Students and Applied Academics: Learner Agency in a Changing Curriculum

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Abstract: Student perspectives are important, yet under-recognized, resources for reform. This paper examines student opinions and needs with respect to curriculum reform aiming to bridge school and work. Through interviews with 20 students enrolled in applied academics courses, such as Applications of Mathematics, which attempt to integrate education, work, and life activities, we explore what matters to students and what roles they play in a changing curriculum. Findings indicate that students pursue applications courses more as a way of gaining access to curriculum and to pedagogical practices that transform their views of mathematics and of themselves as learners of mathematics than as a means toward a particular career goal. Students’ educational needs complicate and push beyond Dewey’s distinction between education for and through occupations. Students became active advocates for a course taught in ways that emphasized engagement, connectedness, and collaboration where learner agency was valued and respected. Student voices provide insight into how students might participate in curriculum reform and into how such curriculum shapes them.

Sommaire executif: Bien que Dewey (1916) se soit prononcé pour l’étude de certaines matières scolaires par le biais de la pratique professionnelle, la frontière qui sépare les différentes matières est souvent perçue comme un problème lorsqu’il s’agit de concrétiser des innovations visant à intégrer l’enseignement traditionnel et l’enseignement professionnel. Cet article s’intéresse à ce que pensent les étudiants des innovations introduites dans les curriculums, par exemple l’enseignement pratique appliqué, qui vise à établir des liens entre des principes abstraits par le biais des liens qu’on trouve dans la pratique professionnelle. On a interviewé 20 étudiants de niveau secondaire provenant de deux écoles situées dans une région désignée, à l’échelle provinciale, pour l’expérimentation de l’enseignement pratique appliqué. Ces étudiants ont été inscrits dans un cours relativement nouveau appelé Applications des mathématiques [AM], offert aux étudiants de la 3e à la 5e secondaire. Pendant les entrevues, les élèves discutent de leurs expériences vécues dans le cadre de ces cours, des raisons pour lesquelles ils ont choisi de poursuivre dans cette voie et du rôle qu’ils peuvent jouer dans la mise en application du nouveau curriculum.

Les résultats indiquent qu’ils préfèrent les cours de mathématiques appliquées aux autres cours plus traditionnels, citant comme aspects importants les contenus individualisés et pertinents, les occasions de travailler en collaboration avec des groupes et les rapports avec les enseignants. Grâce aux expériences vécues dans ces cours, les étudiants affirmaient avoir retrouvé un intérêt pour les mathématiques. Certains d’entre eux se sont même faits les champions des cours de mathématiques appliquées auprès de leurs parents, des enseignants et des administrateurs lors de séances de perfectionnement professionnel organisées dans différentes régions. Puisque les cours de mathématiques appliquées attirent des étudiants qui éprouvent des difficultés devant les principes mathématiques les plus abstraits, ces cours ont la réputation d’être « faciles ». Les étudiants que nous avons interviewés ont rejeté d’emblée cette idée, affirmant au contraire que les cours appliqués permettent « de comprendre plus facilement », non que les contenus soient « plus faciles ».

Nos résultats indiquent que ce qui importe le plus aux étudiants n’est pas que l’enseignement dans les cours appliqués tire profit de la pratique professionnelle. Ce qui compte beaucoup plus à leurs yeux,
c’est que cette méthode d’enseignement favorise la participation, les relations et la collaboration. Il ressort que les étudiants refusent de se limiter à jouer le rôle de simples destinataires passifs devant les savoirs mathématiques. Ils trouvent dans les cours de mathématiques appliquées un lieu où peut se développer leur identité en tant qu’apprenants de contenus mathématiques significatifs et contextualisés, et où leur qualité d’apprenants actifs est valorisée et respectée. Nos données indiquent également que les étudiants continuent de suivre des cours appliqués surtout pour avoir accès à des pratiques pédagogiques susceptibles de modifier l’opinion qu’ils ont des mathématiques et l’opinion qu’ils ont d’eux-mêmes comme apprenants de cette matière, et non parce qu’ils visent un objectif professionnel en particulier. Notre recherche suggère que la qualité de l’enseignement et les contenus contextualisés ne sont pas nécessairement les seuls facteurs qui stimulent les apprenants à se construire une identité où l’agir joue un rôle important, mais c’est grâce à l’intégration d’une pédagogie et de contenus contextualisés que les élèves sont en mesure de participer activement en tant qu’apprenants au lieu de se limiter à être des récepteurs passifs.

