Mathematics Council NEWSLETTER

The Alberta Teachers' Association

Providing leadership to encourage the continuing enhancement of teaching, learning and understanding mathematics.

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President's Report

This special issue of the *Mathematics Council Newsletter* has been produced for two reasons:

- With it, you are receiving copies of "Tomorrow's Mathematics Classroom: A Vision of Mathematics Education for Canada" (Grades 1-3, 4-6, 7-9, 10-12).
- I was able to discuss the new high school mathematics curriculum with Hugh Sanders, acting assistant director of Mathematics and Science, Curriculum Standards Branch, Alberta Education, and the text of our discussion follows.

The documents and conversation are important because they help us to understand how Alberta's new mathematics curriculum "fits" into thinking across Canada. The four documents were created by a group of mathematics educators from across Canada. This group met twice, in the summers of 1996 and 1997, to create these vision statements.

My talk with Hugh occurred the day Alberta Education announced that, in Alberta, the new Pure Mathematics 10 would be implemented in September 1998, but that the new Applied Mathematics 10 would be optional for September 1998.

If you don't teach students in Grades 10-12, the conversation will help you to better understand how the mathematics program changes from a single-grade outcome structure for Kindergarten to Grade 9 to a multi-outcome structure in Grades 10-12.

Once you've had a chance to review and think about these documents, I hope that you have a chance to use the activities with your students or to discuss/share the activities and ideas with colleagues. The possibilities are endless!

On behalf of the entire executive, I hope that you enjoy the thought-provoking ideas presented in this issue of the newsletter. ▲

–Florence Glanfield

Conversation Between Florence Glanfield, MCATA, and Hugh Sanders, Alberta Education

Florence: *Tell us about the "pure" and "applied" focus for the new courses.*

Hugh: In all the literature that Alberta Education has put out, [the focus] has to do with "an emphasis is placed on this, as opposed to this." In the pure area we're focusing on "algebra for algebra's sake"; there's a focus, an emphasis. Whereas, when you look at the applied, there's still algebra there, but you're looking at using algebra as a tool to solve problems, to tease the algebra out of the solution, so that it almost comes after-the-fact, or certainly during-the-fact, of solving the problem–as opposed to the more typical pattern of "here's an algebraic structure, a quadratic formula–let's work out how to solve quadratic equations." And we've got a nice formula that allows us to do that. To say, "Here's the problem. Out of that problem comes an algebraic structure that looks like a quadratic equation; maybe we use a graphing tool to help us solve it. So, that we know, indeed, that there is a solution." And, afterward, we can start to look at the question, "Is there an algebraic way in which we could look at that?" In the applied structure we may not focus on the formula, whereas in the pure, we most definitely would want to tease that out.

Florence: *Please talk a bit about how you came into the structure of the pure outcomes, the applied outcomes and the common cluster of outcomes and what was some of the thinking behind it.*

Hugh: The task presented to us in the Western Canadian Protocol [WCP] was keeping six political jurisdictions at the table discussing mathematics education in the context of K-12. It was easy for K-9, relatively speaking, because all the provinces and territories have a graded structure: a single-graded

structure till the end of Grade 9. There are some exceptions, I guess, with BC's initiative to have an applied approach to Grade 9. But basically, it's a K-9 program–single grade, single program.

High school presented a different challenge to us, in that BC had two program streams, Manitoba had two program streams, Saskatchewan had a single stream in their recent program revision and Alberta, technically, has four streams. What we were looking at was a way in which we could actually all work together.

And out of that program discussion, we arrived at the notion of two categories of outcomes that we could teach to high school mathematics students. One category would be those outcomes that would have a pure sense to them, which would be your precalculus route. We have an audience in postsecondary education that requires that particular thing, so we had to maintain that structure within the context of our high school program. Alternatively, we were looking at a lot of applications to mathematics: looking at the tech-prep initiative, coming out of Red Deer and area, applications of mathematics being supported through NCTM where there were a lot of applications in mathematics that were being used as the way to deliver mathematics education to students.

So we looked at pure and applied, as a way to at least get our curriculum to focus on different kinds of mathematics that we could look at students acquiring in their high school years. Out of that discussion came the sense–because we could not talk about graduation requirements, it was not part of our mandate–that we had to consider that some outcomes in both of stacks of curriculum outcomes were important for all learners, regardless of the orientation, if you wish, of this applied/pure discussion. Hence, that became the "common outcomes." Those are important for all kids, regardless of which stream, or pattern, they might be attached to. So the common came after the fact. It was not the initial driver.

