Program evaluation of
Math 030 (ethno-math)

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May 21, 2004

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Executive Summary:

The development of the goals of the College of New Caledonia's Community Education Department's proposed curriculum revisions for math 030 was in direct response to a perceived need to increase the number of aboriginal students and these students' overall success rate in mathematics courses. In an effort to fulfill this need, a commitment to engage in a curriculum revision pilot designed to address issues of student anxiety and fear of mathematic

necessary. In our view, this tension arises out of normative values and beliefs that place the ideal of “neutral universality” in opposition to practices of recognition or redress. We also recognize that such tensions are apparent in the broader community, and that CNC simply represents a microcosm of a public debate about how equity is best achieved: this is not unique to students of mathematics.

We do believe however, on the basis of the substantial literature in the field and the results of our conversations with aboriginal students that there is value in the work that has begun here at CNC. We see this as an opportunity to re-design curriculum and implement pedagogically driven instructional strategies that better meet the needs of a significant client population and an opportunity for CNC to take a leadership role within the region in continuing this important curricular and program innovation.

At the same time, we also believe that this program’s initiatives need to consider the social context and the nature of its clientele; this means assuring that there continues to be a broad focus on improving student learning and mathematical achievement overall.
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Prince George area and take advantage of how evolving expertise, innovative practices and initiatives in mathematics instruction can be shared.

6. That the DCE consider ways that it can draw on the experiences and leadership offered by its pilot program staff in developing an institution wide focus on meeting the needs of aboriginal students in mathematics.

Curriculum content

7. That the broader northern and/or aboriginal focus for socio cultural content be continued in subsequent revisions. Commonalities and links among cultures should be emphasized.

8. That there be specific content added to the curriculum modules that develops student's understandings of the cultural contributions of various ethnicities to modern day mathematics.

9. That projects continue to be developed that can supplement quizzes or review tests as a strategy for reducing aboriginal fear of mathematics. The projects must be clearly linked to required mathematics content and awarded marks so that the value of the activities are emphasized.

10. That projects, wherever possible, offer the opportunity for a multiplicity of ethnic perspectives to be expressed (modeled after the ethnic cookbook project).

11. That future curriculum revisions consider the possibility of offering increased student choice between projects or quizzes as a means of demonstrating student understanding and a strategy in reducing fear of mathematics.

Instructional techniques

12. That instructors continue to develop strategies that emphasize the links between everyday applications of mathematics, the purposes of math projects and core mathematical topics.

13. That instructors consider a more explicit means of discussing multiple learning styles and approaches to problem solving, including open discussions about how students process responses, i.e., use of metacognitive strategies.

14. That group work, peer/partner strategies be more frequently used during classroom instructional time to accommodate aboriginal learning styles and preferences.

15.

stronger peer relationships, enhance levels of trust and reducing anxiety about math topics.

Specific measures for aboriginal students

16. That DCE consider setting targets for increasing aboriginal student enrolment in mathematics courses.

17. That the FN Center/ DCE consider implementing an aboriginal peer tutoring service in mathematics.

18. That aboriginal students be provided the opportunity to attend a workshop/ seminar on anxiety reduction strategies, including test taking skills.

19. That DCE consider how it might slow the pace of its mathematics courses, or offer additional lab type classes on a weekly basis in order to accommodate aboriginal learners concerns.

20. That DCE consider implementing a regular means of monitoring anxiety levels among aboriginal math students and track this change over time.

THE PROGRAM: MATHEMATICS 030

Mathematics 030 (math 030) is a course offered to adult students at the College of New Caledonia (CNC). Its targeted clientele includes students who have not completed a mathematics course at the Grade 10 level. Mathematics 030 is designed to offer an equivalent designation for adult students who may not have completed secondary school and are upgrading in order to receive their Grade 12 equivalency, or alternately for students who need to take a mathematics course in order to qualify for admission into a university program, trades or technology career.

The course is offered on a semester basis, and frequently is offered in multiple blocks, based on enrolment. Math 030 is one of three basic or fundamentals of math courses offered by CNC. First is math 020, which provides equivalent credit to that of a Grade 9 mathematics course; this is followed by math 030, the subject of this evaluation; and finally math 045 provides the equivalent credit of a mathematics 11 course. While aboriginal students are not formally identified at an institutional level due to privacy concerns, many students self identify as having aboriginal ancestry, including some of those enrolled in math 030. The Dean of the Community Education Department and the Coordinator of the Aboriginal Student Center both agree that there are a significant number of Aboriginal students who attend this and other basic pre- college level mathematics courses. While not able to provide us with firm numbers on how many aboriginal students were enrolled on a semester to semester basis[1] anecdotally the

[1] CNC does not track students on the basis of ethnicity at this time. We were given to understand that this policy may be under review.

mathematics instructors reported to us that approximately 15-20% of overall student enrolment would likely be considered having aboriginal ancestry.

THE CONTEXT FOR THE CURRICULUM REVISION OF MATH 030: A STRONG CONCERN FOR ABORIGINAL STUDENT SUCCESS

The Community Education department at CNC is mandated to consult with the community and identify areas of adult learning need in the Prince George and northern regions of the province. One of the important stakeholder groups that offer advice to their department includes a number of local and regional aboriginal bands and educational societies. As a part of these ongoing consultations, an area of identified concern has been the capacity of Aboriginal communities to have skilled workers in science, technology and trades available to service their regions and people. A significant barrier to achieving this goal is aboriginal student success in school: since the late 1980's the government of BC has been tracking aboriginal student success in the K-12 school system, and has documented an unacceptably high level of student drop outs among aboriginal students. Recent initiatives have been taken within many northern school districts to address this concern and aboriginal student completiomaadis lenmepo0ring iou6ie s10(r)2(v),9( )1(i)c10(o)-6(p)6(p)5(u)

THE GOALS OF THIS CURRICULUM PROJECT:

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better meets the learning needs of our students?" As researchers, we understand this to be an underlying value and belief of adult educational institutions, including College of New Caledonia. The program evaluation model most appropriate for this focus is an "improvement focused model" (Posavac & Carey, 2003, p. 29).

In this model, program evaluators consider the goals and objectives of program designers and organizational leaders in relation to clients, clients' perceived needs, the actual service provided, and the match between the outcomes achieved versus the outcomes projected (p. 29). This approach identifies potential discrepancies, and in doing so provides the opportunity to recommend actions and policies which can rectify these gaps. Such an approach requires the evaluators themselves to make personal observations in a variety of settings and with all affected stakeholders. In the case of this program evaluation, this includes a mix of both qualitative and quantitative measures involving both CNC faculty and students.