Cette étude jette la lumière sur ce que pensent les étudiants de la réforme des programmes. Elle répond à l’appel lancé par Fullan (2001), qui suggérait de prendre au sérieux l’opinion des étudiants sur ce qui compte pour eux dans les innovations proposées en éducation. Les besoins éducatifs des étudiants vont bien au-delà de ce que Dewey appelle un enseignement centré sur la pratique professionnelle. En écoutant la voix des étudiants, on est mieux en mesure d’entrevoir les façons dont ils pourraient participer à la réforme des programmes et le rôle que jouent ces programmes dans leur formation.

Introduction

With worldwide economic change influencing the very nature of work, the disjunction between school and work is becoming more apparent. Attention to the role of workplace learning and the relationship among subject matter, learning, and work are, as Steinberg says, ‘long overdue’ (1998, p. viii). The role of schooling in the preparation for work has, over the past decade, received increased attention from governments, post-secondary institutions, and business and labour groups. This is, in part, due to changes in labour market demands within the new knowledge-based economy that challenge conventional conceptions about the relationships among education, work, and economic returns (Bailey, 1995). Understanding more about how school-to-work transitions are developed and implemented provides important insights for appropriate policy making and for the development of meaningful educational practice.

Applied academics is a term that refers to a program of courses that emphasize the acquisition of academic principles and concepts through classroom and laboratory activities that connect abstract knowledge to workplace and other out-of-school applications. Applied academics courses, referred to by the British Columbia Ministry of Education Integrated Resource Packages (1995, 2000) as application courses, are intended to motivate more students, improve student retention, and make the transition to workplace and post-secondary studies more smooth. We have been conducting a case study to understand the issues involved in the implementation of applied academics courses. This paper focuses on an aspect of that case study and examines the experiences of students enrolled in applied academics courses in one school district, designated by the Ministry of Education as an applied academics demonstration site for the province. This district is involved in implementing provincially mandated application courses in the areas of mathematics, physics, information technology, and technical and professional communication.

In, Gaskell, Nicol, and Tsai (in press), we argued that the pressures of gaining acceptance within the wider educational community for new courses that aimed to develop academic principles within occupational contexts led teachers to downplay occupational contexts in favour of non-work contexts and to emphasize the idea that placing concepts in ‘context’ was just ‘good teaching.’ In this paper, we pay particular attention to students in order to include a dialogue between students’ experiences and teachers’ views. Our research questions include What are the backgrounds, interests, and future intentions of students enrolled in applied academics courses? What
outcomes are important to students of applied academics and how are these outcomes actualized? Through interviews with 20 students, we examine the outcomes that matter to them and the connections they see to life activities, to the workplace, and to their future plans and directions.

**Theoretical frameworks**

**Applied academics and educational innovation**

Attempts to integrate vocational and academic subject areas are not new but are recognized as a complex undertaking. Many researchers have explored the differences in vocational and academic subject areas in schools (e.g., Lewis, 1994; Grubb, 1995; Steinberg, 1998). Academic subject areas are those that are thought of as university preparation—such as science, mathematics, and English—while vocational subject areas are those that focus on occupational or domestic contexts—such as technology studies and home economics. There is such a gap between these two areas that Little (1995) refers to these areas as ‘two worlds.’ These two worlds of vocational and academic study differ most obviously around issues of status, with the academic subjects being considered as the route by which the best and brightest students move toward high-status pursuits in the future. The vocational areas, on the other hand, are not chosen by university-bound students and often are marginalized and are, therefore, at risk of being cut from school programs (Steinberg, 1998). Although the vocational subjects are often seen as more relevant to and important for all students, vocational and academic subject areas find themselves in competition with each other, and academic areas resist integration in order to preserve subject integrity. Subject-matter boundaries are frequently looked upon as a problem in actualizing educational innovation (Fullan, 2001). Little (1995) warns that difficulty is likely in attempts to bridge the two worlds: ‘It would be a mistake to underestimate the power and persistence of these two worlds, and their significance for teachers, students, and parents’ (p. 58).

The value of integrating vocational and academic areas was described by Dewey almost a century ago. Dewey (1916) argued for a study of subject matter through the intertwining of academic and vocational education. For Dewey, teaching through occupational themes was one of the most appropriate ways of designing instruction: ‘Education through occupations [not for occupations] consequently combines within itself more of the factors conducive to learning than any other method’ (p. 309). Dewey considered the concept of education through occupations in the broader sense and was against narrowing education to job-specific vocational training. He argued that ‘the only adequate training for occupations is training through occupations’ (p. 310).

