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May 5, 2008

Dr. D. Kent King, Commissioner  
DESE  
P. O. Box 480  
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Dr. Robert Stein, Commissioner  
DHE  
3615 Amazonas Drive  
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Dear Commissioners Stein and King:

On March 13, 2008, the National Mathematics Advisory Panel (NMAP), appointed by President Bush in 2006, released its final report [Ref. 1] which will surely become the primary national document for K-12 mathematics education for the next decade. This timely and definitive report makes very specific and detailed recommendations for the K-8 mathematics curriculum in particular. It is of great significance that the National Panel included mathematicians along with cognitive psychologists, mathematics educators, and policy experts, many from major universities. The overall conclusion of the National Panel has been widely reported and accepted:

*"This Panel, diverse in experience, expertise, and philosophy, agrees broadly that the delivery system in mathematics education – the system that translates mathematical knowledge into value and ability for the next generation - is broken and must be fixed"* [Ref.1, p. xiii]

Given the importance and long-term national impact of the NMAP report, we write to urge an immediate, comprehensive, and broadly based expert review of the following two major Missouri state mathematics education documents:

- The DESE/METS K-12 Mathematics Learning Goals [Ref. 2]
- The MDHE Mathematics Postsecondary Entry-Level Competencies [Ref. 3]

It is essential that these two documents together provide clear and specific guidelines to Missouri schools which are closely aligned with the primary recommendations of the NMAP report. A central consideration for mathematics education of Missouri students must be consistency with national guidelines and expectations of the next decade, not merely continuity with Missouri and national documents of the last decade. Missouri students need to remain competitive in the national arena for higher education or employment opportunities. Missouri businesses and schools need a workforce educated within the current and future national norms.

The NMAP Final Report and Task Group Reports lay out specific and detailed K-8 mathematics curriculum and evaluation goals based on a comprehensive evaluation of research findings that meet scientific criteria for validity.

1) Curricular Content: "To clarify instructional needs in Grades K-8,... the Panel made a specific effort to delineate the content and demands of school algebra, which

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expects to be covered through high school" [Ref. 1, p. 15]. The primary recommendations from the Curricular Content chapter [Ref. 1, p. 15-16] include: "... The Panel recommends use of the Major Topics of School Algebra (Table 1, p. 16) in revisions of mathematical standards at the high school level in state curriculum frameworks..." The panel supplements this with specific grade-level recommendations [Ref. 1, p. 19-20]: "In view of the sequential nature of mathematics, the Critical Foundations of Algebra ... require judicious placement in the grades leading up through Algebra. To encourage the development of students in Grades PreK-8 at an effective pace, the Panel suggests the Benchmarks for Critical Foundations in Table 2 as guideposts for state frameworks and school districts." Finally [Ref. 1, p. 23], "All school districts should ensure that all prepared students have access to an authentic algebra course – and should prepare more students than at present to enroll in such a course by Grade 8. The word 'authentic' is used here as a descriptor of a course that addresses algebra consistently with the Major Topics of School Algebra (Table 1, page 16)."

These excerpts from NMAP indicate that Missouri must place a heavier emphasis on fully preparing students in the early grades with a solid and coherent foundation for algebra, and that every high school must ensure the availability of an *authentic* algebra course for all prepared students.

2) Instructional Practices: The NMAP report makes recommendations about the important subject of instructional practices and learning processes, stressing that the (implemented) "curriculum must simultaneously develop conceptual understanding, computational fluency, and problem-solving skills. Debates regarding the relative importance of these aspects of mathematical knowledge are misguided." [Ref. 1, p. xix] The report urges that: "Instructional practice should be informed by high-quality research, when available, and by the best professional judgment and experience of accomplished classroom teachers. High-quality research does not support the contention that instruction should be entirely 'student centered' or 'teacher directed.'" [Ref. 1, p. xiv] In connection with the last point, the report also notes that "Explicit instruction with students who have mathematical difficulties has shown consistently positive effects on performance with word problems and computation...By the term *explicit instruction*, the Panel means that teachers provide clear models for solving a problem type using an array of examples, that students receive extensive practice in use of newly learned strategies and skills..." [Ref. 1, p. xxiii]. Note particularly [Ref. 1, Recommendation 23, p. xxii & p. 45], "All encompassing recommendations that instruction should be entirely 'student-centered' or 'teacher-centered' are not supported by research. If such recommendations exist, they should be rescinded. If they are being considered, they should be avoided."

These excerpts from the NMAP report contrast sharply with the 'student centered' focus dominating the Missouri K-12 document, which repeatedly prescribes that students "explore", "investigate", "develop models", and "conduct experiments". The proposed Missouri K-12 document is based narrowly and almost exclusively on the

NCTM standards that were the motivation of much of the mathematics curriculum work of the LAST decade rather than the work of the NMAP for the NEXT decade.

