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Guest Editorial: Reaction to the Final Report of the National Mathematics Advisory Panel

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The panel and the report

In 2006, President Bush appointed the National Mathematics Advisory Panel (NMAP henceforth) which issued its Final Report on March 13, 2008. The Final Report (summary), plus reports of three subcommittees and five Task Groups, together with two appendices containing the Presidential Executive Order setting up the panel, and details of the panel membership and other personnel, can be downloaded from www.ed.gov/about/bdscomm/list/mathpanel/index.html

The subcommittees dealt with Standards of Evidence, Instructional Materials, and a National Survey of Algebra Teachers and the task groups with Conceptual Knowledge and Skills, Learning Processes, Teachers and Teacher Education, Instructional Practices, and Assessment. Henceforth "the report" refers to these documents collectively, and "Final Report" to the summary document.

Practitioners, scholars, and researchers within the field of mathematics education were under-represented on the panel, and accorded surprisingly little input to the style and content of the report. In this collection of papers, some of us raise a number of issues that we find troublesome in the report. Many others issues, notably practices of assessment in school mathematics, are equally deserving of scrutiny.

Taking aim

> Consider the way in which the National Council of Teachers of Mathematics (NCTM) begins its draft of Standards 2000. No Socrates-like character asks "And shall we teach mathematics?" Even if the answer is a preordained "Of course, Socrates," asking the question raises a host of others: To whom shall we teach mathematics? For what ends? Mathematics of what sort?" In what relation to students's expressed needs? In what relation to our primary aims? And what are these aims?
> (Noddings, 2003, p. 87).

In the NMAP Final Report, the main aim is clearly stated. Mathematics (and science) education is seen as key to economic competitiveness, with implications, moreover, for national security. Thus, it is declared (p. xi) that "the safety of the nation and the quality of life – not just the prosperity of the nation – are at issue" (and see Gutstein, this issue).

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Nationalistic motivations of this kind are by no means confined to the United States, but are most strongly expressed in this country. Yet, there is an alternative worldview in which mathematics and science are seen as having a central role in solving the problems of humankind in general. D'Ambrosio (2003) has written passionately about the ethical responsibilities of mathematicians and mathematics educators:

> It is clear that Mathematics is well integrated into the technological, industrial, military, economic and political systems and that Mathematics has been relying on these systems for the material bases of its continuing progress. It is important to look into the role of mathematicians and mathematics educators in the evolution of mankind. … It is appropriate to ask what the *most universal mode of thought* – Mathematics – has to do with the *most universal problem* – survival with dignity.
>
> I believe that to find the relation between these two universals is an inescapable result of the claim of the universality of Mathematics. Consequently, as mathematicians and mathematics educators, we have to reflect upon our personal role in reversing the situation. (Emphasis in original).

The task that the panel was charged with was daunting, as can be seen by reading the President's Executive Order that launched the endeavor. As pointed out by O'Brien and Smith (this issue), surprisingly few of the panel were researchers in mathematics education. Members from outside the field (including mathematicians) could not be expected to begin the process with the width and depth of multidisciplinary knowledge that those within the field attempt to achieve.

In order to make the task manageable, it was therefore necessary to simplify it. I believe that the choice of means for simplification was, in many respects, inappropriate, leading to simplism, incoherence, imbalance, and to a number of startling lacunae, the most glaring of which are characterized below.

In particular, the members (with commendable, but arguably misplaced, diligence) plowed through (and regurgitated) huge masses of empirical work, preselected according to strict criteria that excluded most of the deepest work in the field. In my opinion, a lot of their time and intellectual energy would have been much better spent on reading rich reflections on mathematics education, such as the work of Hans Freudenthal (1983, 1981).

