

RAPPORTEUR'S REPORT

W.E. HAVER

*Dept. of Mathematics and Applied Mathematics, Virginia Commonwealth University
Richmond, VA 23284
wehaver@vcu.edu*

I have been energized by what I have learned during these two days concerning the work that scientists, mathematicians, and educators are doing across Virginia to strengthen the preparation of middle school science and mathematics teachers. I welcome the opportunity to give the “Rapporteur’s Report” summarizing where we are as we leave the Harrisonburg Conference.

Thomas Elliot, Assistant Superintendent from the Division of Teacher Education and Licensure of the Virginia Department of Education, began the Conference by reminding us of our challenge and opportunity. Four years ago, with encouragement from the Virginia Mathematics and Science Coalition, the Virginia Board of Education changed its regulations to require that future middle school teachers either complete: a grades 6-12 endorsement which requires a major in their area of endorsement; or, a grades 6-8 endorsement which requires a concentration in the area(s) that they will teach [1]. Therefore, teachers will no longer be permitted to teach mathematics or science unless they have completed an area of concentration in mathematics or science, respectively. In particular, they must demonstrate knowledge of the subject matter they will teach through their performance on the PRAXIS II examination.

Before I begin my Rapporteur’s Report, I would like to express the appreciation of all of us for the support provided by the Fund for the Improvement of the Postsecondary Education (FIPSE) of the United States Department of Education. This support aided ten colleges and universities in our efforts to respond to this new requirement for future middle school science and mathematics teachers. FIPSE also supported this statewide Conference that has provided us with an opportunity to learn about the work done by all of Virginia’s colleges in this area.

Importance of Appropriately Prepared Teachers

I was struck by the depth of agreement among the large number of scientists, mathematicians, and educators at the conference concerning the preparation of middle school

teachers. We are in agreement on the importance of middle school mathematics and science teachers: 1) being committed to their disciplines; 2) knowing and caring about middle school age students; 3) viewing themselves as mathematicians and scientists with a deep understanding of the mathematics and science they teach; and, 4) continuing to develop professionally throughout their careers. Based on presentations and discussions I have heard throughout this conference, it appears to me that there are a number of reasons for the agreement on the importance of preparing middle school teachers who both know and care about who they teach and what they teach.

Students Learn Best in an Active Classroom — An effective middle school mathematics and science program includes long-term projects, collaborative learning, well-designed laboratories and open-ended activities. If teachers do not have a deep knowledge of their subject matter, they cannot develop and offer such a program. By necessity, they will lecture to their students and then have their students complete worksheets or exercises from their textbooks.

Middle School Students Know Whether Their Teachers Are Genuine — The students detect and care whether their teachers care about the subject matter being taught. The students know whether the teachers care about them.

Well-Prepared Teachers More likely to Remain in the Profession — Donna Sterling's presentation, a description of the large attrition rates of teachers, provided some interesting information concerning the large percentage of teachers who leave the profession during their first years of teaching; and, the fact that those who enter teaching without completing full-scale teacher preparation programs leave at much higher rates [2].

Middle School Experience Crucial for Students' Academic Program — They come to middle school as young students with few long range plans and, based to a large degree on the nature and quality of their middle school experience, leave with academic and career plans that in most cases will influence the rest of their academic and work-related lives.

Preparation of Current Middle School Teachers and the Opportunity

A study conducted on behalf of the Virginia Mathematics and Science Coalition in 1999 found that more than 50% of middle school mathematics and science teachers did not have the equivalent of a minor in the area that they were teaching, even taking into account coursework

completed after being assigned to teach middle school mathematics or science [3]. The study found, for example, that 55% of full-time middle school mathematics teachers studied twelve hours of mathematics or less as undergraduates. In fact, a very large percentage of those teaching middle school mathematics and science did not initially prepare to teach these disciplines as part of their undergraduate training. The teachers assumed these assignments at the request of their school systems, since there were no individuals who were specifically prepared for these assignments and since the regulations permitted them to do so.

Virginia's education community (higher education and school systems) has been given the opportunity to change this situation. As stated earlier, based on the importance of well-prepared teachers and the fact that most middle school mathematics and science teachers did not specifically prepare for their duties, the new state regulations now require middle school teachers to have at least the equivalent of a minor in the subjects they teach. Virginia's high stake SOL testing program, as well as the testing requirement of the federal No Child Left Behind legislation increases the support for teachers well versed in their disciplines.

In short, we have the opportunity. If colleges and universities can develop programs, recruit students, and prepare the kind of teachers we have been describing during the Conference, these teachers will be hired by the school systems. This will have a profound effect on Virginia students' achievements in science and mathematics.

