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Comments Delivered on May 15, 2007 by Nancy Nutting, Executive Director of SciMathMN, Regarding Proposed Minnesota Rule 8710.4770: Teachers of Science Endorsement Licensure by Examination

The SciMathMN Board of Directors is opposed to using the passing of a required PRAXIS II discipline science exam as the sole measure of content knowledge as part of an alternative path to gaining a license to teach any science discipline in any grade, 7-12.

The SciMathMN Board of Directors objects to this proposed rule for three reasons:

1) **Validity** – the PRAXIS II is not normed for this purpose and should not be the sole indicator of teacher quality leading to the awarding of licensure to teach a specific science content area.
2) **Definition of High Quality Teaching** – while teachers clearly need to be knowledgeable in the content they teach, *pedagogical* content knowledge is also critical to student success – both are necessary components of defining and ensuring quality instruction for and assessment of student learning.
3) **Equity –** while appreciating staffing shortages that are real issues, particularly in smaller or isolated school districts, weakening or short-circuiting the requirements for teacher licensure may potentially create an unequal educational system. Larger school systems can continue to maintain staffs that are more thoroughly prepared to teach specific areas of science and smaller districts will only attract those who merely pass a content test.

Validity

The assumption that should be made in designing an alternative preparation path to any license for teaching is that all preparation paths to earning a particular license should be equivalent. That includes equivalent sources of evidence of competency in knowledge, skills, and understanding as required by the license. We are convinced that the PRAXIS II exam is by its very design not an equivalent measure of content preparation for a science license.

The reason that the PRAXIS II test is not an equivalent measure of knowledge, skill and understanding is that it is a norm-referenced test. As a norm-referenced test the PRAXIS II test has the following limitations that render it inappropriate for the use this rule proposes:

- The PRAXIS II test only covers 40% percent of the science content material as required by the Minnesota Board of Teaching (BOT) licensure standards. Assessment done in college science courses covers a greater percentage of license content material (knowledge, skills and understanding) through the use of multiple measures.
- The PRAXIS II test is not a mastery or standards-based test. The score earned by the applicant only reports how one did relative to the mean of the group used to norm it. Assessment in college science courses consist of a variety of mastery assessments.

- The group used to norm the PRAXIS II test was not a group of science teachers studying on their own with some course work and experience trying to pass a test to get a license in a second science discipline. If it had been so normed, the current use of the test in Minnesota by graduates of the BOT approved programs seeking a license is also inappropriate.

- The content tested by the PRAXIS II test is not known by the BOT, the parents or general public, or the teacher as the questions on the test are the intellectual property of ETS. Since that is the case, how will the BOT and the public ever know what the PRAXIS II test is measuring?

Definition of High Quality Teaching

The Minnesota Board of Teaching (BOT) approved teacher preparation programs in Minnesota must prepare science teachers in a specific set of knowledge, skills, and understandings as required by the BOT. Minnesota teacher education institutions spend a great amount of time and money proving to the BOT that their programs provide this detailed preparation to its graduates which includes comprehensive assessment of its graduates' mastery of the knowledge, skills, and understandings required of highly qualified science teachers.

The use of the PRAXIS II test in proposed rule 8710.4770, as the only measure of science content in an alternative path to science licensure, is in no way equivalent to what BOT requires of Minnesota teacher education programs. Such an alternative path will not license highly qualified science teachers for Minnesota. Is it documented that such an alternative to licensure will meet the NCLB requirement that teachers must be highly qualified in their content areas? Even if it meets NCLB requirements it would water down the current Minnesota standards for licensure. Minnesota's current Academic Standards for Science require deep understanding in multiple areas of science and will most effectively be met by students whose teachers have deep knowledge of the content and pedagogical issues in teaching that content. As Minnesota moves into the first required assessment of science learning in 2008 will this proposed rule need to be repealed since it short circuits high quality?

What has been done already?

The BOT has established a portfolio process that can document a teacher's performance and knowledge of science and science teaching. It is more comprehensive than an exam as it includes course work, professional development activities and teaching experience. Teachers have used this process to secure additional licensure but it can benefit from greater publicity. Professional teacher organizations might be of help here.

Several MnSCU institutions and Minnesota private colleges have been preparing to meet this need. The MnSCU Second Licensure Programs at various institutions have begun to show success in generating programs that work for additional licensure for teachers already licensed in one area of science. This is available in all the licensure areas of science. Plans are underway by MnSCU institutions to expand their current offerings to one year programs designed for individuals already holding licensure in one area of science. These will consist of on-line courses, culminating in face-to-face summer work. The private colleges are also taking note of

the need. Programs, such as the Minnesota Science Teachers Education Project (MnSTEP) developed at Hamline University have been developed. This program has two components, Physics Accreditation for Science Education (PhASE) and Chemistry Curriculum for Additional Licensure (ChemCAL). These combine summer experiences, online learning, and a practicum experience where the candidate is observed by a licensed teacher. Both programs are grant supported, resulting in little financial cost to participants. As the network of higher ed providers expands across the state, teachers in many areas will have access to programs that provide a greater degree of quality than an exam. The MnSCU and Hamline programs provide viable models for other institutions to develop similar programs.

The data in the SONAR actually supports the effect of these programs. The actual increases since 1999-2000 in Physics and Chemistry are partially attributable to the growth of additional licensure programs being developed by Minnesota's higher education institutions. In order to meet current BOT licensure requirements, colleges and universities need time to develop new models and inform potential participants. It is important that we continue to follow the data over the next several years to gauge the impact of these programs. These programs and the oversight provided by BOT ensure that teachers participating in these programs meet the standards for science teaching set by the BOT. Mere passage of an exam does not give Minnesota students the same guarantee that they will be taught by highly qualified teachers.

