Connecting the Classroom to First Nation's Culture

Practical Ethnomathematics Education

EDCUR 992.6 PROJECT

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Project Overview

My project is a hybrid. It combines some of the traditional elements of a Master's project, such as a research question, literature review and table of contents together with my personal story. As such the appearance of the project may be different from what one expects. I begin with my story and motivation for looking into ethnomathematics and First Nations culture. I then review literature on the topic of ethnomathematics and briefly explore Aboriginal approaches to teaching and learning, and compare these with characteristics of constructivist learning. The concept of worldview is imperative any time discussions take place-surrounding culture. Individuals must have a strong awareness of their own worldview in order to understand personal biases and perspective they bring into learning about culture. As such, I look at the issue of worldviews and demonstrate via my experience how a shift in worldview and teaching approach can transform the classroom. Before presenting the unit plan I've designed, I provide some background and instructional techniques related to the unit. This is followed by my unit plan, which combines elements of ethnomathematics with curriculum outcomes. Lastly, I offer teachers a number of resources for them in order to support inclusion of ethnomathematics and First Nation's content in the classroom. My hope is Saskatchewan teachers can use the information and unit plan as an example of how to combine mathematics with First Nations' culture.

Introduction

At the beginning of 2011, my husband and I decided it was time to make a move towards the family farm in rural Saskatchewan. Not long after, I received a phone call from the principal of the local elementary school, inquiring if I would be interested in fulfilling a potential job opening. With the prospect of accepting a job in a school with a large population of Aboriginal students, I began asking the question, how can I be an effective teacher, when I am not informed about the culture? This question led me into discussions with a friend who introduced me to the field of ethnomathematics. It was from that discussion and subsequent reading that my research question emerged. My research question combines what I've learned through ethnomathematics with a desire to apply the knowledge in the classroom. My research question is: What could the instructional design of a unit be involving ethnomathematics in a middle years classroom? Instructional design refers to, "a systematic process of analyzing and solving performance problems that will respond to instruction; creating the "plan" that will be used to solve the instructional problem" (Schwier, 2012, online). For the purposes of this paper, the instructional problem refers to how teachers are able to combine their lessons with ethnomathematics and First Nations culture.

Prior to beginning a discussion on ethnomathematics, it is important to situate myself with in the world of mathematics. As a student of mathematics, I struggled with activities surrounding the learning and doing of mathematics. Simply put, I did not understand or engage in mathematics. The sum total of my mathematics learning was following teacher's directions. I only needed to remember the steps for as long as we covered the specific unit. There were few opportunities for me to make meaning from

the mathematics, which I was learning. O'Brien (1999), refers to this type mathematical learning experience as parrot math. Parrot mathematics is taught in a way in which the thinking is removed for students. In speaking to others who learned parrot or traditional math, O'Brien (1999) indicated there was no room for individual thought, concepts were taught in isolation and there was a strong emphasis on drill and practice of basic operations. Boaler (2001), indicates that girls especially have a strong need to understand the mathematics and traditional mathematics instruction does not emphasize understanding, but rote learning. I believe that my struggles as a student originated with the type of mathematics instruction I received.

As I moved from the role of a student to the role of a teacher, I slowly came to understand there was a different way to teach and learn mathematics. I began to understand mathematics could be interesting and engaging. It was through a renewed curriculum, professional development and enrolling in a Masters of mathematics education that I discovered, reform mathematics. O'Brien (1999), succinctly summarizes reform mathematics by saying, "math should make sense to children and that children should be thinkers rather than storage bins for thinking done by others" (p. 434). As I began to learn the differences between "old" and "new math" or traditional and reform math, I felt an internal conflict. I wondered, if I fully embraced reform mathematics, would my students learn the necessary computational skills? How would parents respond? Did I have a strong enough grasp of how to teach reform style mathematics to embark on such a process? While I wrestled with these questions for a number of years, it was not until being introduced to the idea of the Math Wars, that I understood how large the dilemma really was. At their core the Math Wars involve a dispute between

supporters of reform mathematics and traditional mathematics. (Schoenfeld, 2004). The Math Wars have been raging in the United States for a number of years, and from what conversations I've had, and recent media coverage, the Math Wars are alive and raging in Saskatchewan (CBC News, September 21, 2011; Star Phoenix, December 20, 2011, online).

There is little doubt in my mind that the traditional method of teaching mathematics need to disappear and we as educators need to embrace reform mathematics. I strongly believe ethnomathematics has a place within the reform teaching methodology. I feel that honouring culture will enrich and reform the teaching and learning of mathematics.

Ethnomathematics

A commonly held belief among those who are linked to mathematics, is that mathematics is acultural or, in other words, that it is free of culture and values. According to ethnomathematics, culture and mathematics are inseparable. The following literature review will provide a number of definitions as well as a working definition for this project. Time will be taken to explore theories for integrating ethnomathematics into the classroom and finally we will look into a long term study which effectively combined ethnomathematics in the classroom. This information will demonstrate that mathematics and culture are inextricably linked.