The Executive Order from President Bush required that the report should be "based on the best scientific evidence available" and this requirement was interpreted rigidly. As a result, the literature cited is heavily tilted towards psychology journals (psychologists were heavily represented on the panel), with relatively sparse citation from the mathematics education literature. According to De Corte, Greer, & Verschaffel (1996, p. 492):

> A further source of tension between mathematics educators and psychological researcher is the balance among, in Bishop's words, "what is", "what might be", and "what should be" (Bishop, 1992, p. 714). Psychologists who take mathematics as an area of application tend to investigate the situation as they find it or perceive it, to take mathematics as an [uncontroversial given]. In the course of their research they may identify problems and make suggestions for improvements within the existing framework, but without questioning fundamental goals. Mathematics educators, by contrast, are more likely to call for radical change …

Hence the preponderance of psychogical research contributes to the maintenance of the status quo as described by Roth (this issue).

According to Kilpatrick (1981, p. 22) research in mathematics education exhibits "reasonable ineffectiveness". He quotes Kristol (1973, p. 62):

> Everywhere we hear the refrain: "We can go to the moon, can't we? Well, why can't we do something equally marvelous about the ghettos or education or whatever?
> The answer is, of course, that going to the moon is easy whereas improving our system of education is hard. The one is nothing but a technological problem, the other is everything but a technological problem.
> Doing something about education means doing something about people – teachers, students, parents, politicians – and people are just not that manipulable.

Berliner (2002 p. 18) made similar points, arguing that educational research is "the hardest science of all".

What was the purpose of NMAP? On one level, it can be seen as a reaction to the perceived crisis that Gutstein (this volume) describes, as a number of factors combine to threaten the economic dominance of the United States. On another level, it can be seen as another engagement in the Math Wars (Schoenfeld, 2004), and this is reflected in the unbalanced make-up of the panel (O'Brien & Smith, this volume).

Missing disciplines

The field of mathematics education – at least within the circles I move in – has developed very remarkably in the last few decades in moving beyond psychology and mathematics as the predominant disciplinary influences to embrace many others, such as sociology, anthropology, sociolinguistics, cultural-historical activity theory (Roth, this volume) and many others (De Corte, Greer, & Verschaffel, 1996). That the report does not reflect this rich diversity is perhaps not surprising. What is undoubtedly strange, though, is the exclusion of the work of leading thinkers, practitioners, and researchers *from the field of mathematics education itself*, reflected in the make-up of the panel (O'Brien & Smith, this volume), in uncited literature, and in the lack of reference to the most prominent scholars in the field.

It is also notable that the Task Group on Learning Processes produced a report of 263 pages (for whom to read?) with some 500 references that reads like a textbook on the cognitive psychology of learning/teaching mathematics. Let me stress that I am not questioning the relevance of such work, rather the disproportionate status accorded it in the report relative to other work in the field. Neurological studies (albeit with appropriate disclaimers) enjoy undue prominence. (Maybe 10 years ago it would have been neural networks, and 20 years ago Artificial Intelligence).

Excluded research

Only certain types of research, meeting rigid methodological criteria, were considered to meet the requirement of "best available scientific evidence". If the goal is to improve mathematics education, there are many important questions – perhaps the most important – that are not amenable to such forms of enquiry. For example, as Martin (this volume) points out :

> The imposition of these standards assuredly eliminated a host of qualitative, ethnographic, case-study, and descriptive studies that are commonly used to examine the experience of

> students of color in school settings, including experiences with race and racism. These criteria also minimize the important of studies that have situated schools in their larger sociopolitical context.

For example, how do you try to answer the assuredly relevant question "What are the cross-generational effects on populations against whom, historically, education has been used as a means of oppression?" through the kinds of experimental methods sanctioned? (Ladson-Billings, 2007).

As the panel was doing its work, the second NCTM Handbook of Research on Mathematics Teaching and Learning (Lester, 2007) was nearing completion and Lester wrote as follows to the Chair and Vice-Chair of NMAP, beginning as follows:

> Dear Drs. Faulkner and Benbow,
>
> I am contacting the two of you in your roles as chair and vice-chair of the National Mathematics Advisory Panel to inform you of a resource that may be of value to the Panel in it deliberations. Specifically, I am editing a revision of the Handbook of Research on Mathematics Teaching and Learning that was originally published in 1992 by Macmillan. The 1992 handbook has been the most widely cited reference on research in mathematics education in the world and the second edition is likely to be just as valuable to the research community.
>
> (Lester, 2008).