The need for reexamination of the proposed K-12 expectations for Missouri in light of the NMAP Final Report alone is already compelling. But, in addition, the final reports of the Panel's Task Groups will be available within a month. These reports (drafts available at the NMAP website [Ref. 1]) will contain nearly a thousand pages of definitive material on curricula, learning, instructional practices, teacher preparation, and assessment. They will be invaluable for the detailed work Missouri needs to do on its state mathematics education documents, and it would be unfortunate indeed to proceed hastily to lock in Missouri standards that are inconsistent with the new national consensus standards developed by the NMAP.

Moving now to the statement of competencies for collegiate entry level courses, we urge that these be reexamined not only with an eye to the NMAP recommendations about algebra, for instance, but also for a different reason. Those competencies were never intended, as we understand it, to be other than minimal competencies sufficient only to prepare students for success in college algebra, not calculus. They should not become the norm for K-12 preparation, but the minimum level, insufficient by themselves to get students ready for any collegiate curriculum that anticipates mathematics beyond college algebra. While it is certainly a laudable goal to reduce significantly the need for remedial mathematics at the college level, the DHE document must clearly differentiate for schools the difference between *minimal* competencies for all students and the kind of preparation needed for scientific and technical fields, where Missouri has great workforce needs.

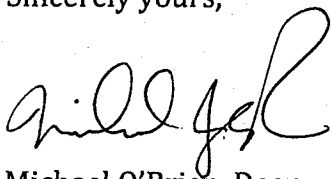
At MU, for example, about 1000 students per year must enroll in Intermediate Algebra (for which they receive no college credit) because they are not prepared for College Algebra. Some students are taking College Algebra who intend to be engineers but are not prepared for Calculus. Most students in Calculus I today could not pass tests routinely given 5-10 years ago at MU to students in the same course. This does not bode well for Missouri's future.

A hallmark of the NMAP process has been the inclusion of mathematicians and cognitive psychologists from major universities; in contrast, Missouri's K-12 standards have historically been developed by a narrower group of K-12 educators and teachers. Missouri's K-12 mathematics standards have been repeatedly rated among the worst in the nation, having received a grade of "F" in each of the Fordham Foundation evaluations of 1998, 2000, and most recently in 2005 [Ref. 4]. We are very concerned that the proposed K-12 standards continue in the same direction that resulted in the distressingly low marks on the 2005 Fordham ratings. We therefore believe it is essential for the future of Missouri and its people that the state be brought up to nationally-accepted expectations in content and in learning methodologies, as reflected in the NMAP report. We also believe that Missouri has not done a good job of educating parents, teachers, school boards, and the public about the difference between what is minimally required for collegiate success in

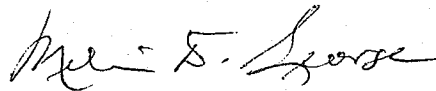
any field and what knowledge and skills are necessary for a technical or scientific education or career beyond high school.

For all these reasons, we urgently request that you, as commissioners with major responsibilities for Missouri education and as members of the P-20 Council, institute an immediate review of both the K-12 draft and the college entry-level document to determine their adequacy in the light of the NMAP. The review must include persons with training and experience in mathematics per se. We write with urgency, not only because of the seriousness of the matter, but because we understand that adoption of the proposed K-12 document is expected by September. We believe, however, that if a delay is necessary, that is far preferable to locking Missouri into standards based on old ideas out of step with the direction of the NMAP and the nation as a whole. We stand ready to meet with you to discuss these important issues, to answer questions, and to assist in any way that would be useful in achieving the goal of better mathematics preparation for Missouri young people. We hope for a response in the near future.

Sincerely yours,

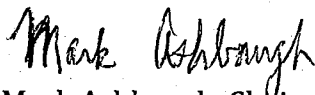


Michael O'Brien, Dean  
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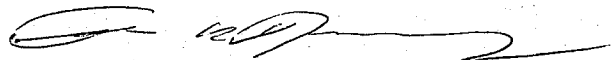


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cc: P-20 Council

President Gary Forsee  
Chancellor Brady Deaton  
Provost Brian Foster

## REFERENCES

[Ref. 1]: **National Mathematics Advisory Panel. Foundations for Success: The Final Report of the National Mathematics Advisory Panel**, U.S. Department of Education: Washington, DC, 2008.

The Final Report, and Draft Task Group Reports are available in electronic format:  
<http://www.ed.gov/about/bdscomm/list/mathpanel/index.html>

Paper copies may be ordered free of charge from <http://edpubs.ed.gov/>

[Ref. 2]: **Missouri K-12 Mathematics: Core Concepts, Learning Goals and Performance Indicators. The March 28, 2008, draft as posted on the DESE website:**

<http://dese.mo.gov/divimprove/curriculum/unitindex.html>

[Ref. 3]: **Mathematics. Revised Draft of Postsecondary Entry-Level Competencies. Curriculum Alignment Initiative.** Missouri Department of Higher Education. The March 13, 2008, draft as posted on the MDHE website: .

[http://www.dhe.mo.gov/cai\\_feedback.shtml](http://www.dhe.mo.gov/cai_feedback.shtml)

[Ref. 4] Klein, D., Braams, B.J., Parker, T., Quirk, W., Schmid, W., & Wilson, W.S. (2005). **The state of state math standards 2005.** Thomas B. Fordham Institute, available from:

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