Definition of Ethnomathematics

While the term, ethnomathematics, has existed in academic circles for some time, it lacks a definitive definition. A general definition of ethnomathematics is the interplay

between mathematics and culture. "The term "ethno" describes "all of the ingredients that make up the cultural identity of a group: language, code, values, jargon, beliefs, food, dress, habits, and physical traits," while "mathematics expresses a "broad view of mathematics which includes ciphering, arithmetic, classifying, ordering, inferring, and modelling" (D'Ambrosio, 1989, as cited in D'Ambrosio, 2001, p. 308). The Digital Library of Ethnomathematics offers a dictionary definition of the term: "…ethnomathematics is the study of mathematical techniques used by identifiable cultural groups in understanding, explaining, and managing problems and activities arising in their own environment" (Gilmer, 2003, online). Yet another definition, from Ron Eglash (1997), defines ethnomathematics as, "the study of mathematical concepts in small-scale or indigenous cultures" (p. 79). Finally, Barton (1997) declares ethnomathematics is a "research programme of the way in which cultural groups understand, articulate and use the concepts and practices which we describe as mathematical, whether or not the cultural group has a concept of mathematics" (p. 214). It is Barton's definition which I will operate under for this project. I have opted to use Barton's definition because it includes the important aspects of ethnomathematics and is presented in a succinct manner.

It is interesting to note the first part of the ethnomathematics, "ethno", does not seem to cause researchers issues in defining the overall term, but the latter, "mathematics" remains vague in their explanations. Ascher (1991) asserts that mathematics tends to be defined by whatever is done in school or college courses, hereafter referred to as academic mathematics, or what is done by Western mathematicians. Some definitions attempt to include too much information, while others

are too vague. The main problem however is that definitions rarely consider global cultures. Most often definitions revolve around what we perceive as academic or Western mathematics. Ascher (1991) indicates, "the category of mathematics is Western and so is not found in traditional cultures" (p. 3). This is important because there is a strong temptation among ethnomathematicians to explain or to infuse Western mathematics into traditional cultures which may or may not have a cultural place for Western mathematics.

While ethnomathematics can apply to any culture, researchers have focused much of their time and energy on Indigenous cultures who previously have not had a voice within academic mathematics (Greer et al 2009). Academic mathematics teaches that the Greeks were primarily responsible for the development of modern mathematics. Little attention is paid to others such as the Egyptians, Africans, Asians, Babylonians and Mayans. The reality is many societies have contributed to the body of academic mathematics knowledge.

While it is important to recognize the historical contributions of ancient civilizations to modern math, it is equally important to study and honour Indigenous (sometimes referred to as traditional) ways of knowing. D'Ambrosio (2009), Barton (1996) and Shehenaz, Alangui and Barton (2003) are strong proponents of the value brought to the field of mathematics by Indigenous cultures.

> The (mathematical) ideas of (traditional) peoples are not static but develop through time. Such knowledge may provide us with new concepts and problems in mathematics. This is a statement of human ingenuity. Privileging some peoples ideas in the discourse of mathematics while denying others is colonialism. Decolonisation involves reclaiming, protecting and valuing the unique ways of indigenous knowing and doing. (Shehenaz et al, 2003, p. 328)

As we move forward in our quest to improve the state of mathematics education in North America, we need to redefine the math that we teach. One way to accomplish this is honouring cultural knowledge.

Ethnomathematics addresses the long held belief that mathematics is acultural. In fact, mathematics is intrinsically connected to culture. If one is to stop and think about Western culture, mathematics is in nearly everything we do and every conversation we have. The Western culture that we live in is obsessed with numbers and they are a part of everything we do. Often mathematics is so interwoven in our every day lives, we do not notice the extent to which we are participating in it. While it may not be to the same extent, I believe that ethnomathematics tells us that the same is true of indigenous groups. They may not be obsessed with numbers, but the math that they use is intricately woven into their daily lives. It may be in the form of daily activities, art, music or games, but mathematics is there, even if the category of math does not exist in their world.

Ethnomathematics in the classroom

After becoming familiar with ethnomathematics, I began reflecting on a number of related questions. Some of these questions include, is there a need for ethnomathematics in elementary and secondary schools? How does ethnomathematics translate into the field of education? Are there direct links between the research and a practical application to what is being done in the classroom? The following portion of my literature review explores what current research says in relation to these questions.

One of the major issues that exists in the teaching of mathematics today is the lack of relevance between instruction and curriculum and the lives of the students (D'Ambrosio, 2001). D'Ambrosio indicates that many teachers do not understand how

culture relates to children and their learning. He claims that, "much of today's curriculum is so disconnected from the child's reality that it is impossible for the child to fully participate in it. The mathematics in many classrooms has practically nothing to do with the world that the children are experiencing" (D'Ambrosio, 2001, p. 308). This sentiment, of isolation between the students and mathematics content, is echoed repeatedly in current mathematics literature see for example D'Ambrosio, 2001; Boaler, 2002. While there are a number of factors to be considered in remedying the situation, D'Ambrosio believes, for students to achieve their full potential as mathematicians, recognition of culture needs to be infused into the classroom. He states that if, "a child's traditions, beliefs, language and habits are reflective of the culture it may foster opportunities for children to invent personal meaning and thereby better retention of subject material" (D'Ambrosio, 2001, p. 308). While D'Ambrosio is a strong proponent of why ethnomathematics needs to be considered, he does not offer suggestions or directions, in his 2001 work, as to how teachers can infuse ethnomathematics into their classrooms.