Florence: *There has been a lot of been a lot of talk about the applied math program at the Grade 12 level as not being accepted by postsecondary institutions. How are we able to counsel our students into the appropriate program?*

Hugh: First, let's look at it in the context of our current program stream of Math 13, 23, 33, and 10, 20, 30, the two main streams in Alberta. Math 33 doesn't have as broad an acceptance as people would like. My sense is that we have the potential with the Applied Mathematics 10, 20, 30 program of engaging in a positive discussion with postsecondary institutions about the mathematics experience that kids will have. [This is] different from what we have in the 13, 23, 33 program, because, basically, it is a subset of Mathematics 10 and 20. As for high school teachers, none–at least I haven't met one yet–would disagree with this comment, "Mathematics 10 and 20 have a higher standard expected of students, than those who would complete Math 13, 23 and 33." So, what we have is a single stream in Alberta. We don't have two streams in Alberta, and if one wants to consider this in an almost trivial sense, we're asking postsecondary institutions to accept either Mathematics 20 or Mathematics 30 for their program entrance; it's either Grade 11 or Grade 12, but in the precalculus stream.

What we're trying to do with the applied mathematics program is to present postsecondary institutions with a different set of learnings. Hopefully, because of the approach that is being encouraged, we'll have a little bit of glue stuck to those outcomes when it comes to the learners, because of the way in which they're approached.

Florence: *Can we talk about these programs as follows: the pure program is for students who are intending to take a calculus-intensive program at university or college, and the applied program is for students who are not intending to take a calculus-intensive program at university or college?*

Hugh: Yes, I think so, and that was part of the advice that we had in the actual validation of the pure and applied discussion, when we looked at the identification of 24 clusters and then the creation of six courses (applied mathematics for Grades 10-12 and pure mathematics for Grades 10-12). We had identified a group of six or seven mathematics professors at the postsecondary level, or instructors, to review the applied and the pure work that we were doing, as it was being developed. And the recommendation accepted from that group, as it was from other provinces, was, basically, that if students are going to take calculus at the postsecondary level, they should indeed have the pure mathematics stream in their background. However, there was a significant reference to acknowledging that there is mathematics of significance in the applied stream that should stand students in a very good stead, from a general education perspective, and that would be useful to them in their postsecondary life, if they were not studying calculus. So, we're looking at a variety of programs in terms of entrance.

People are interested, of course, in what postsecondary institutions are going to say, as am I. That discussion is ongoing and presentations have been made to most postsecondary institutions, which are looking at it carefully. One concern that I have is the comment from some people that if a student is admitted to a postsecondary program with Applied Mathematics 30 and, after admittance, wants to change programs and the new program that they want to get into requires Pure Mathematics 30, then that student would have to go and complete that prerequisite program—and that would be grounds for not using Applied Mathematics 30 for the first program. Now that's the kind of counseling advice or dialogue characterized by some comments that I have had from postsecondary institutions and from people who are working in high-school, junior-high school counseling. I think it's unfortunate, because life is not made up of people fulfilling all the requirements of every program before they get on.

I guess the most extreme case would be then if we accept that argument: all students entering postsecondary institutions out of high school should have Mathematics 31, because then their program option of choice is indeed mathematics. To me, it is unfortunate to force everyone through a single funnel. I think the important thing now is that there is considerable discussion going on within the various institutions in Alberta, regarding entrance requirements to postsecondary programs.

Florence: *How will schools register if they wish to implement the applied program in the 1998–99 year? And tell me about the resources.*

Hugh: We're in the process of developing a contract with Addison-Wesley that will see the publisher having the sole market, from a Western Canadian Protocol perspective, for the development and authorization for breadth resources for applied mathematics at the Grades 10–12 levels. Schools have to let us know because [we need to know] in terms of the printing of the preprint materials that will be available in a manuscript form for the first third of the materials, June 1, 1998, and also 100 percent of the materials available at what is called a preprint version, a black-and-white version of the materials, by August 15. [Because of] all those materials the publisher needs to print, we'll need to know early in the spring which schools are going to be involved in this thing, so that we can indicate to the publisher how many copies to preprint. That process will be basically the placement of an order for x volumes of the finished product for Applied Mathematics 10. On the basis of that order, Addison-Wesley will publish sufficient copies of the preprint materials to satisfy the needs of that particular school or sets of schools. There will be no billing for that material, until the final product is delivered in June 1999. So, in essence, the school gets one year of materials free.

The cost of the resource will be the same, regardless of whether a school has been participating in the optional implementation year or waits until September 1999 to begin provincial implementation for the applied program.