Developing education through occupations and curricular programs that integrate vocational and academic content challenges subject boundaries and, in so doing, faces great challenges. The introduction of the applied academics curriculum involved teachers and students in Fullan’s (2001) three dimensions of change: the possible use of new curriculum materials, the possible use of new teaching approaches, and the possible alteration of pedagogical beliefs and assumptions about how best to teach mathematics (p. 45). Fullan suggests that ‘changes in actual practice along the three dimensions—in materials, teaching approaches, and beliefs in what people do and think—are essential if the intended outcome is to be achieved’ (p. 46). He states, furthermore, that change is difficult to achieve without district superintendent, principal, and teacher advocacy of the curricular change. But what place do students have in championing their own understandings of new curricula, their experiences with innovation, and their insights into future school improvement?

**Students’ perspectives on educational innovation**

‘People think of students as the potential beneficiaries of change [but] rarely think of students as participants in a process of change’ (Fullan, 2001, p. 13). The educational change literature high-
lights the power of professional-learning communities that work on the problems of relevance (teaching for understanding) and relationships (treating students differently) (e.g., Bennett & Rolheiser, 2001). Although much of the focus on understanding the implementation of educational innovation involves an analysis of professional-learning communities that support student and teacher learning and success, we know very little about what students think about the curriculum innovation that involves them. Rudduck, Chaplain, and Wallace (1996a), in a large, five-year study, invited high school students to share their views on school improvement. These researchers found that students were very willing to share their ideas and provide analytic and constructive comments. They found that, although young people found it difficult to describe positive learning experiences, they were able to identify aspects of schooling that 'get in the way of their learning' (p. 8). Kershner (1996) conducted a satellite study, as part of Rudduck’s main study, to examine students’ experience of ‘working hard’ and the meaning they attached to the phrase. In interviewing students she found that

the pupils interviewed had quite a sophisticated understanding of those aspects of the school system which obstructed their learning and those aspects which were supportive ... [They] all had their own concerns about school, even those who were achieving well across the curriculum. Their comments showed that they had ideas about how schools should be, that they were prepared to explain their views, and that teachers could learn from consultation with them. (p. 85)

Researchers such as Fullan (2001) and Rudduck et al. (1996a) argue that pupil perspectives on reform do matter. Student perspectives invite teachers, parents, administrators, and policy makers into the world of students and what they consider important in school improvement. Although these researchers caution us to consider student views as one source of evidence in building and pursuing educational change, they highlight the importance of treating students as 'serious members of the school' (Fullan, 2001, p. 152). Asking students what they think about curricular reform involves asking those who are at the very heart of these initiatives to participate in the change process by contributing their voices. This point is emphasized by Fullan (2001), arguing that students are an underutilized resource of educational reform: ‘Not only must they [students] be part of the solution, but in many cases, they may even have better ideas for solutions’ (p. 162).

Our study seeks to extend and contribute to Fullan's (2001) call for the inclusion of a student perspective in educational innovation. While Rudduck et al. (1996a) interviewed students to learn about their views of how school might be improved, our study examines students’ perspectives on an innovative educational program. In particular, we invited students to share their views of their experiences learning mathematics as part of the provincial Applications of Mathematics pathway.

Data collection and method

For the past five years, the Interior School District in British Columbia has been the Ministry of Education’s demonstration site for the implementation of an applied-academics pathway to post-secondary education and work. For this paper, we focus on learning more about the experiences of students enrolled in Applications of Mathematics (AM) 10, 11, and 12 in two senior secondary (Grades 10–12) schools. These two project schools were chosen for their district and school-based leadership in implementing the Applications of Mathematics courses. The district itself is also seen as a leader in the province for applied academics. It has hosted four applied-academics summer institutes over the past five years. It hosted the Interior Mathematics Teachers Conference in 2001, with a focus on AM courses, and Interior District school teachers, particularly teachers of pupils in our two project schools, have been involved in the professional writing of student and teacher resource materials for AM coursework.