There are a number of other researchers who have hypothesized approaches for including ethnomathematics in the classroom. Shehenaz et al (2003), compiled some of these potential methods proposed by other researchers. While, I have added the term "approach", these methods include: the additive approach, a progressive approach involving children's mathematical perspectives and an integration approach. Ascher (2001), Gerdes (1991) and Zaslavsky (1996) as cited in Shehenaz et al (2003), suggest the inclusion of aspects of culture whether through art or other means as an additive to classroom content. Researchers hypothesize this method would increase students'

interest in the subject of mathematics. Shehenaz et al (2003), also bring forward Begg's (2001) idea that mathematics curriculum could be designed around a progression from a child's personal mathematical world, to the mathematical world of the child's culture, to the global mathematical world. A curriculum of this nature may be an interesting solution if it is able to effectively make mathematics meaningful and relevant to the child's world. Finally, Shehenaz et al (2003) state,

> The approach [Shehenaz et al] favour is an integration of the mathematical concepts and practices originating in the learners' culture with those of conventional, formal academic mathematics. The mathematical experiences from the learner's culture are used to understand how mathematical ideas are formulated and applied. The general mathematical knowledge is then used to introduce conventional mathematics in such a way that it is better understood, its power, beauty and utility are better appreciated, and its relationship to familiar practices and concepts made explicit. In other words, a curriculum of this type would allow learners to become aware of how people mathematize and use this awareness to learn about a more encompassing mathematics (p. 332).

For me, Shehenaz et al's (2003) final suggestion seems most logical, yet most difficult to accomplish. They suggest a seamless integration of academic mathematics with the learner's culture. While I agree with the general idea and have attempted to employ their theoretical idea in my unit plan, I do believe that accomplishing this integration has challenges. The two most noteworthy challenges are teacher's possessing a knowledge of the culture in which they are teaching and examining the worldview from which educators are approaching the subject material. Bringing ethnomathematics into the classroom is a worthy and a necessary pursuit. It will however require further exploration and cooperation between researchers, teachers and cultural knowledge keepers, if the pursuit is to be successful.

Math in a Cultural Context

Lipka, Yanez, Andrew-Ihrke and Adam (2005), conducted a long term project in Alaska referred to as Math in a Cultural Context (MCC). This project involved the development, implementation and testing of mathematics modules which focused on Yupik, Athabaskan, Inupiaq, and Tlingit cultures. These modules were a collaboration between teachers, academics and local cultural leaders. They offer a multitude of examples detailing where math is and has been used in their cultures. Workshops were offered to instruct teachers how to use this ethnomathematics material in their classrooms. Lipka et al's (2005) statistically significant results were able to show the positive outcomes in student learning when ethnomathematics is used in instruction. Despite the positive outcomes, Lipka et al's (2005) work is extremely expensive and time consuming to replicate in different geographical locations. It is simply not practical for individual school divisions to embark on a process similar to the one used by these researchers.

It is no secret in the fields of education and mathematics, that Math Wars have been raging for quite some time. At their foundation, the conflict is surrounding the ideas of how to reform mathematics education in order to make the teaching and learning more relevant for our students (O'Brien, 1999). As a mathematics educator, I firmly believe that change needs to take place. I also believe that ethnomathematics has a place in that change.

Worldviews

A worldview or paradigm is an individual's perspective on life and society. One's worldview is shaped by past experiences, relationships, formal and informal education. New experiences, relationships and education can alter one's worldview. When it comes to ethnomathematics, Ascher (1991) implies, that it is nearly impossible to separate oneself from their worldview, in order to study other's ideas.

> Nonetheless, despite viewing the mathematical ideas of others in their contexts, we must keep in mind that we are limited by our own mathematical and cultural frameworks [or worldviews]. It is more likely that we can see or understand those ideas that are in some way similar to our own, while the ideas of others, we will, of necessity, recast them into our Western mode. And, at times, in trying to convey the significance of ideas, we will do so by elaborating on our Western expression of them. (Ascher, 1991, p. 3)

Despite our best efforts it is very difficult to shed our worldviews and to consider mathematical ideas of others without a Western lens. Ascher's quote makes it clear that our understanding of mathematical ideas is framed by the ways in which we see the world. It is important to have a deep understanding and awareness of our personal and societal paradigms when exploring and attempting to understand a different culture.

An example of where we, educators, need to be aware of our worldview is found in comments made in the provincial grade 7 mathematics curriculum. Saskatchewan Ministry of Education (2007) states,

> It is important for teachers to recognize the influence of cultural contexts on mathematical learning. Educators need to be sensitive to the cultures of others, as well as to how their own cultural background influences their current perspective and practice. Many First Nations and Métis view the world from a more holistic perspective than mathematics is often taught (p. 17).