He received only a formal response from an administrator. The panel showed no interest in receiving the resource, and it is not cited anywhere in the report.

Excluded mathematics

The instruction by President Bush that directed the panel towards a focus on algebra may have partially contributed to incoherence – perhaps it would have been more appropriate to call it the National Algebra Advisory Panel. In any case, it is very noticeable that geometry, probability, and data handling receive little attention. Moreover, geometry (in some cases) and combinatorics (throughout) are accorded attention only insofar as they feed into algebra.

More serious yet, in my opinion, there is the almost total inattention to two fundamental aspects of doing mathematics, namely (a) applications and modeling, including data handling and statistical modeling, (b) problem solving (O'Brien & Smith, this issue). The first of these I consider of much more importance for responsible citizenship than a knowledge of algebra.

Ignoring the real world of schools in the United States

Curiously, the report makes almost no mention of *No Child Left Behind*, despite its evident effects on mathematics education and education in general, and research on those effects (Nichols & Berliner, 2007). This lack is particularly odd for the Task Group on Assessment, where the act is scarcely mentioned.

Achievement gaps are mentioned at several points, but there is no attempt to place them in the context of "the education debt" (Darling-Hammond, 2006) and resources gaps. Here is a reality check from Darling-Hammond (2007, pp. 247-248):

> At Luther Burbank school, students cannot take textbooks home for homework in any core subject because their teachers have enough textbooks for use in class only … Some math, science, and other core classes do not have even enough textbooks for all the students in a

> single class to use during the school day …Luther Burbank is infested with vermin and roaches, and students routinely see mice in their classrooms …
> … Eleven of the thirty-five teachers at Luther Burbank have not yet obtained regular, nonemergency credentials, and seventeen of the thirty-five teachers only began teaching at Luther Burbank this school year (Williams v. State of California, Superior Court of the State of CA for the County of San Francisco, 2001, Complaint 58-66).

The composition of the panel and the contents of the report markedly fail to reflect demographic trends within the United States and the constellation of problems that arise from class and racial inequities (Martin, this issue).

Lack of appreciation of mathematics as a human activity

The report also gives no inkling that mathematics has a long, multicultural, intellectual and social history, one that is of interest in its own right and also offers insights into the cognitive obstacles that students face. An extra-terrestrial reading the report might reach the conclusion that the people of this planet recently received mathematics as a complete body of knowledge.

Many of the developments within the field of mathematics education manifest aspects of the general theme of mathematics as a human activity, including ethnomathematical research, studies of the history of mathematics, studies of people behaving mathematically in natural settings such as work, new directions in the philosophy of mathematics, attempts to establish connections between school mathematics and the lived experiences of the students. Within our field, it is being questioned whether mathematics as a school subject should continue to be dominated by mathematics as an academic discipline or should reflect more fully the range of mathematical activities in which humans engage. The report doesn't go there.

Curious lack of intellectual excitement

Perhaps the strongest impression that the report leaves me with is a lack of any sense that mathematics is intellectually exciting, and could be taught in a way that makes it so, for at least a majority of students. Instead, what the report brings to mind is the satirical depiction of education by Charles Dickens in "Hard Times", in particularly the second chapter which is entitled "Murdering the Innocents".

Among the pancultural well-springs of mathematics as a human endeavor are a sense of aesthetic and pattern, and a delight in puzzles and games. As mentioned above, the report scarcely deals with problem solving, in the sense that Polya wrote about. Polya (1945, p. v) pointed out that just as "he cannot know that he likes raspberry pie if he has never tasted raspberry pie" a student who has not experienced the tension and triumph of discovery in mathematics is unlikely to develop a taste for mathematics. In a powerful short piece, Noddings (2007) stated that:

> Intellectual life is challenging, enormously diverse, and rewarding. It requires initiative and independent thinking, not the tedious following of orders. It should not be reduced to mental drudgery.

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