Florence: *Tell me about the resources for the pure program; I know that the resource call was set for February 2. What is the process after that date?*

Hugh: We have a bureaucratic nightmare of logging in all the resources, so that every single item that is submitted to us has a file, and a database, along with the appropriate paperwork to put it through a first-cut review and, subsequently, if it meets the first-cut requirements, into an in-depth review. We have a resource review process that involved about 45 high school mathematics teachers from across western Canada during the first week of March. Representatives from the teaching community in each region supporting this WCP were invited to participate in our review. Subsequent to that, we then have a series of recommendations generated from that review process that will require the approval of a variety of committees that have a Western Canadian Protocol focus, the resource review committee, the directors of curriculum and the assistant deputy ministers steering committee. Our hope is that by the time we are going through the process of getting go-aheads from each level of approval, we'll be developing the annotated bibliography for those resources that are in the pool. On final approval, we will be able to announce the list by April 30.

The best place to look for the bibliography will be on Alberta Education's Web site for WCP resources [http://ednet.edc.gov.ab.ca/wp/]. We'll be posting it there first. Subsequent to that, we'll create our own Alberta Education list of approved resources for high school and that also will be on our Web site. And then the paper copy that we'll send to all schools will be the Alberta Resource List for High School Math.

Florence: *Now I want to know a bit about the Alberta Program of Studies. At the high school level there have been two documents that have been circulated to the schools. I believe all schools in the*

province received them in June 1996. How do those two documents differ?

Hugh: The two packages, the Courses document and the Western Canadian Protocol Framework for the high school, go hand-in-hand. The Courses document will generate a program of studies for Applied Mathematics 10, 20, 30, and for Pure Mathematics 10, 20, 30. Through discussions that we've had with teachers and the different information sessions that we've had, there have been a variety of comments and suggestions made about how students move from one program stream to another.

If you look at the core structure that we've got, you have six clusters that have been identified through WCP as being common, and then nine in each of the pure and applied. If a student is successful in Applied Mathematics 10 and wants to study Pure Mathematics 20, the course design would show that Pure Clusters 1 and 2 from the Framework have not been accomplished. So we have designed a bridging course, a three-credit course which would identify Pure Cluster 1 and Pure Cluster 2 outcomes from the WCP as being the outcomes that the student would be deficient in and should acquire before proceeding into Pure Mathematics 20. Or, if a student completed Applied Mathematics 20 and wanted to go to Pure Mathematics 30, there would be a five-credit bridging course that would contain Pure Clusters 1–5, which would be those outcomes that the student would be deficient in. So there'd be a five-credit bridging course there and similarly on the other side. What we're looking at is a transfer route based on success, rather than what we have had in the past, a transfer route that has been based on failure.

There will be opportunities for some students to still get into this retroactive discussion. If, for example, a student takes but fails Pure Mathematics 10 or Applied Mathematics 10—and according to the rules at the school level—the best interest of the child would be to place that student in Mathematics 24. Then if they're successful, they could gain credits, five credits in Mathematics 14. So we'll still have the 14–24 program, currently undergoing review.

Florence: *What would you suggest that we do to be ready for implementing the pure program?*

Hugh: I think in both streams there has to an awareness of what the program structure is. I think it's really important to read the whole document to understand the direction that the program is taking and to embrace the philosophy behind that. So that there is then some context to which you can attach the outcomes of, say, Pure Mathematics 10.

Florence: *What about technology?*

Hugh: Technology expectations were certainly there in the 1991 Program of Studies and have not gone away. The technology expectations are in both pure and applied programs. One thing from the technology perspective that we're looking at is a comprehensive calculator policy out of the Student Evaluation Branch that would help address the kinds of handheld pieces that students could use, not only in Grade 10 but also in Grades 11 and 12.

There's also an expectation of some use of spreadsheets in the applied and the pure programs, but mostly in the applied. With our publisher-partner, we're looking at the kind of minimal expectations in terms of hardware and software packages that would be needed to actually do the mathematics there.

Florence: *One last question, does Alberta Education have any plans for professional development for high school math teachers?*

Hugh: We have some thinking in that direction. It's very difficult to commit to that because it's a budget issue. We're certainly, within the Curriculum Standards Branch, exploring some opportunities which would see us maybe with an extra person to help in terms of providing information about programs. There has to be, I think, an initiative of, or an acceptance, if you wish, that these programs are going to go forward and schools and school jurisdictions need to start to think about a"what do we do, here?" Our resources are limited but there certainly is a strong will to try and support and help in any way that we can. But I think in program change initiatives, there has to be a certain individual acceptance that people need to do some work on their own to cause that change to take place. That's certainly happening in K–9, teachers are working to hard to embrace the new program, methodology, and resources, and it's high schools' turn, too.

Florence: *Thank you.*

If you have further questions about the new high school mathematics program, contact Hugh Sanders; phone 422-3220, e-mail hsanders@edc.gov.ab.ca. ▲

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