Equity

While appreciating the staffing shortages that are real issues, particularly in smaller or isolated school districts, weakening or short-circuiting the requirements for teacher licensure may potentially create an unequal educational system. Larger school systems may maintain staffs that are more thoroughly prepared to teach specific areas of science and smaller or isolated districts will only attract those who can merely pass a content test.

Minnesota students have scored among the best in the world at grades 4 and 8 in the TIMSS '95 assessment. This is attributed to several factors including a strong inquiry pedagogy that has developed through professional development over time and an absence of ability grouping in science which permits the opportunity for all students to learn important science content. This provides a strong foundation for more focused work at the high school level. All students deserve to be taught by well-qualified teachers and it is critical that we continue to build on the strong elementary and middle school foundation our students have shown in the past as we implement new requirements. As we expect all students to take both life science and either chemistry or physics in high school, ought we not be more aggressive in ensuring that students will be able to be successful in that coursework? By having the instruction provided by teachers who know not only the content in physics and chemistry but how to teach that content to a wide variety of learners and to provide safe laboratory or field experiences in all content areas, we increase the guarantee that all students will have access to strong instruction in all areas of science.

It is a fallacy of conventional wisdom that content in one area of science transfers to another area of science. Clearly there is some transference. Inquiry as a process for learning is well documented and can transfer across multiple areas of science. But each discipline also has certain concepts that have a strong research base on how students learn them. Knowing how

students learn ideas in biology may not be the same as identifying typical problem areas in physics or chemistry or earth science. Recent research in science education, published in a variety of juried science teaching journals, are showing that both content and pedagogical content knowledge affect student performance (see, for example, "Misconceptions as Barriers to Understanding Science," *Science Teaching Reconstructed*, www.books.nap.edu/readingroom/books/str/4.html). These studies show a positive relationship indicating that a teacher whose content knowledge is greater than that of another teacher will more likely have higher student achievement. Likewise the pedagogical knowledge also correlates positively with increased student achievement. Teachers need specific training in the best ways to teach the key concepts of each science to guarantee student learning, retention of scientific ideas, and the ability to build on those ideas to learn additional content within an area of science. The deeper the content knowledge of the teacher AND the more familiarity a teacher is with the best practices/pedagogy and the potential misconceptions students hold or develop within each discipline of science, the stronger the science education will be for every child or young adult.

To maintain equity and to address the unique needs of smaller or isolated districts, regions might develop partnerships for sharing staff members. By sharing across semesters or through annual exchanges, a region might have a cadre of science teachers upon which to draw and be able to maintain high quality teachers for its students. Some models exist that might form a productive basis for creating similar systems in Minnesota. Dr. Roy Unruh, University of Northern Iowa, has pioneered a sharing effort among districts in Iowa to effectively deliver physics instruction to a greater number of learners.

What needs to be done?

The SciMathMN Board of Directors urges the following steps be taken:

1. The Minnesota Board of Teaching (BOT) should withdraw proposed rule 8710.4770.
2. Legislation and the BOT need to continue to support the portfolio process, along with greater publicity for the process.
3. Legislation and the BOT need to continue to encourage the development of coursework among Minnesota higher education institutions, who might work in conjunction with regional professional development agencies, to guarantee coursework and professional learning opportunities in both content knowledge and pedagogical knowledge. This increases the guarantee that Minnesota students continue to receive a science education that has been nationally and internationally recognized. This is an area that can integrate on-line learning experiences and networks of educators to make the learning time and experiences workable for teachers in smaller or isolated school districts and for experienced teachers in all regions who already hold full time teaching jobs. These models should be disseminated through MDE, BOT, and professional organizations such as MACTE, MCTM, MnSTA, MASA. MASSP, MSBA, Education Minnesota. This may require judicious extension of variances as these programs phase in.
4. School districts and their professional organizations, including teacher contract organizations, might develop policies and share the costs of increasing the science areas in which a teacher is certified in exchange for a guarantee of continued employment in the district or region for a specified time period. This is often a condition of sabbatical

leaves and could be modeled as a condition of district/regional support for additional licensures.

5. School districts might form professional, contractual relationships to regionalize their staffs to create models that allow a teacher licensed in one science to teach in multiple school districts. If there were creative "exchanges" across years or semesters, districts could offer a stronger variety of science course work to their students knowing they are providing students learning opportunities with teachers knowledgeable in both the science content and the pedagogy specific to that content area. It might be wise to pilot some models of regional collaboration to gain a sense of the logistics involved.
6. The BOT should appoint a task force involving key stakeholders to generate equitable solutions to the staffing shortage that will maintain a high quality education for Minnesota students in all areas of science, not just the area in which their teacher was first licensed. While this has been attempted in the past, with access to better data and alternative models that are now just being tried, the timing is appropriate to reconstitute such a task force. SciMathMN would to happy to assist in convening this group or working with others to do so.

This is fundamentally a staffing issue to be resolved by other means than changing licensure requirements. Maintaining highly qualified teachers is important to Minnesota's students and for the impact on Minnesota's workforce. New staffing models and providing valid alternatives for additional licensures in areas of science seem the more productive and more effective route than the quick route of adding licensures merely through a test that is normed for a different purpose.