Most often, when discussing mathematics, teachers approach the subject from a Western worldview. The curriculum document is encouraging teachers to be aware of personal paradigms and to consider approaching their teaching from a holistic perspective.

The following is a table comparing a Traditional Western worldview to the Indigenous worldview. The term Indigenous worldview refers to an overarching worldview; each Indigenous group has worldview characteristics, which distinguish them from each other. It succinctly summarizes and highlights many of the foundations of each worldview. (The table is the work of Gale Russell, a PHD candidate at the University of Saskatchewan.)

TRADITIONAL WESTERN WORLDVIEW	**INDIGENOUS WORLDVIEW**
<u>Values</u> o Linear and singular o Static and objective (resulting in one true answer, one right way) o Specializations are ranked in terms of prestige o Scientific method "an observation is attempted in isolation and in an artificial environment o Definite conclusions (that is the way it is) o Measurability is essential – if it can't be measured it can't be trusted. o Focus is on physical objects and processes that are external to the person o Compartmentalization, isolation, and	<u>Values</u> o Wholeness: focusing on the group with the individual contributing to the group, focusing on the overall context rather than one or more components of it. o Relationships (with all of creation) o Subjective o Reciprocity – things are done to give back to the greater whole o Physical, emotional, spiritual, and intellectual diversity and knowledge o Observation and personal experience and intuition as sources of data o Place where knowledge is constructed and lives o Truth can be kept in oral language

categorization of knowledge o Truth is captured in written language	

Personal Reflections on Worldviews

As a beginning mathematics educator, I taught as I had learned. My lessons and methods were steeped in "traditional" mathematics. My lessons looked similar from one day to the next. Each day I would discuss and correct the previous days work with the students, introduce, teach and demonstrate how to complete the day's assignment and finally provide students with a new assignment. Topics were taught in isolation. If I was presenting multiplication of fractions, that is all we would do. I did not relate multiplication of fractions to the real world or relate the topic to other elements of math. I followed the very compartmentalized textbook. Several aspects of the above story demonstrate how clearly rooted I was in the traditional Western worldview. First of all, as the teacher, I was the authority in the classroom and told the students the way it was. If discussions arose over the correct way to complete a question – I was the authority and determined the correct way. My students were taught to follow the steps to the correct answer. As long as steps could be followed and remembered, they were practically guaranteed a good mark, which was the measure of success in the classroom. My practices were firmly rooted in the Western tradition: I was the authority, there was a correct and incorrect way to complete the assignment and students were assessed based on their percentage of correct answers. Students were not encouraged to think in a mathematical way. They were not encouraged to pursue different ways to solve problems. They were not given opportunities to construct their own knowledge.

In the last number of years, I have learned the value of reform style mathematics and have altered the ways in which I teach mathematics. According to the principals of instruction NCTM's 1989 Standard's document, reform math revolves around five main goals. "Students should: value mathematics, be confident in the ability to do mathematics, become mathematical problem solvers, learn to communicate mathematically, and learn to reason mathematically. Reform is about children and learning" (Van De Walle, 2003, online).

Several changes have taken place in my thinking in order for me to alter my teaching. First of all, I recognized that the traditional mathematics was not serving my students; often they were not engaged by learning mathematics, in fact many dreaded math. Over the course of a number of years, lots of professional development and working towards a Master's degree in mathematics education, I have begun embracing a reform approach to my teaching and, in particular, embracing a constructivist and a holistic worldview. "Constructivist learning is based on students' active participation in problem-solving and critical thinking regarding a learning activity which they find relevant and engaging. They are "constructing" their own knowledge by testing ideas and approaches based on their prior knowledge and experience, applying these to a new situation, and integrating the new knowledge gained with pre-existing intellectual constructs." ("Learning Theories", 2007, Online).

My classroom and its format look very different than it once did. The voices of my students are heard most often. When I speak it is often in the form of a question to solicit students thoughts and opinions. Our classes often begin with a problem, one that may or may not be related to our "current topic". At times, we spend the whole class on

one rich problem. Students are encouraged to work together to solve the problem. My role is to prompt, lead discussions and draw ideas out of my students. At times, I will demonstrate how I solved a problem and then invite students to come up and show their methods for solving. The emphasis is no longer on racing to an answer, but the processes by which problems or questions can be solved. Rarely do my students sit quietly at their desks; they are interacting, debating and helping one another. My hope is that by adopting a more holistic and constructivist approach, my students will gain a deeper, lasting appreciation of mathematics.

