

7.45-8.45PM

Discussant on the presentation

Hyman Bass and Roger Howe

Roger Howe

He is also in the high school document committee. He is also extremely happy with the main focus of the document, mainly reasoning and sense making. However, he has trouble teasing them apart. It seems that they are inextricably linked. It seems to him that the first habits of mind is that mathematics should and must make sense. If we're going to teach all students far more mathematics through algebra we must focus on this habit. It is his experience that students come to the university knowing a lot of mathematics but the mathematics is jumbled and does not make sense. That should be our first priority; to make sure that it does.

We have to look at the preceding curriculum. "Productive Disposition" it's a strand of mathematics proficiency in "adding it up." There is always a tension between learning the formalities and making sure that they have not lost sight of the main structure. Prof. McCallum summed it up that kids do not see that things make sense. That habit started before they get to algebra.

This semester Prof. Howe tried to do something that he has never done before. He tried to teach arithmetic at Yale. He went over an example of how do his students think of multiplication. One girl came up and drew a three by four circles. He asked whether anyone had seen area model of multiplication, and no one had. He had to show them how to partition rectangles to show distributive properties. Students carry their problems in readings, grammar and syntax throughout schools and they affect students' understanding of algebra.

Hyman Bass

Summary:

He briefly addressed the Math Panel Report, mainly saying that we should focus on the agreement achieved by the panelist and use that to affect policy changes. With respect to the NCTM High School standards, he is happy about the focus in reasoning but wanted the concept of symmetry to be part of the document. He then addressed some of the issues discussed so far in the meeting, mainly definition of algebra, parental role in education and the role of experts in making decisions about policy.

Details:

Concerning the Math Panel Report, he said it is hard to add to what Deborah Ball has summarized in detailed. He would subscribe to everything that she said but will emphasize some more than others. There are some productive ways to use the MNP report

The public discourse has been highly unproductive. Even though the document does not represent a complete harmony but it does show some common conclusions that deserve priorities. There are some conclusions that can support policy changes. Much of the achievement gap can be mitigated with intervention like in some of the findings.

He shared with Roger Howe the happiness of the theme of the high school document. He thinks that the major deficiency is in the implementation of curriculum is the role of deductive reasoning. He gave an example of second year with advanced placement students proving a step function is discontinuous at zero. Student response was saying that it is obvious. A second example he gave was computing the

limit of $\sin x / x$ as x goes to zero. He showed them the proof and allowed them to copy and bring it to the midterm but only one student attempted to write the proof and this student used L'Hospital rule.

In sum he's very happy with the focus of the high school document. One thing that he felt was absent was the attention of the concept of symmetry. He went over the use of computational method vs. symmetry. People have a lot of mystery about a number pi. If they have knowledge that all circles are similar and all similar figures have proportional areas and any linear factor... Pythagorean theorem is a scalar multiple of the triangle equation. And there are beautiful applications of the idea of proportionality.

Attendees of the conference touch on the definition of algebra, at least a curricular definition. Zalman Usiskin's definition is very traditional and uses strong ties with geometry. James Fey is closer to theory of modeling: dynamic processes, modeling with appropriate functions with data measurements etc. Those are quite different areas of mathematics. He said that we should exercise care in the use of language. Why do we insist on calling all these different things with the same name? He said that it is almost as if there is a contest for a specific area. The math panel believes that competency in algebra is for college/ higher studies of math in high school. Jim Fey's notion is an acceleration to university level math. The judgment of students entering university is that they are deficient. One of the urges is the lack of coherence in the American curriculum. If we have a curriculum that's fair, it'll create ...

-There is a serious question if we should enter a public conversation for a national curriculum. It's taboo but any other developed countries has a national curriculum.

-Parent issues and expertise:

Attention to parents is crucial. Anybody who studies children's learning knows that support from family is important. Any curriculum intervention has to consider parents' buy-in.

What teachers need to teach mathematics? They need to be able to explain to parents what is needed for parents to help their kids. But he is not proposing that parents have the prerogative to judge how a curriculum should be used. There is a view that anyone who is intelligent is capable of teaching, but this is certainly not true and we will not do this with other skilled professions. There is a need for professional culture of expertise. Mathematics education is intrinsically multidisciplinary and so preparation for teachers the preparation for education lies with those people instead of political bureaucracy.

Comments and questions:

-Pat Thomson would like to follow up on what Jim says about algebra. He said that university faculties found students' weak algebra skills mainly in calculus. Maybe high school should prepare students for calculus. On the other hand perhaps college is meant to teach college algebra more so than calculus.

He shared an anecdote about when he chaired the calculus reform. He said that there's a need for students to learn rate of change. They tried to teach it but there's no gain but drop in concept of rate of change understanding.

In their efforts to track students' progress, they follow students who are taking pre calculus to prepare for calculus. These are students who stated they need calculus in their major. These students got an A in pre calculus but 43% did not take calculus over the next five-year period. It goes into the issue of if they hate what they're doing what does that mean to prepare them for skills.

-An attendee from Canada, said something about student focus on grades. He also said that sometimes students just need to believe or axioms. Knowing involves believing. He brought up measure theory to illustrate his point.

-Zalman Usiskin said that one of the most difficult things to teach deductive reasoning. What is it that students are allowed to use from last year or four years ago? One of the difficulties in designing curriculum is knowing what you need to know when you're supposed to know it. Which is why curriculum of geometry is still strong today.

-Gene Mithcell CSU Monterey Bay, there's an intuitive foundation to a lot of math concept. It precedes the mathematics. She's confused of explaining mathematical justification, reasoning and proof.

-Mark Sol?

First question, what are the experiential bases of kids learning deductive reasoning?

What is reasoning? He said that he will settle for some reasonably well formed understanding of if a then b. Something where you can derive one thing from another. If you can build that then I can build the rest. But he even struggled with that.

-William McCallum

There is an extensive discussion on what's meant by reasoning and sense-making. There's language to make it clear. Regarding Hy's remark about using the report as a platform productive resource... He just wants to let people know that there is a conference in the fall in Washington where people will discuss those things that they agree on from the report.

-Hyman Bass

He said that you need something that rescues you from infinite regress from the statement if a then b. The logical rule what functionally substitutes the axiom is what's called base of common knowledge. In the reasoning you get finer and finer grain of statements. You get to simple elementary step in 7th grade but not in 3rd grade because of the level of common knowledge. If teachers want to cultivate reasoning, they need to determine what is the foundational knowledge that can be used to develop new knowledge. If they meet the standards of the peers then it can be put as a theorem somewhere on a poster board etc so it's clear where students can build their knowledge from.

-Mai-Hi Lim, Teacher Ed Suny

What are some of the pointers for design for research that can answer some of the questions that Deborah Ball wanted to address? Also, would it be productive to know what algebra is?

-Roger Howe

This issue of making sense, the method he used is that he asked a question and rephrased the question until students can answer the question.

-Marge Muray, University of Iowa

Roger's said a lot of the problem in learning mathematics is linguistic. From the MPR there is report about the misuse of language and equal sign. What do we do with symbols? She spent a lot of times convincing students that there is grammar behind mathematics.

-Roger Howe

Much too little attention is given to the grammar of expression (what variable means). It is sort of skipped over. There is a lot of evidence that the transition into symbolic algebra is a huge watershed in

human thinking and we only brush right by it in algebra instruction. A lot of issues are fuzzy because quantification is largely ignored in high school.

-Hyman Bass

Math instruction has something to learn from those who teach reading. Sense-making of text and mathematics might intersect. He agrees that language is a big underlying factor.