Twenty students, 11 female and 9 male, enrolled in Applications of Mathematics courses volunteered to participate in this study. We spoke with 6 students enrolled in AM 10, 6 enrolled in AM
11, and 7 enrolled in AM 12. Transcribed interviews with these students make up the main part of the data for this study. We relied on the assistance of an Applications of Mathematics teacher in each school to select and arrange the student interviews. This teacher selected students so that we would be able to talk with students from a range of grade levels and range of ability levels as determined by the teacher. These semi-structured interviews were about 30 minutes in length and involved individual or small groups of students. We had planned to interview students individually but many students seemed more comfortable talking with us while in the company of two or three of their peers. This made the discussion more relaxed and placed what was said in a more public forum. We also conducted a number of interviews collaboratively, with at least two interviewers. This gave us a chance to talk with students as a research team and for each of us to experience the interview ‘live’ rather than from a transcribed written text.

In the interviews, students were asked to describe a typical day in their AM course and explain how this compared to their non-applied mathematics courses. They were asked to comment on their decision to enrol in the Applications of Mathematics pathway, their perceptions of the kind of students applications courses were designed for, and what they felt they had learned in their application courses. We also asked students for their ideas on how they would change the course and what outcomes were important to them. Interviews were conducted at the student’s school, during a time convenient for the students and classroom teachers.

Analysis of the data focused on what students said they did in applied academic courses and what their plans for the future entailed. In analysing the data, we first highlighted issues that arose for us upon completing our interviews and then read and re-read the transcripts to compare and further refine the issues that we felt expressed the experiences of those who participated. In selecting sample quotes to highlight variations in meaning among participants, we use Patton’s (1990) intensity sampling. Here, examples chosen are ‘intense’ in that they are ‘excellent or rich examples of the phenomenon of interest, but not unusual cases’ (p. 182).

Research findings

Contrasting applied academics and non-applied courses

In depicting a typical Applications of Mathematics class, participants described the structure of class activities as involving a sequence of three events: (a) homework checking; (b) lesson development through note taking; and (c) individual work on the assignments. This Grade 12 student’s depiction of an AM 12 lesson is representative of those given by all the students we interviewed.

The [teacher] would get up at the front … writing on the overhead … up there giving us a lesson and we would take notes in the booklets and then after we were finished that she would answer any questions we had and we would just go ahead and work in groups and finish up the book. (Grade 12 student #1, male)

Students’ descriptions of applied and non-applied courses were similar in identifying this structure of events. Yet, what stood out for students in applied courses that they felt was different from their experience in non-applied courses was the attention given to them as learners. This attention was described in terms of the differences they noticed in content and in pedagogy between applied and non-applied coursework. Students spoke about personalized and relevant content in Applications of Mathematics that was ‘more than a bunch of numbers’ (Grade 12 student #6-1, female). They emphasized the collaborative group work and team atmosphere that had developed in their applications courses—something they felt was not part of their non-applied math experiences. Students spoke about their comfort in asking questions of their peers and the teacher during the lesson and how this was different from non-applied courses. This Grade 12 student’s
comments are telling: 'I]n Principles [of Math] it's weird to ask a question ... people just put their heads down and work, and everyone else knows how to do it and I don't ... I just felt uncomfortable' (Grade 12 student #3-1, female).

To learn more about how students viewed the comparison between applied and non-applied experiences, we asked students to respond to the question, 'If Applications of Math could be an animal which animal would you choose?' In their descriptions, students chose animals that represented applied mathematics as being spontaneous, comfortable, related, understanding, soaring, collaborative, and personalized. In contrast, students' descriptions of non-applied courses involved animals that were uninteresting, prowling, stalking, incomprehensible, rare, alone, individual, biting, and attacking. This Grade 12 student's description of AM is representative of others: 'AM would be a dolphin because they work in groups and they are like the atmosphere in class—light and easy—very free and—just like how we work together [in AM class].' Students such as this Grade 11 student described non-AM courses as animals like 'crocodiles because they eat away at you until you don't really like math anymore.'

Students' reasons for their choice of animal depict their strong feelings that the applied course is approachable, understandable, relational, and achievable. Their reasons also vividly show their personal and intellectual detachment with the study of mathematics in the non-applied coursework.