The first role of the program evaluator is to become familiar with the nature of the program they have been asked to evaluate: understand its goals and purposes, become familiar with the people it serves, and reasons for the program review (Posavac & Carey, 2003). It is also important to make clear to those responsible for the program the methodology used by the researchers during the program evaluation itself, addressing issues of validity, reliability and generalizability. In other words, how can the recipient of the evaluation be assured that the tools the evaluators use are appropriate and useful to their institution, their curriculum and their goals? This evaluation summarizes our response to these questions.

PROGRAM EVALUATORS:

Catherine McGregor and Peter MacMillan were contracted by the CNC

district's academic plan. Catherine is researching teaching practices which may offer enhanced learning opportunities for aboriginal students.

EVALUATION DESIGN:

The evaluators met with a number of key staff, including representatives from the Community Education department, the Aboriginal Student center coordinator, and instructors of the course. An inherent assumption in this review process was the question "How can we continue to improve this course so it better meets the learning needs of our students?" This question was a central theme in many of the interview questions and responses given by those interviewed.

The evaluation was conducted over a period of approximately two months. Initial interviews were held in mid-March, 2004; a focus group with students was held in the third week of March, 2004. Student surveys were completed and collected during the final week of April and early May. Individual student interviews followed and were completed by mid-May.

All of those who were interviewed were given explicit information about the purposes of the evaluation; institutional processes were followed to assure rules for permission of student participation were followed. No individual interviews occurred without written permission; a sample permission form is included in Appendix A. All interviews were tape recorded, and then transcribed. Transcribed notes were coded for common themes and then categorized by evaluators. All tapes were destroyed after transcription in keeping with confidentiality agreements.

METHODOLOGY:

In this report, we have used a number of techniques common to contemporary program evaluation models including:

1. **Semi structured interviews**: specific questions were posed but open ended questions which encouraged participants to discuss the program from their own experiences, and beliefs were also used. Comments were taped and later transcribed. This approach was used with faculty interviews and follow up student interviews. There was a $25.00 stipend provided to encourage student 6(x)-1(pl)3(i)-6(c)15(i

Some readers might question the theoretical basis of our decision to interview individual students based on their response to our demographic questionnaire, and identification on the basis of ethnicity. Our reasons are two fold. First, because our focus group was conducted with all classroom participants, we were concerned that aboriginal students may have chosen to remain silent about some of their views and beliefs. There has been significant research to suggest that individuals of different ethnic or racial groups are often silenced when the mainstream, cultural constructs of a white, Eurocentric discourse are voiced (Denzin & Lincoln, 1994; hooks [sic], 1984; Lather, 1991). A commonly expressed, normalized belief about what "equality" means, that is, that all people regardless of race should be treated in "exactly the same way" often accompanies discussions which focus on accommodating difference on the basis of race or ethnicity; yet the privilege afforded to mainstream white society is rarely revealed. We were interested in creating an opportunity for aboriginal students to safely voice their own perspectives which may be different than their white counterparts. Second, some existing research suggests that aboriginal students have different learning styles and preferences in mathematics, and our intention was to explore these ideas more fully during individual interviews; this will enhance our knowledge of how to better serve Aboriginal students in mathematics education. This is consistent with our goal of identifying ways in which this program can realize its goal of enhancing student success.

LIMITATIONS OF MEASUREMENT TOOLS

One of the limitations that must be acknowledged in this report is the limited time span over which this trial curriculum has been piloted, and the ability to identify specific indicators of success within a three month time frame. While we understand the importance of meeting government requirements to engage in formal evaluation to assess success in achieving goals and outcomes, it can be difficult to measure small, incremental change in a limited time frame. As well, the goals of the program changes are broadly framed, and suggest a longer term focus: as the program improvement literature suggests, such systemic changes do not happen overnight. For example, increasing the number of aboriginal students enrolled in adult re-entry mathematics programs will be the result of a number of modifications to existing institutional practices, one of which includes the re-design of curricula. The goals of this program pilot, while laudable and supported strongly by research in the field, need to be considered within the historic context of aboriginal student success in schooling, and the continued presence of cultural, social, political and economic barriers for aboriginal students within British Columbia's (BC) educational system. It also needs to be situated in an institutional context, where curricular change is only one part of the ongoing efforts to address aboriginal student academic success. It is our hope that this evaluation is considered only the first in a series of efforts to investigate program effectiveness over time.

Torres, 1994 (cited in Posavac & Carey, 2003, p. 49) reports that program evaluations can be resisted when those who are engaged in service delivery feel they are being judged on the basis of criteria which they cannot affect. For example, teachers often resist the publication of student exam results because they believe it will be used to

judge teacher performance rather than a measure of student effort or ability. "Those whose success depends on the performance of others as in the case of teachers… face a more uncertain situation than do people who are more directly in control of the results of their efforts" (Posavac & Carey, p. 50). Therefore, it is important for evaluators to assure service providers that appropriate criteria are being used to measure program performance, that they are given a voice in commenting on the evaluation design and given the opportunity to identify limitations and contexts that should be considered in designing recommendations and drawing conclusions. During our interviews with the curriculum designer and the class instructor, we gave several opportunities to engage in such a dialogue. We invited both to consider questions that might be appropriate to ask students. As well, in designing our questions to put to students, we were conscious of the

Ethno-mathematics is a theoretical and practice based approach that can be applied using a socio-cultural framework.

D'Ambrosio (1994) is credited with identifying ethno-mathematics as a conceptual framework through which to consider mathematical learning. According to Rowlands and Carson (2002) D'Ambrosio describes ethno-mathematics as "the study of

ANALYSIS:

Once all data collection was complete, the program evaluators met to discuss common themes and emerging patterns present in the student and instructor responses. Each set of interviews were transcribed, re-read and coded into descriptive groupings; from these smaller coded units larger categories were created and then considered in light of the program review objectives. Student interviews and the focus group session were similarly transcribed and coded. Student survey results were tallied and then specifically

of these items for evaluation purposes, there may not be any reaction from non-aboriginal students as to the reasonableness of the inclusion of such items. A goal that all students see aboriginal content as a routine part of mathematics will have been achieved. Should such a reaction continue to occur there might be reason for class or individual student-instructor discussion about why the inclusion for information related to any particular group within Canadian society should not be a welcome addition to increase mathematics relevancy in the course.

The second class of changes consisted of content that the course developers felt had an aboriginal connection but may or may not be perceived as such by either aboriginal or non-aboriginal students. Content may be more broadly described as northern rural. Some examples in this category were the hunting cabin, the purchase of firewood, and ice fishing. The strength of this type of content is that all students may perceive the examples as relating to them. The non-aboriginals cannot view the material as catering to a group other than themselves and the aboriginal students may be able to identify with the content as something out of their own experiences. A current weakness of this class of content is that lack of evidence that the aboriginal students do identify with this content.