The Good News

The Conference has been full of good news. Virginia's scientists, mathematicians, and educators are responding to the challenge. With partial support from FIPSE and other funding agencies, and often with no external support, Virginia colleges and universities are responding in exciting ways to the challenge of improving the preparation of middle school mathematics and science teachers.

Undergraduate Programs to Prepare Future Middle School Teachers

- James Madison University has developed an interdisciplinary major designed for future elementary and middle school teachers. Those earning the Mathematics/Science concentration within the major complete twenty-one credits each of mathematics and science. Most of this coursework is designed specifically for prospective teachers [4].

- Radford University has developed a program for future middle school teachers with a particular focus on preparing teachers with strong mathematics and science backgrounds, and with an understanding of the middle schoolers they will teach.
- During the past year, Longwood University has approved an add-on middle school mathematics and science endorsement that builds on their already existing Liberal Studies major [5].
- Also within the past year, Norfolk State University has created a new program to prepare middle school mathematics and science teachers.
- Virginia Commonwealth University has refined its Interdisciplinary Science degree to include concentrations in mathematics and in science [6].
- These and other colleges have developed special opportunities for prospective middle school teachers within their academic programs that lead to grades 6-12 certification. We learned about specific opportunities provided by the University of Mary Washington, Virginia Tech, Virginia Intermont College, and others.

Alternative Routes to Teaching

- George Mason University has developed the New Science Teachers' Support Network that focuses on investigating various factors designed to support provisional licensed middle and high school science teachers [8].
- A state university has teamed with a public school system to establish an alternate licensure program to prepare "highly qualified" middle school mathematics teachers [7].
- The Virginia Community College System is completing a plan for a new career switcher program to "meet the need for skilled, talented, diverse, and highly qualified" mathematics and science teachers.

Appropriate Courses for Future Middle School Teachers

- James Madison University has developed an upper-level science course that considers whether there is "life in the universe and how do we go about looking for it?" The science content of physics, chemistry, life science, and earth science is studied through this thematic approach.
- Hampton University has developed a course for future science teachers with the unifying theme of how the location of a school at the junction of three rivers impacts

transportation systems, occupations of parents, availability of financial resources for the school system, and classroom content delivery.

- The Science Museum of Virginia, in conjunction with Virginia Commonwealth University, has developed and regularly offers a course that helps future middle school teachers develop a more sophisticated understanding of science concepts and methods by guiding them through some of the great discoveries in the major scientific disciplines. The course makes use of the interactive exhibit resources of the Science Museum [9].
- The University of Mary Washington has just graduated its first class of students in a Master of Science degree in Elementary Education. The four students in the mathematics specialization group each conducted an action research project investigating some aspect of teaching mathematics.
- The College of William and Mary has developed a tool to develop clarity and consensus on mathematics instructional practices, and how these practices are implemented in the classroom. This tool is particularly useful for cooperating teachers in their supervision of student teachers [10].

Enhancing the Best Mathematics and Science Teachers

- The Mathematics and Science Center of the Richmond area schools, the University of Virginia and Virginia Commonwealth University collaboratively offered a Master of Interdisciplinary Studies degree in Mathematics and Science for twenty-four outstanding middle school teachers.
- The Virginia Board of Education has requested that a license be created for K-8 Mathematics Specialists. In response to this request, the Virginia Mathematics and Science Coalition is leading a statewide conversation among school division personnel, colleges of education, and mathematics departments to develop programs to prepare outstanding teachers to serve in this capacity.

There is indeed a lot of good news. In March 1999, as we learned during the statewide Charlottesville Conference on Preparing Virginia's K-8 Teachers in Mathematics and Science, most of the work focused on courses for grades K-5 future teachers, and the needs of future middle school teachers had not been addressed at most Virginia colleges and universities [11]. However, the program courses described at this conference and summarized here represent just a sample of what has been accomplished in the subsequent four years.

The Remaining Challenge

Simply stated, as an educational system we are still not producing enough teachers who are prepared to teach mathematics and science at the middle school level. This situation is part of a broader problem of not producing sufficient numbers of teachers certified to teach mathematics and science in grades 6-12. The numbers are stark. Individual institutions are required to report the number of program completers by endorsement area to the Virginia Department of Education [12].

Table 1
Summary Numbers for the 2001-2002 Academic Year

Mathematics	Biology	Chemistry	Earth Science	Physics
82	80	26	13	7

These statistics do not include the large number of individuals who completed B.S. programs in science or mathematics and some education coursework, and who were hired by school systems before completing their preparation.