Reclaiming interest and confidence in learning

In order to learn more about student interest in applied mathematics, we examined students' motives for taking an applied mathematics course and their perception of how this course selection compared with that of other mathematics courses. We asked students how they first became interested in taking an applied academics course. All 20 students stated they enrolled in the AM pathway in order to pursue a more successful study of mathematics. Seventeen of the students entered the applied pathway after completing mathematics at the Grade 8 or 9 level, 2 students entered after completing Principles of Mathematics 10, and 1 student entered after completing Principles of Mathematics 11. Although students began their study of AM at different grade levels, they had similar reasons for why they entered: They found themselves frustrated or alienated by the way mathematics was taught in their non-applied courses. Most students were recommended by teachers or counsellors to consider the applied courses, once it was recognized that they were having difficulty with the non-applied course. As one student said, 'I was told it was more hands on and it was a little bit easier because I really had a tough time in Math 8' (Grade 12 student #S3-1, female). Other students spoke about how they had just enough of being confused and frustrated by mathematics: 'I just couldn't get it ... it was like a trap door and it's hard to get back up' (Grade 11 student #S8-2, male). In all cases, students reported that their grades in non-applied courses were low and many stated that they had little confidence in themselves as learners of mathematics. They welcomed the opportunity to study mathematics differently.

After enrolling in the application courses, students saw their course marks rise. Their self-confidence was renewed and their interest in learning regained. Students' dedication to the course can be seen in their commitment to regular attendance at the AM courses. One student commented that, if she were to skip a class, it would definitely not be an AM class. Evidence of how moving to the AM courses provided positive learning opportunities for students can be seen in the following student comments:

For me personally in Grade 10, that was a very emotionally rough year for me and I pretty much stopped going to my principles [of math] class ... so [the teacher] recommended me for the applied program and I took it the following year and did really well ... with high 80s and my last two terms' were like high 90s ... so it totally reintegrated me in math and like got me back into math. (Grade 12 student #6-2, female)
... in Grade 9 ... I didn’t understand how I got it. So if I’d try to do a test, I wouldn’t know how to do it and I just get so frustrated and it wouldn’t make sense to me at all ... I would just pass—like I got a C. So [the teacher] recommended that I go into applied and then when I got to that, everything seemed a lot easier and I just really concentrated into it and my marks went up and I got As in that class ... it kind of like, OK, I can actually do math. Like before, I don’t think I could do this anymore—I don’t want to be involved in math. And now I’m like whoa, I’m actually doing it. It’s not so bad. (Grade 12 student #6-1, female)

I would say my interest increased. Math was like my worst subject. (Grade 11 student #52, male)

These positive consequences reported by students are consistent with the outcomes described in a provincial ministry evaluation report of applied academics courses (Haslin, 2000). This report shows that, from year 1998 to 2000, there were 291 students across the province enrolled in applied academics courses. When comparing applied academics with non-applied academics, about 70% of the students, agreed with the statement ‘my marks improved in these courses’; 73% agreed with ‘I understand course work much better’; and 65% agreed with ‘I would recommend applied academics courses over other courses to students.’

Most students we interviewed attributed their regained interest in mathematics and rebuilt confidence as learners of mathematics to their experiences in the applied mathematics courses. In schools we visited, however, students recognized that AM courses were perceived as a second choice and were mostly recommended to students when they were judged to be unsuccessful in more ‘academic’ courses on principles. For example, one student commented, ‘[W]hen I first started [Applications of Mathematics] I got made fun of. “Oh, yah, you’re in applied math and you’re not smart”’ (Grade 11 student #51, female). Although applied courses promise to be a meaningful and worthwhile alternative to the existing courses on principles, they are not valued equally in the existing school structure. Through an examination of how students came to the applied courses, we can see that teachers counselled students into the applied pathway as an ‘easier’ choice for less competitive students. On the one hand, applied academics is successful in providing an alternative pathway for students; on the other hand, however, its impact and influence in schools are regulated and channelled and it occupies a subordinate place.

As many students were counselled to take the applications pathway at the end of their Grade 8 or 9 year, few students spoke about enrolling in the applied courses in order to pursue a particular post-secondary education program or career. Although student motives for enrolling in AM courses focused on pursuing connected, contextualized teaching, I student stated that he also chose the applied pathway because it allowed him to study a type of mathematics that he felt would help him pursue a career in the trades. Fifteen of the 20 students, particularly Grade 11 and 12 students, were able to articulate their future career goals and identify the mathematics needed to enter post-secondary institutions in order to meet those goals. What is interesting is that many students spoke about how their experience in Applications of Mathematics courses helped them reconsider their career goals. Two students, for example, mentioned that it was their experience in the Applications of Mathematics class that helped them decide to pursue a career as elementary school teachers. The Applications of Mathematics pathway was not seen by most students as connected to particular types of careers. However, experience in the course gave students the confidence and ability to consider careers they might not have considered otherwise.