The third class of course changes were eit lehito2( )1(s)11(wi)5(u)-5(d)5(s)-4(g)2(n)-12(z)5(l)42(i)-

Suggestions Arising from Content Analysis

This first class of items should be unapologetically used and expanded upon. While some of this content is highly desirable but unavoidably non-Canadian, (after all the Mayans with their counting system were not Canadian residents), other examples that deal with Canadian content, even British Columbian content could reasonably be included. The long houses, the totem pole construction and the box making of the West Coast cultures would provide a wealth of problems and projects for many of the units that comprise Book 1. Not to neglect the traditional inhabitants of the Interior, the Shuswap round pit-houses with their cone shaped roofs could be a source of non-trivial geometric mathematics problems. The addition of traditional local technology might reasonably be expected to result in a greater degree of identification for both aboriginal and non-aboriginal CNC students alike.

The content of the second class, i.e., not overtly aboriginal, needs to be examined by an outside group of CNC aboriginal students and/or staff. If the aboriginal students do not see this as relating to them, then the value would be lost. One particular instance, the cans of salmon question, Q 10 p. 151, was not independently identified by the evaluators as being of aboriginal content. However such an item could easily be re-worked to take place within a Port Simpson cannery and then would be un-mistakenly identifiable as an aboriginal content item to these students. This class of items has particular value in that these items and examples can have appeal to all northern rural modern cultural groups rather than simply the aboriginal students that choose to value traditional aboriginal culture. Again, the quantity of this category of could be greatly increased to match the backgrounds of the majority of CNC students in the Math 030 course.

The evaluators recognize that this analysis does not include any adaptations made to any general teaching strategies as adaptations for the aboriginal students. In this sense, we have underestimated the overall adaptation of this course. Continued searches for strategies that are more effective and increasing learning while decreasing anxiety levels about mathematics are to be encouraged.

INSTRUCTOR VIEWS:

As the literature review in this report indicates, the majority of literature in the field supports the view that increasing the amount of aboriginal content is one of the key routes to improving enrolment and retention rates of aboriginal students in post secondary institutions. As Malatest (2002) notes: “It has been argued that if students do not see their culture reflected in the curriculum or in the larger culture of the post seneu-5(s)-i(o)-he is o1(s)71 Tw16(r)-9

to both aboriginal and non aboriginal students in an urban environment. Understanding this context suggested she would need to broaden her focus to ensure that any revisions considered the need for good mathematical instruction and examples that supported all learners. She supported this decision based on her review of the literature. More specifically she stated: *"What's good for First Nations students is good for everybody. If I do some things to try and accommodate their learning styles, we probably make that more accessible and less of a terror for the majority of students."* As a result, the CR made a decision to include a number of socio-cultural examples that represented a broader "northern" perspective, rather than one that was exclusively aboriginal. In this way she could also avoid the inclusion of potentially contrived examples; based on comments from elders and experienced aboriginal educators she met with during the revision process, this is an important consideration. Lack of authenticity can be easily detected by both aboriginal and non aboriginal students.

These changes were also driven by more than the needs of aboriginal students, but also the broader context of good pedagogical instruction in mathematics. As the CR pointed out "*I've wanted to do [this] for a long time….I gave a lot of thought of how to bring some continuity into the book. I don't think students saw the relationship [between math topics]… So I am hoping they will… that this is an application of what they learned before. We [teachers] think they are totally connected, but students don't see the connections."* It is through the introduction of projects in particular that this conception of applying mathematical knowledge to practical examples was seen as a priority enhancing all student learning.

An important observation that the CR offered was how through research, workshop attendance and the curriculum revision process her own knowledge and understanding changed: she became much more aware of the links between the recognition of aboriginal culture, its contributions to the world of mathematics and how this enhanced aboriginal interest and success in mathematics.

The course instructor (CI hereafter) also has a strong pedagogical commitment to ongoing course improvement, including the introduction of meaningful examples that will enhance course relevance to students. She saw the goal of introducing these changes in the curricular material, particularly its focus on aboriginal culture as consistent with this goal. As she stated, "*If we…[add] first nations content then that makes it more interesting for the first nations students, and for all of us!"*

The introduction of ethnic examples also had the benefit of increasing her repertoire of "unique strategies" she could use to enhance overall sti bs

There was a limited amount of support for the inclusion of socio-cultural examples by some non-aboriginal students. Generally, this was framed in a "do no harm" framework: in other words, we have to do math problems anyway, as long as we are doing the math, how can it hurt to include problems that include aboriginal people. One student commented: *"Yeah, but why shouldn't they be included? Its still a math question so it doesn't really matter."*

In the case of aboriginal students, there was a higher overall belief that the inclusion of aboriginal examples could assist learning and increase interest. The student surveys, when analyzed on the basis of identified aboriginal ancestry showed a higher degree of preference for examples that included a native focus (See Appendix C). However, this was not unanimous belief. This was reinforced during the personal interviews conducted: One interviewed aboriginal student was not in favour of introducing aboriginal culture into mathematics: she shared the view expressed by others during the focus group that "math is math" and it doesn't require any cultural content. However, she did support its inclusion in initial courses that were offered to aboriginal students, particularly those who had recently moved to the Prince George area and who might be less familiar with the urban environment. "*Maybe for lower levels like 015, 010…when you are at the lower levels that is when you first come off the reserve…and when you are right into the school system you are doing it like everyone else."*

INSTRUCTOR VIEWS:

As noted in this report both the CR and CI were strong proponents of changes to the program that could enhance student learning, although both expressed the general concern that the inclusion of socio-cultural examples enhance should all student learning, not just those of aboriginal students. Both believed that the projects served a broader pedagogical purpose— they represented a teaching approach that enhanced the learning environment and the ability of students to make connections between the every day applications of mathematics and conceptual ideas, symbols or formulas.

Both also expressed concern that this content might create a backlash among non aboriginal students: one1( )1(o)-1(f)7( )-10(c)-()-1(f( )]TJ(n)-6-2( )-9(i[(ap)-5(p)5(l)-2(i)-1nnw1(en)-1(t)-00

There was some support for the use of projects. As one student suggested, *"I think some people do better on a project than they do on a test so then it's also a change in your everyday – it's a different way of looking at your math and I think that the content of it is good… It was kind of a break from the regular and yet it was still math."* Another student suggested it was a way of showing personal commitment: *"I think its fair ball because it goes to show who does their homework and who doesn't, and its such a simple project, you get given a week, there's no excuse and it doesn't take long at all."* Projects were also considered something that would reduce fear and anxiety by reducing the amount of tests taken.