First Nations and Métis Mathematics Education in Saskatchewan

Saskatchewan's most recent curriculum documents acknowledges the importance of teachers understanding the link between culture and mathematics. The curriculum document indicates that some First Nations and Métis students develop a negative sense of their abilities and as a result perform poorly in mathematics assessments. The curriculum writers suggest the reason is "students may become alienated from mathematics because it is not taught to their schema, cultural and environmental content, or real life experiences" (Saskatchewan Ministry of Education, 2007, p.17). They go on to say,

> A first step in actualization of mathematics from First Nations and Métis perspectives is to empower teachers to understand that mathematics is not acultural. As a result, teachers then realize that the traditional ways of teaching the mathematics are also culturally-biased" (Saskatchewan Ministry of Education, 2007, p. 17).

These comments demonstrate the importance of the fields of ethnomathematics and culturally responsive education as they pertain to First Nations and Métis student success in the province of Saskatchewan.

Teachers in our province are in a challenging position. We are expected to incorporate and honour First Nations and Métis content and ways of knowing through the curriculum. For teachers who intimately understand First Nation's and Métis culture, integrating content/culture may be straight-forward; however, for teachers, like myself, who are trying to learn about and honour First Nations and Métis culture, the challenge is difficult. Resources put forth by the Office of the Treaty Commission and information available via the Saskatchewan Indian Cultural Center are excellent beginning points for incorporating content. Many of these resources, however, do not provide information that is intended for the mathematics classroom. It is left up to teachers to find and incorporate mathematics related cultural content into their classrooms. For me, fear of being disrespectful to the First Nation and Métis communities can dissuade me from attempting to include cultural content.

Aboriginal and Constructivist Approaches to Teaching and Learning

It is important to employ First Nations and Métis approaches to teaching and learning along side content. Kenneth Campbell (2003), in his BC First Nations Studies Teacher's Guide provides a list of Aboriginal Approaches to Teaching and Learning. In reading these approaches, it is crucial to notice the emphasis placed on holistic ways of knowing. These approaches include:

1) Mastery, belonging, generosity, independence

2) Modeling and observation
3) Watching, then doing
4) Respecting the learner and the choices the learner makes
5) Teaching and speaking with a language of respect
6) Accepting and honouring the contributions of all.
7) Building on the strengths of the learners
8) Using reflective thinking
9) Building on the ideas of others (as opposed to offering a critique)
10) Patience
11) Humour
12) Understanding that learning in a group context such as the family can transfer to the classroom situation
13) Valuing the oral tradition and storytelling
14) Encouraging harmony, acceptance, and understanding
15) Connecting with each other in a close, caring relationship
16) Incorporating hands-on experiences
17) Recognizing that real, relevant experiential learning can occur outside the classroom
18) Understanding that everything is connected and concepts cannot be isolated from other concepts
19) Mentoring
20) Using Talking Circles (p. 12)

Upon reviewing the Aboriginal approaches to teaching and learning, I was struck at how closely related many of the approaches were to constructivist learning theory. Constructivist learning is widely accepted as a best practice among educators (O'Brien, 1999) and (Boaler, 2001). As such, it is interesting to compare a list of constructivist characteristics with those of Aboriginal approaches to teaching and learning. Elizabeth Murphy (1997) compiled a list of constructivist approaches some of which include:

1) Goals and objectives are derived by the student or in negotiation with the teacher or system.
2) Activities, opportunities, tools and environments are provided to encourage metacognition, self-analysis, -regulation, -reflection & -awareness.
3) The student plays a central role in mediating and controlling learning.
4) Learning situations, environments, skills, content and tasks are relevant, realistic, authentic and represent the natural complexities of the 'real world'.
5) Construction takes place in individual contexts and through social negotiation, collaboration and experience.
6) The learner's previous knowledge constructions, beliefs and attitudes are considered in the knowledge construction process.

7) Exploration is a favoured approach in order to encourage students to seek knowledge independently and to manage the pursuit of their goals.
8) Knowledge complexity is reflected in an emphasis on conceptual interrelatedness and interdisciplinary learning.
9) Collaborative and cooperative learning are favoured in order to expose the learner to alternative viewpoints. (Online)

In comparing Murphy's (1997) and Campbell's (2003) approaches to learning, a number of similarities emerge. First of all, both approaches are firmly rooted in a holistic worldview. While Aboriginal Approaches to teaching and learning mention the holistic worldview, constructivist approach implies a holistic worldview. A focus on collaborative and cooperative learning, emphasis on the real world, and focus on student centeredness, implies a holistic approach. Thus, in both descriptions effective instruction takes place when teachers understand and embrace a holistic worldview. Other similarities include the emphasis on real world experiences, building on the ideas of others through social connections, collaboration and cooperation with in the learning process. Employing these strategies while including the culture of one's students can greatly enhance their learning experience.

Saskatchewan teachers need to realize that while there are differences between Aboriginal approaches and constructivist approaches to teaching and learning, both have some of the same elements and may already be in place in their classrooms. By employing constructivist and Aboriginal approaches to teaching and learning, Saskatchewan teachers can begin to address the challenges associated with "schema, cultural and environmental content, or real life experiences" (Saskatchewan Ministry of Education, 2007, p.17). By using constructivist and Aboriginal approaches, teachers can make changes, which can positively impact all students, regardless of their cultural backgrounds.