As of this date, the Virginia Department of Education does not keep records of middle education program completers by endorsement area. In order to obtain an estimate of the number of middle school teachers, all participating colleges and universities were asked to provide their best estimate on the number produced. Not all Virginia institutions of higher education participated, but those that did produce more than 90% of the grades 6-12 program completers described in Table 1.

Table 2

Individuals Who Completed Programs at Virginia Colleges and Universities and Accepted Positions Teaching Mathematics and/or Science at the Middle School Level

Completed 6-12 Certification in Mathematics or Science *	Complete 6-8 Certification in Mathematics or Science	Completed Science and/or Mathematics Major; not Certified
46*	54	21

* These teachers are counted in both Table 1 and Table 2.

The most recent analysis of the need for new mathematics and science middle school teachers in Virginia was reported by J. Sigler [13]. He stated that a conservative estimate to meet Virginia’s needs ranged from “slightly less than 100 to about 115 newly trained 7-8 math teachers each year and a like number of 7-8 science teachers.” He also reported in his paper that:

An informal telephone poll of schools and departments of education in the Commonwealth, as well as a study of catalog information leads to a conservative (on the high side) estimate that the current statewide production of math-science middle school (7-8) teachers is between ten and twenty total. The number may be much smaller [13].

Summary

We are making progress. Clearly, a great deal of thought and effort have gone into developing new courses and programs, and the number of students completing our programs are much greater than they were four years ago; but, we need to complete our work. Collectively, we need to immediately increase the number of new middle school mathematics and science teachers who meet the new license requirements. If we do not, school systems will be forced to find individuals to fill the openings, and the requirements will be interpreted or revised to reflect the reality.

I know that we leave this conference recommitted to taking full advantage of our opportunity. ■

References

- [1] *Virginia Licensure Regulations for School Personnel*, Virginia Department of Education, Richmond, VA, Internet: <http://www.pen.k12.va.us/VDOE/Compliance/TeacherEd/nulicvr.pdf>
- [2] D. Sterling, "The Teacher Shortage: National Trends for Science and Mathematics Teachers," *The Journal of Mathematics and Science: Collaborative Explorations*, **7** (2004) 85 - 96.
- [3] W.E. Haver, "Rapporteur's Report," *The Journal of Mathematics and Science: Collaborative Explorations*, **2**(2) (1999) 194.
- [4] C. Klevickis, R. Kolvoord, M. Handley, K. Giovanetti, D. Peterson, T. Daughtrey, and S. Fairchild, "First Steps Toward Change in Teacher Preparation for Elementary Science," *The Journal of Mathematics and Science: Collaborative Explorations*, **7** (2004) 37 - 48.
- [5] J.D. Smith, "Liberal Studies at Longwood College: Preparing Teachers for Virginia's Future," *The Journal of Mathematics and Science: Collaborative Explorations*, **2**(2) (1999) 19-25.
- [6] R.W. Farley, "Virginia Commonwealth University B.S. in Science Degree Program," *The Journal of Mathematics and Science: Collaborative Explorations*, **7** (2004) 61 - 65.
- [7] R.Q. Berry, III, "Transition to Teaching: An Alternative Certification Program Through a Partnership between a Public School District and a Public University," *The Journal of Mathematics and Science: Collaborative Explorations*, **7** (2004) 149 - 165.
- [8] J.J. Matkins, D. Sterling, and A. Kitsantas, "Helping Provisionally Licensed Middle School Science Teachers," *The Journal of Mathematics and Science: Collaborative Explorations*, **7** (2004) 97 - 108.
- [9] D.L. Neely-Fisher and D.B. Hagan, "*Experiencing Science*, An Introduction to 'Real' Methods of Science for the Pre-Service Teacher," *The Journal of Mathematics and Science: Collaborative Explorations*, **2**(2) (1999) 159-163.
- [10] M. Mason, D. Johnson, J. Rozelle, A. Koziol, Y. Smith-Jones, R. Cofer, L. Quick, E. O'Brien, W.M. Geiger, and K. Grass, "What Does an Exemplary Middle School Mathematics Teacher Look Like? The Use of a Professional Development Rubric," *The Journal of Mathematics and Science: Collaborative Explorations*, **7** (2004) 49 - 60.
- [11] Preparing Virginia's K-8 Teachers in Math and Science, *The Journal of Mathematics and Science: Collaborative Explorations*, **2**(2) (1999).

- [12] Virginia Department of Education website, Internet: www.pen.k12.va.us/
- [13] J. Sigler, "A Preliminary Analysis of the Supply and Demand for Middle School Mathematics and Science Teachers in Virginia," *The Journal of Mathematics and Science: Collaborative Explorations*, **2**(2) (1999) 53-64.