One important point to note is that several of the aboriginal students interviewed expressed both a high level of interest in the projects themselves and the possibility that other projects, such as beading, offered a way of integrating math and aboriginal culture effectively. Another important factor for aboriginal students was that projects had the effect of reducing fear, particularly fear that arises from taking exams. This is an important point to note because the student survey indicated a higher overall level of general math anxiety and fear of testing among aboriginal students. I will return to this theme in a subseque04 T0t68 1th an7(e)1(1)-4(ur)-3()-4(t)

A two tailed t-test between the two sets of class scores was performed. The results ($t = -1.98$, $df = 36$, $p > .05$) did not indicate any statistically significant difference between the two groups. This lack of difference occurred in spite of reported instructor perception of the students in the new Math 030 (Winter 2004, ethno-math) group as possessing a lower degree of skills on entry than the previous class (Fall 2003). While the course instructor provided the evaluators with the limited previous grades of the students, the data were too incomplete to test for differences in student abilities upon entry to Math 030. This was unfortunate as had we been able to document and statistically adjust for the class ability differences, an effect favouring the new Math 030 might have been detectable. At present, we have no conclusive evidence of achievement level differences. The instructor perception of overall class ability was supported by the responses of two students who were questioned on this topic when the main interview they volunteered that they had take the course in the previous, Fall 2003, session as well. Neither student knew the reason for the line of questioning. Each was simply asked about the nature of the two different classes. The students were completely consistent in their descriptions of class size, quality and frequency of student-student and student-teacher interactions. Given these interpretations, the lack of a drop in letter grades for this lower ability/skills class may be viewed as a possible sign of success for the ethno-math curriculum intervention.

THEME THREE: INCREASING STUDENT INTEREST

INSTRUCTOR RESPONSES:

As we noted in our preliminary report, an important perspective on student success that needs to be included are the views of the instructor. The one person most familiar with the behaviours, needs and responses to the changes represented in this pilot ethno-math class is its instructor, so measuring her satisfaction with the course design, its instructional elements and content is central to determining success. In this case, there were several elements of the course revision that have been considered highly successful

higher degree of motivation, permitting a student to take on more complex problems without fear.

Mathematics educators have studied for some time the role of motivation in learning mathematics: a key method for developing a strong interest in mathematics is by introducing practical, realistic examples of how mathematics is used in everyday life. The National Council of the Teachers of Mathematics (NCTM) have developed a series of content and process standards for the basic school mathematics curriculum: an area of heavy emphasis is the process of problem solving and the inclusion of real life application of mathematics in classrooms. These goals have been an important part of the math 030 program revisions, and are represented in the introduction of projects and problems that use aboriginal cultural experiences and examples which would fit the social context of local aboriginal and non aboriginal students. It also enhances mathematical interest, which in turn increases the possibility that students will persevere with difficult or complex problems. Therefore student interest, as identified by teachers is a highly

suggested the use of “real life” mathematics and topics I am “interested in” (see Appendix C.)

A commonly expressed view was that personal goals and in particular, capacity to access other training programs was the highest motivator for these students. There were several references to a “chart” that had been placed on the classroom wall that detailed what math prerequisites were necessary for a variety of careers or trades. As a course designed to meet the needs of adults re-entering education in order to access higher levels

examples in the course content was important, perhaps a more critical feature was teaching methodology; practices that take a variety of approaches, and engage students in a supportive learning environment would increase students comfort and therefore permit a change in attitudes towards math. This was seen as central to student success in mathematics: building trust through confidence building talk and inclusive, success oriented strategies during instruction were key elements of reducing student fear.

Another area of higher anxiety was in the area of math tests. More aboriginal than non aboriginal students feared tests; as a result, they were more likely to favour projects as a way of showing understanding or knowledge. (See earlier section of this report).

Individual tutoring was identified as a successful strategy for reducing fear. However, access to tutoring for all students was problematic: several students expressed a need for extra help but could not access it because of course load or financial constraints. The reduction of class sizes was also identified as a possible solution to assisting with more one on one support between teacher and student.

One aboriginal student made clear that anxiety is not a one time thing to be

One of the most important features of effective program implementation is the

things that would try to draw in all the different cultures of students. But it is very hard for me to say to… [another instructor] this is how you need to teach the course. Because I don't think you can do that."

These comments illustrate two components of autonomy: personal comfort with culturally sensitive practices and the need to acknowledge the variety of approaches that are necessary to accommodate many different learners within the classroom setting.

These views suggest at least two professional development needs of faculty who are currently involved in the program pilot project, and potentially other instructors, should this revised course continue to be taught or expanded to other mathematics foundation courses. These needs include: enhancing knowledge of student learning styles, particularly those of Aboriginal learners; the sharing of the research base foundational to the program design; and the need to engage all faculty in a discussion about how to more inclusively accommodate Aboriginal culture issues in their classrooms. The responsibility for meeting the goals of the program and committing to the organizational values represented in the program revisions should be considered collectively by all of the program staff.

There is a need to set some specific targets and measures of success for evaluating this pilot program in the short and longer term.

When we were contracted for this review, we were given a broad framework from which to consider this evaluation. While offering considerable flexibility in designing methodology, it has also presented some specific challenges for determining measures of program success. Therefore, as evaluators, part of our work during interviews was to probe for what faculty and staff understood to be markers of student success in mathematics 030. This probing for how different institutional staff members understood appropriate markers of success has revealed some important values and potential measures of success. This informed our subsequent discussions with aboriginal students who voluntp omsanteT*0 uasu si ad4(i)4(6(o)5(p1(n5(i)-2(lr)8(s)n)-5(t)-2(p)-1r)2(o)-7(m)73(s)-4(an)9(-5(cw
cowho vclroomrt009 Ti. nu (-5(cw( )10(d)-5(e)1-3( )101(l)-2(en)-e)-10(a)10d)5(,s)-30(ed1(Ct)-6(u)-(t)-12(t)

The budget for this pilot program included release time for its writer. The institution released the program author from teaching duties for one class during the fall 2003 semester, just prior to the pilot trial period. The goal was to complete the entire

that both felt a revision to the first mathematics foundation course, mathematics 020 might be an even more appropriate place to introduce a component of cultural knowledge. This is because mathematics 020 covers the grade nine curriculum, and its content lends itself in particular to the introduction of more real life examples. It would also permit a greater capacity for linking related topics and permit more explicit instruction in the connections between related mathematical skills. For example, proportion, ratio, percentages, fractions, and decimals are all related topics in the math

APPENDIX A

PLEASE INDICATE THE FOLLOWING:

AGE:	X under 20	Education status:	Y some high school
	X 20-29		X high school graduate
	X 30-39		X some post secondary
	X 40-49		X post secondary certificate, degree
	X 50 +		

I learn best when my teacher directly teaches a new idea and uses a model to help explain how to solve this problem.	A	D
I learn best when my teacher talks about the connections between real life math and the math we are learning in class.	A	D

I learn best when my teacher uses examples in math that are about things I

I didn’t feel welcome here at CNC: I felt different than everyone else.	T F

Part IV: *Your experiences in Math 030.*
Please circle A to agree or circle D to disagree with the following statements.