**Becoming advocates**

Positive experiences in learning the Applications of Mathematics not only helped students regain their interest and confidence but also enabled them to become advocates for the courses. For example, when asked why they chose to participate in our interviews, several students were outspoken in defence of the course. One of the students said, ‘I first thought you are evaluating this course
and seeing if it should stay in the schools and I thought right away that, yah, it totally should! Just because I feel so strongly about this course I really wanted to talk to you about it’ (Grade 12 student #3-3, female). Her experience in the AM course moved her to defend it against possible detractors. Other students displayed similar strong emotions.

'I am proud of it! I’m proud to say that I’m in this class and doing well!’ (Grade 12 student #3-1, female)

'I am proud of it! I’m very fond of this course.’ (Grade 12 student #3-2, female)

Not many people have much of an understanding of Applied Mathematics. They just think that it’s just an easier math and they don’t understand the benefit that students can actually get from it. I want to let everyone know that it is really fun and to let everyone know that it’s a good course. (Grade 11 student #51, female)

These statements are remarkable and interesting. They were made by students who had been frustrated in a particular, dominant mode of mathematics teaching and had lost their self-confidence and interest in learning. After experiencing an alternative educational setting, they learned to appreciate the course and became advocates for it. The students talked about their previous difficulties with a sense of detachment that was partly born of their current self-confidence.

For some students, advocacy for the course was achieved through sharing what they were learning in their applied courses with friends who were enrolled in the non-applied courses. One student, for example, spoke about how she invited her friends to visit her class during a break in the school day: ‘[T]hey would see the work we had to do and they realized that it is not necessarily easier math; it’s just differently set up so it’s easier to learn’ (Grade 11 student # 51, female). Others spoke about how they have friends currently enrolled in the Principles of Mathematics course who now would prefer the applied pathway. One student stated, ‘[M]y friend wishes she had taken applied math because it seems so much more fun and easier and more practical in life’ (Grade 11, student #52, male).

Students were also advocates for the course in a more public way. Four of the students interviewed had volunteered over the school year to speak about their experiences in the Applications of Mathematics courses at local and regional mathematics conferences. At these conferences, students responded to teacher, parent, and administrator questions about their experiences in the applied courses. One student was recently invited by her teacher to participate in a panel discussion at a regional mathematics-teacher conference. Impressed with all the work her teacher had done with the applied course, this student wanted to join her teacher in support for AM courses: ‘I feel that I’m kind of an advocate now for [my teacher]; I just really want to advertise it [the applied course] more.’ These 4 students had developed a strong relationship with their teachers—teachers who were also well-spoken advocates for applied mathematics.

This kind of student pride in, and advocacy for, an educational experience is a rarely achieved goal. In this instance, it seems to be a product of particularly sensitive teachers working with a course that stressed putting topics in contexts meaningful to students. Although students in other AM classes were positive about the applied approach, they were not as enthusiastic as the students in the classes of two particular teachers. Students stated that learning in these teachers’ classrooms was different because the teachers cared—they were patient, paid careful attention to students who were having difficulty, and were always able to provide a reason why and context for what they were learning. The kind of pedagogy and learning environment teachers establish with their students matters. This reinforces Fullan’s (2001) point that successful educational change also requires a change in teaching approaches and beliefs. As students in our study recognized, a change to content that is more contextualized is not enough.
Demanding recognition for ‘easier’ ways of learning

The ready student advocacy of Applications of Mathematics was probably also in response to
their experiencing the scepticism of students and teachers in other courses about the value and stan-
dards of the applications courses. These ‘outsiders,’ who do not know the courses well, still have
stereotypical views about the courses and the students who take them. These views are an obstacle
to the recognition that students and teachers feel applied academics courses deserve. This recogni-
tion is sought not only from students and teachers in other courses but also from post-secondary
institutions.

When recommending AM courses to students, teachers mentioned to students that the applica-
tions courses were ‘easier.’ There is a general impression that AM is designed to be ‘easier’ in
order to fit some students with lower academic ability. This impression leads to the problem that,
although students achieve high marks or improved grades, their achievement may be discounted by
other teachers, students, and ‘outsiders.’

