics professional development program for elementary teachers at the heart of which is mathematics content knowledge. Begun in 1999, the VMI is designed to train a cadre of mathematics teacher leaders across the elementary schools of Vermont. To date the VMI has trained 184 teachers (136 graduates, 48 currently enrolled) from over 100 elementary schools and 50 school districts, which represent roughly 40% of the elementary schools and 85% of all school districts in Vermont. The target over the lifetime of the program is to place at least one mathematics teacher leader in every Vermont school district and in at least 75% of the elementary schools.

VMI is guided by four goals. Through coursework, classroom applications, mentoring by VMI staff, and leadership training, teachers in the VMI:

- Build a strong and deep knowledge and understanding of mathematics content
- Demonstrate effective mathematics instruction
- Conduct action research that informs instructional decisions at the classroom level and beyond
- Provide leadership that supports school-wide improvement of mathematics teaching and learning.

The ultimate mission of the VMI is to improve the teaching and learning of mathematics in grades K-6 across the schools of Vermont.

The VMI is a partnership of the University of Vermont, the Vermont Department of Education, and school districts throughout Vermont.

In 2004 the VMI commissioned this external evaluation of the program. Dr. H. (Bud) Meyers, former Vermont Deputy Commissioner for Assessment and Accountability, and Dr. Douglas Harris, Executive Director of The Vermont Institutes, have served as lead evaluators.

Evaluation Methodology

This evaluation employed a mixed methods approach, combining quantitative and qualitative data collection and analysis.

Quantitative Methodology

Unit of Sampling: The VMI is a professional development program targeted at teacher leaders. The impact of the teacher leaders occurs at the school level. Therefore, the unit of analysis is the school. Student outcomes on statewide standardized testing are the variables being measured, and these are aggregated to the school level.

Measures of Student Performance: During the years the VMI has been in existence, the state of Vermont has tested students in grades 4, 8, and 10 using the New Standards Ref-

erence Examination (NSRE). The New Standards Reference Exam includes embedded items from the Stanford Achievement Test, Ninth Edition (SAT-9). These items yield a scale score predictive of student results were the student to have taken the entire SAT-9. Because the SAT-9 yields scaled scores that are linked and vertically equated, and because the NSRE is not vertically equated, the embedded SAT-9 items provide a stronger data set over time than would the NSRE. At this writing comparison data is currently available for grades 4 and 8.

Cross-sectional study: Cross-sectional comparisons were made at grade 4 for two groups of VMI schools – one of which had multiple VMI teachers in a school and the other of which had only one VMI teacher in each school – and one group of control schools. These comparisons consider changes in performance at grade four, and were made annually from 1999 (baseline year) through 2004. In each year, the currently enrolled group of students was tested.

Longitudinal study: Since results of cross-sectional analysis may be masked by ‘cohort effects,’ a longitudinal analysis was also conducted. The fourth grade cohort of students tested in the spring of 2000 in grade 4 was tested again as eighth graders in the spring of 2004, and this cohort formed the basis for the longitudinal comparison. The longitudinal studies comprised matched sets of scores representing performance of the same student in fourth and eighth grade. This controlled for the potential of migration as a threat to validity. A similar longitudinal comparison was made for the baseline student sample tested in grade 4 in 1999 and again in grade 8 in 2003, which is reported as baseline data.

Annual gains in mean percentile rank between grade 4 and grade 8 were calculated for students in the two groups of VMI schools and the group of control schools. Percentile rank gains were compared across the groups of schools in 2000-2004 (the intervention data). Comparison was also made with the 1999-2003 baseline data.

Overall Findings: Quantitative Results

Overall findings of the quantitative study of student performance are presented according to differences in mean scaled scores in the cross-sectional analysis and mean percentile gain in the longitudinal analysis.

Finding 1: Cross-sectional

Comparisons of VMI grouped schools with control schools yielded an overall consistent pattern of the VMI schools exceeding the performance of Control schools in the cross-sectional analysis.

Finding 2: Longitudinal

A pattern of gain favoring the group of VMI schools having more concentrated numbers of VMI teachers emerged from the comparison of percentile rank gains over time. Students in these VMI schools progressed at a rate more than three times that of their peers in either the group of schools having a single VMI teacher or the group of Control

schools having no VMI teacher. The results for the intervention year cohort are contrasted with those for the baseline year cohort, with the results substantially favoring the intervention year cohort of VMI schools having concentrated numbers of VMI teachers. The educationally meaningful statement is that Vermont students who are taught by teachers who have studied mathematics in the VMI program can expect to increase their percentile gains in an average range of from 14 to 23 percentile points over a period of 4 years.