Your Experiences In Math 030	AGREE / DISAGREE
The Math 030 curriculum is interesting because it uses lots of real life examples of how math works.	A D
I learned about how math is used by people in different ways; for example, how aboriginal people have used math as a part of their culture.	A D
I learned about how mathematics is important in every day life.	A D
The ethnic cookbook we created in class is a good example of a project that helped me understand how math is used in every day life.	A D
The ethnic cookbook project made me proud of my culture and beliefs.	A D
I was surprised when someone asked me to figure out how much birch bark it would take to make a moose caller for a math project.	A D
I liked working with my classmates on the moose caller problem.	A D
I attend math class more regularly because I am starting to enjoy math more.	A D
I think putting an ethnic focus on math is wrong: math is math; it isn't different for different people.	A D
Because I am getting so much better at math, I would like to help another student with their math.	A D
I enjoyed the group projects and math projects that were added to this course.	A D
I like the way my teacher made connections between math ideas; it helped me to understand and learn.	A D

Part V: *Math anxiety.*

Part VII:

Focus group about Mathematics 030

Name _____

Phone number/or address _____

Age:

( ) below 20

( ) 20's

( ) 30's

( ) 40's

( ) 50's

( ) 60's

Education:

Years of formal education finished (circle the appropriate number)

6 7 8 9 10 11 12 post secondary certificate or degree

Race:

( ) Aboriginal ( ) White

( ) East Indian ( ) other

( ) Asian descent ( ) Hispanic, Latino, Chicano

Gender:

( ) female ( ) male

Student category:

( ) full time student ( ) part time student ( ) working outside the home while attending school

Y **I WOULD BE WILLING TO PARTICIPATE IN A FOLLOW UP**

Q4: What helps you to learn math? What kinds of things are you doing when you are learning math well? What are the qualities of a good environment for learning math?

Q 5: Can you describe an activity from this class that you thought was a particularly useful way of learning about a math topic?

Q 6: The person who re-wrote this course replaced many of the chapter quizzes or tests with projects that were designed to apply math learning to the project. Did this enhance your math learning?

Q7: Can you recall a specific example of a problem or project during this math class that you would consider culturally sensitive, had an aboriginal focus, or was particularly meaningful to you? How did you feel about it?

Q8: is there anything we've missed that you think would be important for us to consider in developing this report?

Follow up interviews with selected students:

1. Math fear/worry about math. This is something that many researchers have written about, that how a student feels about their ability to learn math can influence how they do in math. What are your feelings about math? Were you worried about math when you began taking this course? Did you feel less worry as the course went on? How did you get over this worry?

2. Tell me something about how you learn math best. For example, some people believe that seeing a problem with pictures is the best way for them to learn. What do you do to help you learn math?

3. Note to us: Because the students didn't have as much familiarity with examples of the projects and specific ethnic examples that were used in this class (because it was only in the first book of the course and they are well beyond it at this time) we should begin by giving an examples of one several of the projects or problems used that had a practical or an ethnic focus.

One of the goals of this course revision was to introduce some "real" examples of math to help students learn. It was also a goal to include examples that would have meaning to aboriginal students who might take the class: for example, the project where you were asked to design and figure out the area of a moose caller. Did this project help you to

example, when learning about graphing, examples that discussed trapping and hunting were used and made the math concepts more understandable and interesting. Knowing this information, should math teachers incorporate this way of teaching into their classrooms?

5. Questions for Aboriginal students. The CNC continuing education department believes it is important to support aboriginal students in learning mathematics. There has been some research to suggest that aboriginal students face more barriers to learning math than others. Aboriginal students are also under represented in math, science and technology, as well as trades courses. Many bands are anxious that aboriginal students take these training programs so they can fill the need for people with these skills on reserve or in service to the aboriginal community. Given these facts, changes to the content of the math course and including examples of how aboriginal people use mathematics would be part of the solution for these problems.

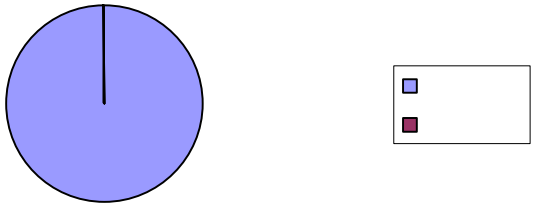
10.

APPENDIX C:
Summary of selected student survey results

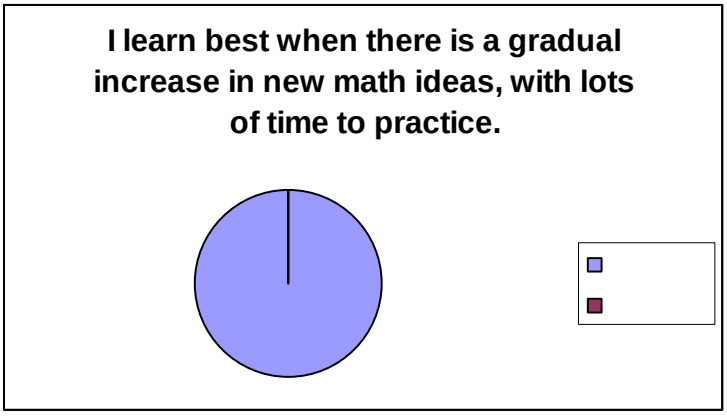
Things I believe about math learning
No significant differences between aboriginal and non aboriginal respondents

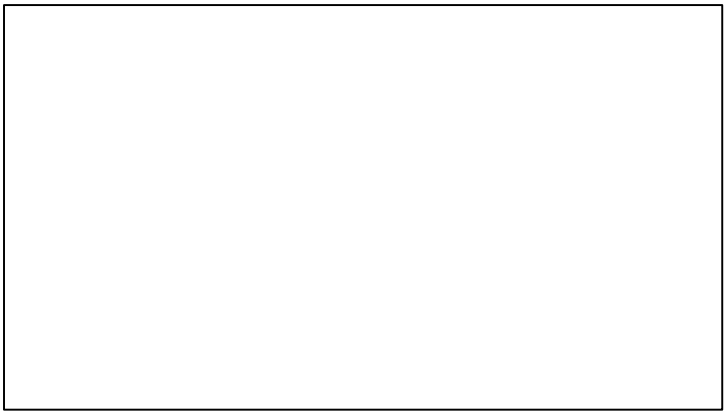
The best way to understand what students know about math is to ask them to tell you how they got the answer to the question

I learn well when someone explains a way of solving a math problem

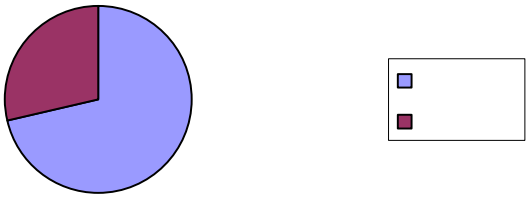


I learn best when I feel confident with a new math concept before I start a new one.