When we asked students about this notion of ‘easier,’ they positively rejected this ability dis-
tribution against them and clearly drew a line between ‘easier content to learn’ and ‘easier way
to understand.’ While they admitted that they had encountered difficulties in non-applied courses,
they strongly asserted that the AM course content was not easier at all. Instead, what was ‘easier’
was that, in AM courses, similar content was made ‘easier to understand.’

It’s just different way of learning … it’s not that it’s easier. It’s just that some people aren’t meant to
sit there and look at numbers. (Grade 12 Student #3-2, female)

I thought I couldn’t do principles ’cause I thought that was normal but I find applied math more nor-
mal because they take it easier, they don’t stress the situation and I found in principles they were
rushing. (Grade 12 Student #2, male)

It [applications of mathematics] is still hard. But in a different way ... And it is easier because it’s
easier to grasp the concept of what [the teacher] is trying to teach because ... the teacher will do
examples of real life situations so I think you can grasp it better. (Grade 11 Student #56, male)

The message students would like to convey strongly is that they are not learning easier
things—they are learning equally challenging things in different ways. And these different ways
suit those people who find themselves uncomfortable in the non-applied academics ways of learn-
ing. Some students used the word ‘stereotype’ to refer to the conventional misunderstanding that
the applied academics course content is easier and that students who take them are less intelligent.
Some students pointed to the importance of being recognized as students and to how, as applied
students, they felt listened to and valued. Others spoke of the importance of recognition to their
pursuing further studies at post-secondary institutions.

Students’ concerns about recognition are very pragmatic because the status of courses affects
whether the courses are accepted as credit for entrance to post-secondary institutions. At the
moment, some universities in British Columbia do not accept applied academics courses for uni-
versity entrance. However, an institutional strategy has been developed to address this problem.
Students who successfully complete AM 11 and AM 12 (even though they do not complete the AM
12 provincial examination) can do a specially developed unit emphasizing pre-calculus topics. If
they are successful in this unit, they are also given credit for Principles of Mathematics 11. This lat-
ter course is required for general university admission.

Students have found other ways around the university entrance requirements. It is possible to
attend a community college academic program with AM 12 and then transfer over to a university
after the first or second year. For example, a student told us that ‘by taking it, I guess you have to
look at what you want to do [in] post secondary, because of the recognition factor and how it’s rec-
ognized by other institutions’ (Grade 12 Student #51, male).
At the end of one interview, a student, when asked, ‘[W]hat else would you like to say about the course?’ shared his concern with us and hoped that our research would improve the post-secondary institutions’ recognition of applied academics: ‘[A]bove all one should make an attempt to make it equivalent to Principles [of Mathematics courses] for recognition by post-secondary schools ... [W]e learn things that [in] Principles [courses] you don’t learn and vice versa. So it’s just different, it’s not less valuable’ (Grade 12 Student #31, male).

Discussion and conclusion

It is ‘good teaching’ as well as contextualized content that motivates students to participate in applied academic coursework, particularly at the Grade 12 level. Although it is difficult to separate pedagogy and context, students spoke passionately about the qualities of teaching that mattered to them and influenced their success in learning mathematics. In their descriptions, applied and non-applied courses were similar in terms of reviewing homework, explaining content, and doing problems. Yet these two learning environments were different in important ways. Students described their study of applied mathematics as offering opportunities for them to discuss their learning with the teacher and peers and to work collaboratively with others. In contrast, all students spoke about their non-applied courses as being more focused on individual work, with little classroom discussion or collaboration. Content also mattered to students. Many students spoke about the need for relevance and meaning, for content ‘that is more than numbers,’ and for studying mathematics content that was connected to them as learners. These descriptions contrasted with their depictions of non-applied courses, where they were to gain efficiency with disconnected content. The AM pathway was originally designed as an integration of academic and vocational education as an opportunity for students to pursue an alternative way to accomplish career goals. Findings from our research suggest that more students took up opportunities to pursue learning with understanding and collaboration than to pursue alternative pathways to career goals.

It was the development of self-esteem, a belief in their ability to do and pursue the study of mathematics, that seemed most enlightening for the students interviewed. This self-esteem gave them the increased confidence necessary to consider post-secondary education and careers that they might not have considered before entering the applied pathway. Given such ambitions, students also wanted to be sure that their study of AM would provide them with the necessary pre-requisites for university entrance.