Unit Background

A project of this nature is important to Saskatchewan teachers, because we are expected to provide both treaty education and incorporate First Nations and Métis content in all subjects and at all grade levels. In addition, the mathematics curriculum document is requiring that we include aboriginal approaches to teaching and learning.

As a non-First Nations teacher, attempting to fulfill the requirements of the curriculum, I am in a fortunate situation, where almost one hundred percent of my students are First Nations and we have an Elder in our school. Being immersed in their culture has been an amazing educational experience. Recently, I sat down to talk with our school's Elder and she began to explain her cultural customs. I asked her to tell me about the significance of the medicine wheel. She was quick to explain that she was not a treaty Indian, but a Métis person. Much of the knowledge that she had, had been taught to her by her late husband. As she went on to tell me about him and his beliefs, I began to understand that in order for someone to pass on knowledge, they must be given that knowledge by someone else, someone who deeply understands the material, custom or spiritual belief. Being immersed in the culture has been an amazing educational experience.

This project is the result of many people passing their knowledge on to me. The lessons and commentary contained in this project are the result of my synthesis of the information. I have made every attempt to honour the people and the spirit of the knowledge shared with me. I have attempted to embrace a holistic worldview. The fact is, however, that I am just beginning to shed my Western worldview and embrace one more like that of the First Nations people. As a result, there may be occasional

inconsistencies, in my perspective, and approach. These inconsistencies in my perspective signify change is taking place. I have not yet arrived at my destination, but am in the process of learning.

It is also important to note, while this unit is designed to respond to the First Nations' culture, not every child has been educated in their traditional ways; however, there may be opportunity to educate about culture while teaching math. As an example, recently, I was teaching my Grade 2 students about treaties. One of the first lessons discusses how First Nations people helped the fur traders by supplying them with food, canoes etc. I thought the lesson had gone well and the students understood the concepts taught. Later on that evening, in a discussion with one of my student's grandmothers, I was told that she went home and asked if there was anyone in her family who was of First Nations' descent. She, and many others in the class, did not know that they were First Nations. I had assumed that they knew about the cultural differences between them and myself. As I continued my conversation with the school elder, she told me that not every student was educated in their cultural ways. As each lesson is taught, it is becoming clear to me, which students know their heritage and which do not.

Project Design

When I began the instructional design component of this project, I selected circles, because I was able to come up with several examples from First Nation's culture where circles were used. Over the course of planning and piloting my lessons, I am starting to understand how important and sacred circles are to First Nation's people. As such, it is of extreme importance to approach the inclusion of cultural content with caution and utmost respect. Each of these examples has a rich history and significance

that must accompany their inclusion in lessons. From the shape of the tipi, to talking circles, to dances, many traditions of First Nations people occur in or are connected to the circle. Many sacred ceremonies and buildings are in a circular form, including the tipi and a sweat lodge. The Grand Entry and the Round Dance are both in circular form. Allow me to elaborate on the Grand Entry for a moment. As the name suggests the Grand Entry is the beginning of the pow wow. The purpose of the Grand Entry is to bring in all of the dancers. The entry typically begins with Veterans carrying an eagle staff and the Canadian flag followed by dignitaries and dancers. The Veterans' position at the front of the Grand Entry is a sign of respect and honour for their willingness to die for their people and their land. All dignitaries and dancers walk or dance into the pow wow area, form a circle and continue to loop until everyone has entered the area. This is an example of some of the background information, which should accompany the inclusion of customs such as the Grand Entry. Many of the circular examples that I have included in my lesson plans have rich significance to First Nations people. It is important to approach the inclusion of such items with respect. Wherever possible, teachers should bring an elder into the classroom to explain the history, significance and relationship of the topic being introduced to the class.

Professor Emeritus, Dr. Harley Weston, from the University of Regina, and his students developed a website titled, Aboriginal Perspectives, in which they offer an example of incorporating First Nations' culture into lessons. The website presents educators with a wide array of First Nations customs, art and games. In addition, it provides videos on constructing tipis, birch bark bitings and how mathematics is used in the everyday lives of several professional First Nations people. This is a valuable

resource for Saskatchewan teachers looking to incorporate First Nation, Métis and Inuit content into their classrooms. In a recent interview with Dr. Weston, he suggested it is best to use these traditional pieces of knowledge as a backdrop for what is being taught the mathematics classroom (H. Weston, personal communication, March 22, 2012). The format presented in the website is to connect cultural pieces of knowledge to the mathematics subject matter. A detailed history and significance of the cultural item is provided, and then the academic lesson is provided. I support this framework, because it does not impose academic mathematics into a cultural piece of knowledge, but relates the two in a respectful and meaningful way.

Like the issue of being respectful of cultural content, another issue, which requires addressing, is that of awareness and cultural sensitivity. As I was planning my unit, I wanted to pull mathematics into culture wherever possible. When it came to the hands-on problem-solving lesson, I had considered asking students to construct medicine wheels and to find the area inside the wheel. Being fully aware of a need to be respectful and a desire to "pull mathematics into culture" as opposed to "pulling culture into mathematics", I abandon my original idea. I felt that I would not be honouring the tradition of the medicine wheel. In addition, Doolittle (2006) in his article, Math as Medicine, indicates that Medicine Wheels aren't perfect circles.