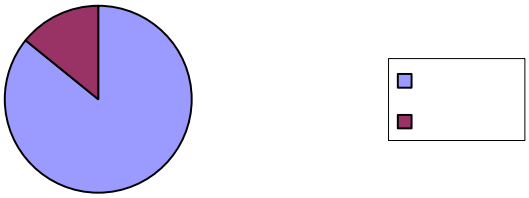

I learn best when there is a gradual increase in new math ideas, with lots of time to practice.



I learn best when my teacher uses examples in math that are about things I like and am interested in.



When I trust my math teacher I am more likely to ask questions about how to do a math problem



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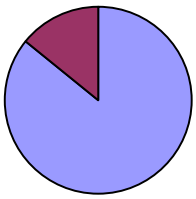
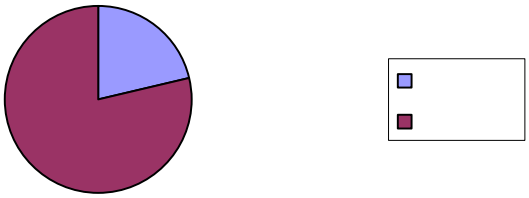
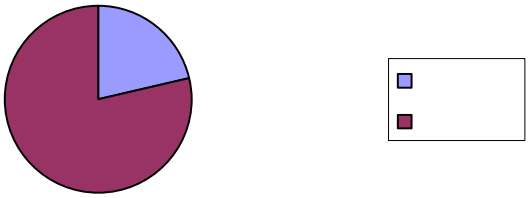


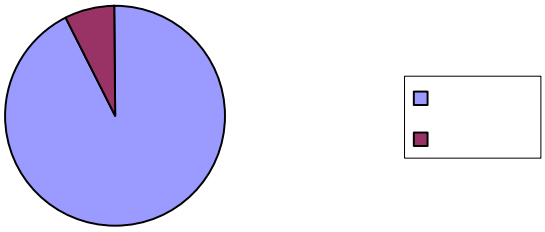
I do better in math class when my instructor tries to understand my culture and beliefs



I would do better in school if my teacher understood more about my personal life and the problems I have.



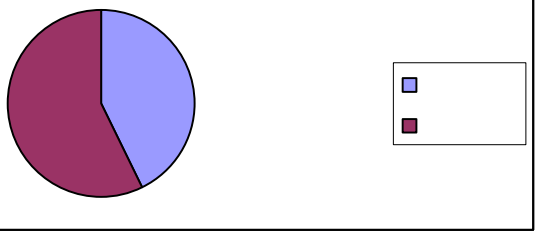
Math is easer for me when I am taught the formulas to remember



Barriers to learning math

Differences between aboriginal and non aboriginal respondents noted

I hated the idea of math tests because I was afraid I would fail: non aboriginal student responses



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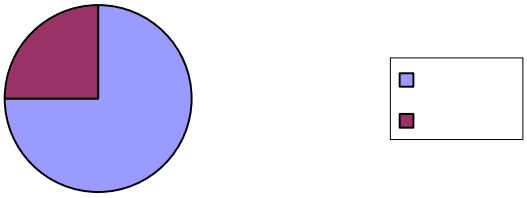
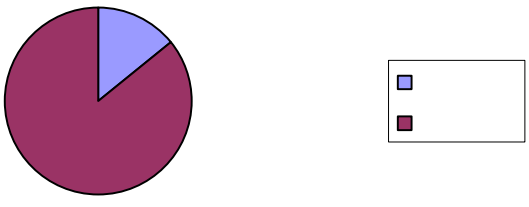
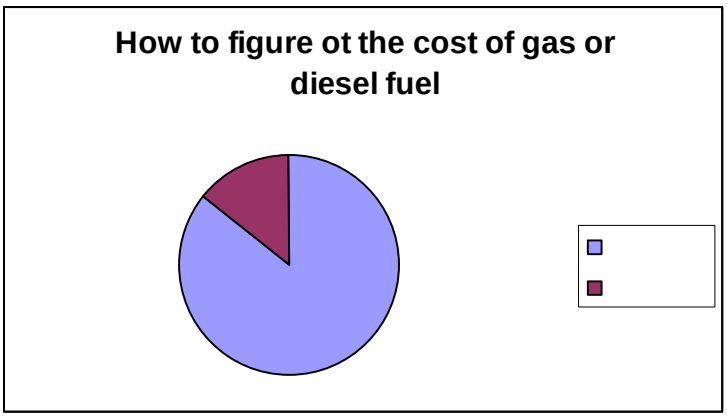


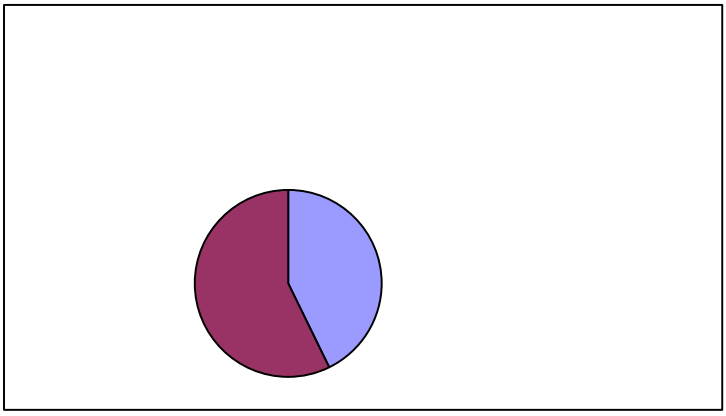
I had trouble relating what I knew about math with what was being taught in the classroom.