Although all students expressed a desire to pursue post-secondary education, most students did not choose the applied pathway in Grades 9, 10, or 11 as a route to a career goal. Using Dewey’s (1916) framework, what mattered to students was neither that their applications course be taught for occupations nor that it be taught through occupations. What mattered to students was that the course be taught in ways that emphasized engagement, connectedness, and collaboration, and that it be taught with a care for students as learners. Within the general context of schooling as students know it, the AM courses were more relevant and engaging, even if they weren’t related directly to occupations. Students in our study, as with the students in Rudduck et al.’s study (1996a), pointed to the importance of the relationships between students and teachers. These findings suggest that the relationships students form with their teachers and with their classmates are central to the learning that takes place (McLaughlin & Talbert, 2001), rather than being an unimportant by-product of a change in pedagogy or curriculum.

By taking applied academics as an alternative pathway, students presented positive and active attitudes about learning. However, not all students spoke about applied courses in the same way. Students in classrooms with opportunities for them to participate in the study of mathematics through connected material and social interaction praised such learning environments. In contrast, students with experiences in classrooms where applied content was taught in more didactic, indi-
ividual ways were less enthusiastic about their classroom environment and emphasized the need for more relational teaching practices. All students we interviewed appreciated and advocated access to non-traditional pedagogies that were less frustrating, more relational and connected, and more focused on the understanding of mathematics. With typical mathematics classrooms dominated by traditional pedagogies (Rogers, 1995; Stigler & Hiebert, 1999), where the mathematical knowledge acquired by students is, for the most part, only justified by the textbook or by the teacher's assertions (Ball & Bass, 2000), students' voices and claims to need a different kind of teaching are important. Although students in our study noted that applied courses were positioned on the fringe of academic acceptance by other teachers, students, and universities, they were proud to belong to a community of learners of applied content that focused on sense making.

It is important to note that, when most students spoke about their advocacy for the applied pathway, they referred to their difficulties with the non-applied coursework, not in terms of cognitive ability, but in terms of ways of learning. This finding is similar to that reported by Boaler and Greeno (2000), who interviewed advanced-placement high school calculus students and found that students in more didactic classes spoke about their learning and the nature of their success in mathematics classrooms in terms of their 'willingness to accept a particular form of knowing and to build identities that give human agency a minimal role' (p. 183). Students in our study found that such didactic teaching and forms of knowing were not acceptable to them; they sought and welcomed a different way of learning. Although the students we interviewed had difficulties learning more abstract mathematical principles, they rejected learning mathematics in ways that did not offer opportunities for discussion, interpretation, and purpose. These students not only learned mathematics in their applied classrooms; they also learned to be advocates for a connected way of learning mathematics. Data from our study suggest that some students were just not willing to adopt identities as received knowers of mathematical knowledge, where student agency in learning mathematics is relatively passive. Students found in their AM courses a space to develop identities as learners of meaningful and contextualized mathematics, where learner agency was valued and respected. For some, their AM classroom helped them transform their views of themselves, as they now consider careers that require mathematics or seek careers where they can use their understanding of applications. As one student said, 'I'm going to become an art teacher and I was kind of thinking of applying some applied math skills into it too' (Grade 12, student #6-2, female).

Developing content and pedagogy that includes students in the process of meaning-making, in which learner agency is significant, is important to students. Our findings suggest that it is not necessarily good teaching or contextualized content that invite learners to construct identities with significant human agency. Instead, it is through an intertwining of both contextualized pedagogy and content that students are able to participate as active learners rather than passive receivers of knowledge.

Efforts to improve mathematics education must, as Fullan (2001) states, take seriously students’ views and opinions about what matters to them. Efforts to implement new courses may be diminished or cancelled by other factors that represent mainstream values and established educational criteria. We suggest, following Rudduck, Chaplain, and Wallace (1996b) that 'the voices of all pupils should be listened to and not just those who are more academically and socially confident, for it is the less effective learners who are most likely to be able to explore aspects of the system that constrain commitment and progress; these are the voices least likely to be heard and yet most important to be heard' (p. 177).

We further suggest that, in addition to the search for strategies for sharing power, deconstructing authority, and contextualizing course content in classrooms, educators need to attend to the complexity of the way students’ educational voices and choices are entangled with other structural factors, such as meritocracy and the knowledge hierarchy. In order to design and provide...
while learning opportunities for all students, we need to continue to understand what matters to students and how such understanding can help us in the task of school reform and educational change.

References