> ….a geometrical, abstract medicine wheel is not real. But what then, is a real medicine wheel? It is an approximately circular arrangement of stones on the ground, often with spokes radiating from a centre, sometimes with loops of stones occurring at irregular intervals around the perimeter. Note that they blend with the landscape as it rises and falls; they are not regular" (p. 20).

It became apparent that in order to make my favored example work, I would need to tweak a cultural construct to fit my purposes. However, I believe this is wrong and

Doolittle (2006) indicates that the changing or oversimplification of cultural practices is likely to disengage or confuse our students.

Upon reflection, I chose, instead, to incorporate an Aboriginal and constructivist approach by looking for something in the real world and our community, which would work. The local skating rink is cylindrical in shape. Instead of forcing culture into math, I chose to respond to the culture and community around the school and to make the community the backdrop for our learning.

Introduction and Comments on Circles Unit

This grade 7 unit plan on circles includes four lessons, which should each take between an hour and an hour and a quarter to teach. My goals for the lessons are to:

1) To combine ethnomathematics with the culture of the daily lives of students
2) To design a strong constructivist unit with an emphasis on reform math
3) Incorporate rich problem solving
4) Incorporate a hands-on approach

The lessons designed are based on learning outcomes and indicators from the Saskatchewan's *Mathematics 7* curriculum document. The lessons cover many of the outcomes outlined in the Grade seven unit on circles. The lessons have been specifically designed for the community that I am teaching in, and therefore includes emphasis on the local community and examples from the Plains Cree traditions. In addition, I have included references to a number of different civilizations and cultural groups. While my focus is on First Nations content, I have made an effort to make the content global as well. Teachers can, however, use the format and ideas to make the lessons relevant for their students and community.

Both the constructivist and aboriginal approaches to teaching and learning included in these lessons emphasize the importance of real world learning. As such, the lessons connect mathematical concepts to the real world and many incorporate a hands-on approach.

Finally, this unit is designed in a slightly untraditional way. The lessons and activities are structured to bring both different cultures and the cultures of youth into the classroom. As such there will not be pages of math to complete, as reform mathematics tells us that children learn better by engaging in and exploring topics. The traditional method of drill and practice has been found to harm students learning (O'Brien, 1999). Instead of drill and practice, I suggest teachers encourage their students to explore the problems and relationships presented in the lessons. By asking students to keep track of which learning outcomes they have mastered in their journals, learning is further reflected on and often solidified. Have students prove to you, the teacher, that they indeed understand the outcomes. I recommend having them hand in their journals daily with at least one self-generated example for each of the outcomes, which can be checked for understanding. Curriculum outcomes can be found in the Supporting Materials section of this paper.

A Note on Black Elk: The second lesson uses a translated quote from Sioux Medicine Man - Black Elk. The quote explains why he believes circles are the basis for power for First Nations people. If possible, teachers should bring a local traditional knowledge keeper or an Elder into the classroom when introducing this piece to the students. The Elder will be able to give their opinion on the quote and answer any cultural questions students may have. A small but interesting point was raised while

piloting this lesson. One of my students pointed out tipi or teepee was spelled incorrectly in the quote. In looking into this, I believe the spelling is dependent upon the First Nation. It would be wise to check this with a local elder.

Circles Lesson Plans

LESSON 1: Introduction to Circles

UNIT: Circles

GRADE: 7

EQUIPMENT: Activity Cards (laminated), circular objects from everyday life, snow, math journals, scissors, and squares of paper

LEARNING OUTCOMES:

- Identify the characteristics of a circle.
- Define and illustrate the relationship between the diameter and radius of a circle.
- Answer the question "how many radii does a circle have and why?
- Answer the question "how many diameters does a circle have and why?
- Illustrate and explain the relationship between a radius and a diameter of a circle.

LESSON CONTENT - ACTIVITY	TEACHING POINTS AND ORGANIZATION
Introductory Activities We are going to play with circles. Ask students what they already know about circles and their role in students' daily lives.	Ask students to share their cultural connections to circles. Some First Nation's examples may include: tipi's, medicine wheel symbol, birch bark baskets, dream catchers, drums, formation of some pow-wow dances.
Skill Development/Concept 1) Take students outside to play in the snow. Construct the most accurate circle that you can. Instruct students to work in pairs and to follow the activity sheet. 2) Bring the students inside: Revisit the questions that were asked outside and draw connections. 3) Construct student definitions of	Depending upon your student's background and experience, they may not see a link between culture and math. A power point showing other examples of circles related to culture (yin and yang, tipi, mandala, drums, curling and other sports) Use the Circles in the Snow Activity Card to direct students. They should discuss each of the questions and attempt to provide answers for each. Once inside, these questions could guide their math journal reflections.