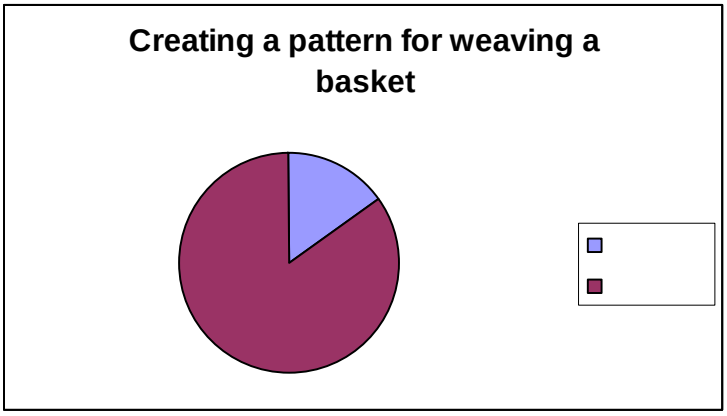


Useful ways of learning math


How to shop for food bargains

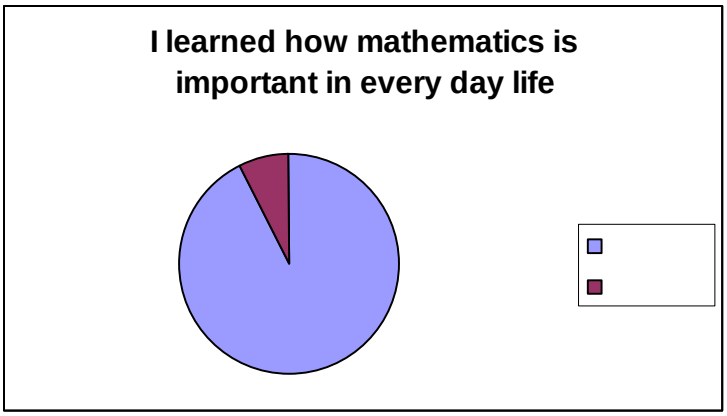

How to figure ot the cost of gas or diesel fuel

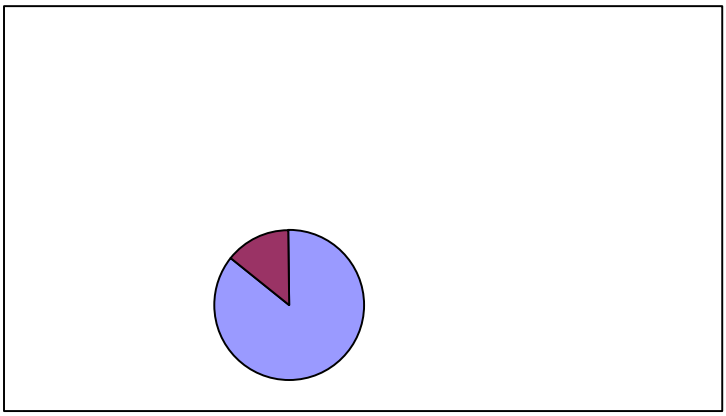


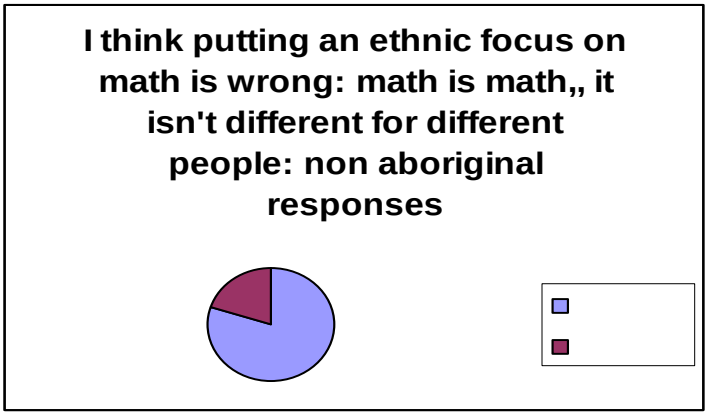


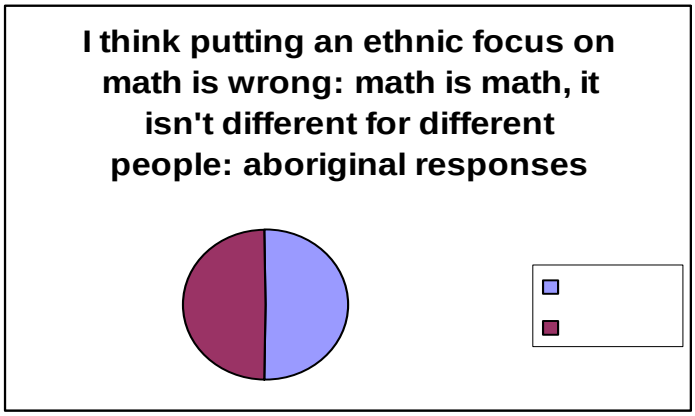
Your Experiences in Math 030

Differences between aboriginal and non aboriginal respondents noted






I think putting an ethnic focus on math is wrong: math is math,, it isn't different for different people: non aboriginal responses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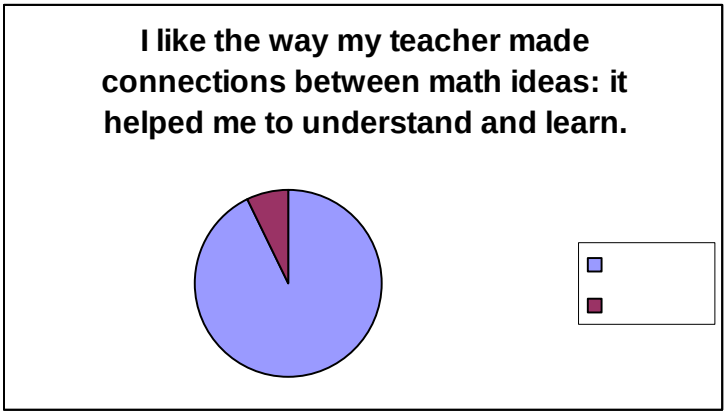
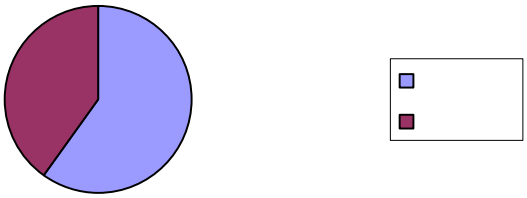

I like the way my teacher made connections between math ideas: it helped me to understand and learn.