Qualitative Methodology

The qualitative data sources utilized in this evaluation included the following:

- Interviews of twenty current VMI participants and graduates.
- Interviews with twelve administrators
- Categorizations of themes emerging from interview debriefing by the interview team
- Observations of VMI sessions
- Interviews and informal discussion with VMI staff and leaders
- Review and analysis of course evaluations
- Review and analysis of participant portfolios

Overall Findings: Qualitative Results

Impact on Participants and Their Teaching

Finding 1: Mathematics Content

Virtually all participants described themselves as unprepared in mathematics prior to VMI. An overarching theme is the impact of the VMI experience on the teacher's own understanding of mathematics content.

Finding 2: Increased Confidence Related to Mathematics

Increased understanding of mathematics content impacts the confidence of participants as related to mathematics, as well as their enthusiasm and enjoyment of mathematics.

Finding 3: Impact on Instructional and Assessment Practice

Participants and principals report that the instruction in VMI, increased content knowledge, and increased confidence have had major impact on instructional and assessment practice in the classroom.

Finding 4: The Impact of Action Research on Classroom Practice

The impact of action research is mixed, with some participants and principals reporting considerable impact, others less so.

Finding 5: Principal Support

The active support of principals makes a profound difference in the VMI participant's work in the classroom and in leadership positions.

Finding 6: Personal Impact on Participants

Beyond the impact of VMI on teachers in relation to math content, instruction, and leadership, the program also has profound personal impact on many participants.

Impact on Students

Finding 7: Transfer of VMI Content to the Classroom

Teachers report direct transfer of mathematics content used in VMI to the math experiences of their students.

Finding 8: Impact on Student Problem Solving

Teachers report that the problem solving emphasis in VMI has significant impact on their understanding of how to engage students in problem solving in the classroom.

Finding 9: Impact of Action Research on Students

Some teachers believe that the interventions begun in their action research projects will continue to impact their students over time.

Impact on Teacher Leadership in Schools and Districts

Finding 10: Impact of Teacher Leaders

Teachers who are currently working as teacher leaders credit VMI for providing the knowledge, confidence, and support for them to take on leadership roles. This is true of teachers working in leadership at the school, district, and state levels.

Finding 11: Need for Ongoing Support

There is a common desire among VMI graduates to maintain the type of professional learning community afforded them through VMI.

Recommendations

Based on the above findings, the evaluators make these recommendations for the Vermont Mathematics Initiative and its leadership.

Recommendations Related to the Funding of VMI

The State of Vermont, local schools and districts, and the Vermont business community should develop a diverse, sustainable revenue stream for VMI to ensure its continuation, its availability to participants from poor and rural schools and districts, and continuous research and evaluation of its success. To this end, VMI leadership should work with state government, businesses, foundations, higher education institutions, and non-profit organizations to support the following investments in VMI:

- Title 2 funds that are received by districts
- MSP funds received by the state
- Local district funds that are set aside for professional development from the general fund (local) budget
- Private business and foundation support of mathematics professional development
- Partnership funding of professional development that includes Higher Education and non-profit contributions

Recommendations Related to the VMI Program

- Mentoring
 - Continue to strongly support and enhance the mentoring and coaching components of the program
 - Evaluate the mentoring and coaching components with a ‘theory into practice’ based research design
- Statistics
 - Continue to integrate the action research content with statistics content while also exploring ways to emphasize the interrelationships among statistics and the mathematics portion of the courses
 - Track the statistics content learned through action research to content taught in classrooms as well as to action research
- Leadership
 - Reexamine current leadership strategies and engage principals and teacher leaders in determining ways to increase the consistency of principal awareness of the VMI program and its impact on mathematics in the classroom
 - Determine ways to support teacher leaders as they transition from the classroom into leadership positions and as they continue in these critical positions over time.
- Learning Community

- Determine ways to continue support of VMI graduates as a professional learning community

Recommendations Related to Continued Study of the Vermont Mathematics Initiative

- Continue to gather longitudinal data from the State of Vermont's Assessment System. In particular, the spring 2005, 10th grade results should be added to a longitudinal analysis of grade 8 results for 2003. This will provide a first data point on students who may be matched across time and schools.
- As Vermont transitions to statewide assessment utilizing the New England Common Assessment, carefully analyze the logic and structure of the NECA and review VMI course content in relation to the Grade Level Expectations upon which this assessment is built.
- Continue qualitative analysis utilizing existing data sources and consider adding series of observations within VMI participants' classrooms to better understand what exactly is happening in those classrooms.
- Select and implement a "theory into practice" change model considering, for example, the IBM/Harvard School of Business Change Toolkit and the McREL Balanced Leadership Model.