I attend math class more regularly because I am starting to enjoy math more: non aboriginal students



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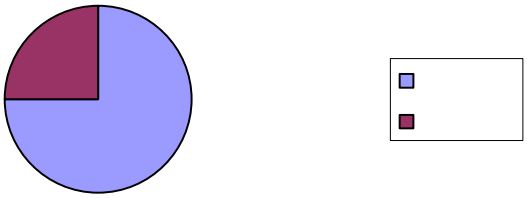
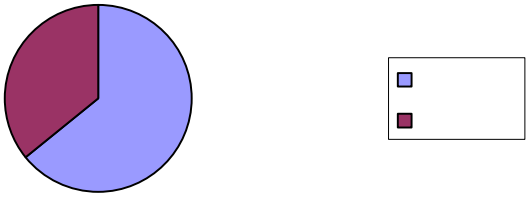
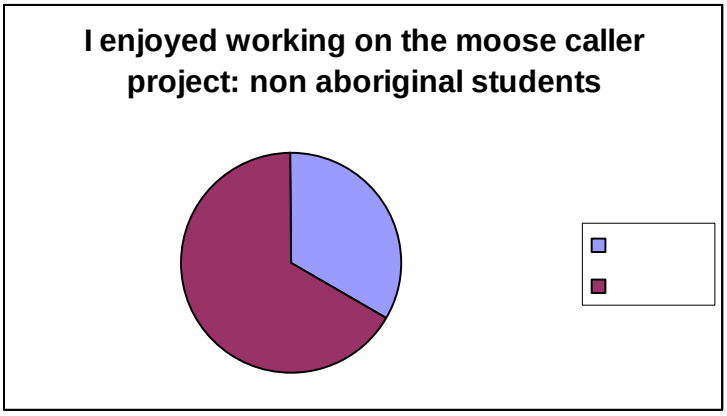
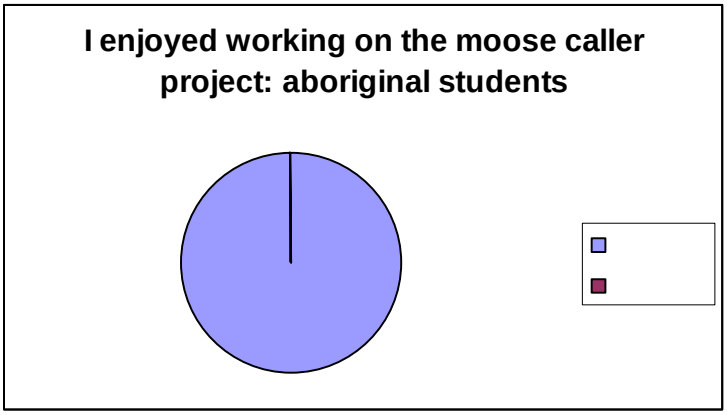


The Math 030 curriculum is interesting because it uses lots of real like examples about how math works.




I enjoyed working on the moose caller project: non aboriginal students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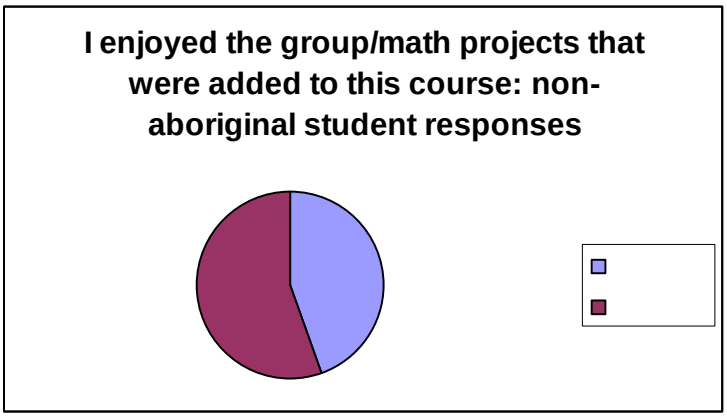
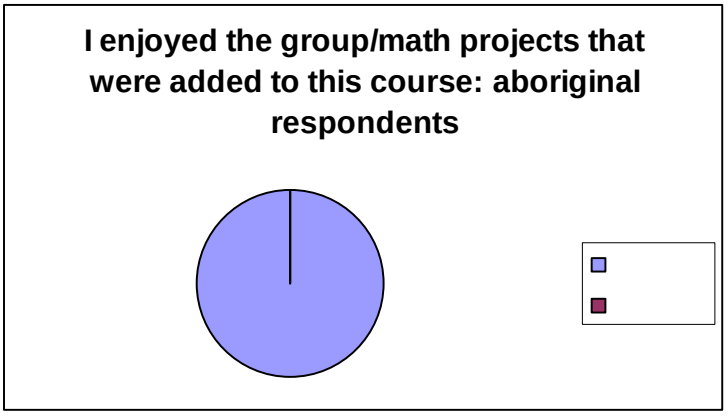
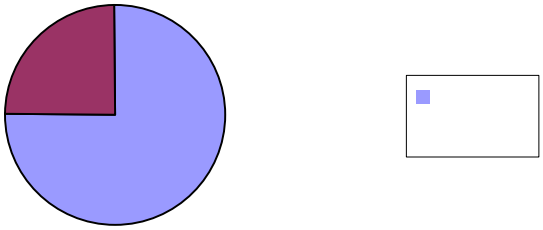

I enjoyed the group/math projects that were added to this course: non-aboriginal student responses

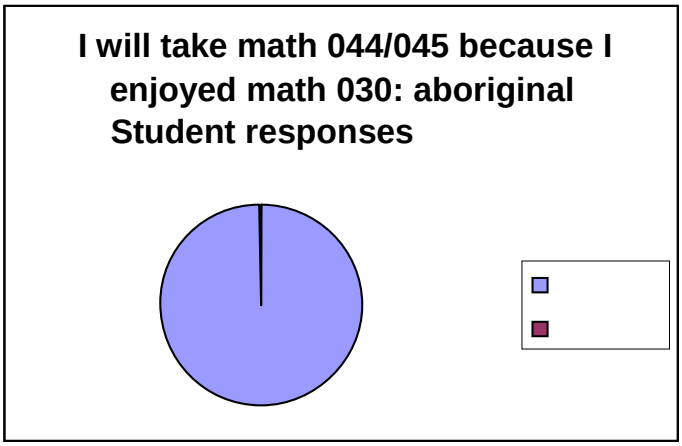

I enjoyed the group/math projects that were added to this course: aboriginal respondents

Reasons for taking next level of Math (044 OR 045

Because of my success in math 030 I may consider further math courses so I could train in a science or technology career: aboriginal student responses

Math 030 has given me the confidence that I can do more difficult math




I will take math 044/045 because I enjoyed math 030: aboriginal Student responses

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