diameter, radius and circumference. Record these definitions in student's language.	
4) Carry out the turn a square into a circle. Provide students with a square piece of paper. Ask them how they know that the shape is a square and can they prove that it is. *Possible answers:* -All sides are the same length -Looks even -The interior angles are 90 degrees -If you fold it in half the sides should line up -If you fold on the diagonal the "triangles" should match Instruct students to construct a circle out of their square. Permit the use rulers, pencils and scissors. Compasses, protractors and trace items should not be allowed. The circle should be as large as the paper allows. This is a preliminary exercise to see what they know about circles and what they can apply. Once students have constructed their circles, discuss how their circles turned out. You may ask them how close to perfect their circles are and how do they know that they are perfect? Brainstorm characteristics of circles: Suggestions: -360 degrees -4 quadrants (medicine wheel) –when we think back to the circle -Round -No matter which way you fold a circle, along its center it will mirror itself -Circle of life -Continuous – no beginning or end point. Walk around the room looking for students who are constructing accurate circles.	Turning a square into a circle lesson is related to the Alaskan Yupik people. Another activity, which is more closely related to First Nations in Saskatchewan, is birch bark bitings. Teachers can easily have their students create birch bark bitings by folding carbon paper inside of regular bond paper. Students would then be instructed to bite patterns into the paper, upon unfolding intricate designs are revealed. Paper and carbon should be cut into squares approximately 4 x 4 inches. The carbon paper should be placed face down on the white paper. Fold the paper in half and then in half again. From the center point fold the two corners of the square into a triangle. Students should practice biting along the center portion and the edges of the triangle, so that designs appear circular. To obtain rich background information, go to http://www.aboriginalperspectives.uregina.ca/workshop2010/biting/symmetryandbiting1.shtml

Ask questions to get an understanding of what students are doing. "I see that you are folding the paper, why?" "Can you explain what you are doing? Bring in the idea of Yupik people of Alaska and the patterns that they create on their parkas. The ancient people did not use traced circles or a compass. They used their understanding of geometry to create accurate shapes. Demonstrate the methods that were used by the Yupik elders. They began with a square and used another small piece of paper or measurement tool to act as a radius. They marked points from the center of their circle. The more points the more accurate their circle. Keep the circle in the math journal. Have students discuss the different methods that they tried and describe the Yupik method.	
Evaluation Have students write about circles in their journals, what did they learn? What are they wondering about? Ask students to pay attention to circles in their everyday lives. Create a list for next class of where they find circles and how they are useful. Also consider if another shape could fulfill the same roll.	
Closure Have student respond to the learning outcomes for this lesson in their math journals, explaining what they have learned.	If you have a classroom blog or access to computers…journals can be done in a creative fashion. For example, you could have students tweet what they have learned.

LESSON 2: What is Pi?

UNIT: Circles

GRADE: 7

EQUIPMENT: Copies of Worksheet #1, cylindrical and circular items from everyday life, string, rulers, calculators

LEARNING OUTCOMES:

- Generalize from investigations, the relationships between the circumference and the diameter of a circle
- Define Pi and explain how it is relates to circles

LESSON CONTENT - ACTIVITY	TEACHING POINTS AND ORGANIZATION
Introductory Activities Review last day's learning outcomes. Ask students to share what they discovered.	Definition: Pi is a number - approximately 3.142 It is the circumference of any circle divided by its diameter.
Skill Development/Concept 1) Warm up activity Begin by reading and discussing the Black Elk quote. If there is an Elder in the school or community, this would be a terrific opportunity for them to discuss the importance of circles to First Nations' culture with your class. 2) Discover pi Discover pi – Fill in the t-chart provided After defining the components of a circle, provide students with a length of string and several cylindrical items such as tin cans, candles, and cylindrical blocks. Have them measure the diameter and the circumference of the items (using string) Record findings in Worksheet #1. Students need to look for the relationship between the circumference and diameter	The website, Angio, has pi to a million digits: http://www.angio.net/pi/digits/pi1000000.txt Consider taking your students for a walk to a circular item/location in your community. Ask them to go through the process of measuring the circumference and diameter of the location. Examples: o Fountain in a park (e.g., Bessbourgh hotel or Innovation Place in Saskatoon) o Grain bin o Throwing ring (track and field) o The rings of a curling rink (possibly combine with a PE trip) o Base of a tipi o Face off circles in hockey

of a circle. With students, demonstrate how to find the circumference of a circle. Have each group share their ideas with the class. Students should discover that the diameter of the circle fits 3 + times around the outside of the circle or that circumference/diameter are 3.14…. Ask them if they know the number 3.142759…and what the term is that is associated with the number. Essentially, they have been able to approximate pi. 3) Talk about ancient civilizations discoveries and what pi would be used for. See information sheet. 4) Ask students how to calculate circumference, if they know or can measure the diameter. With guidance, the students should be able to identify that diameter (or two times the radius multiplied) by pi can be used to find circumference. (Use pictures from the community and have them practice calculations)	In Punnichy, take a picture of the tipi on Gordon's reserve. Have students recreate the tipi base in the snow on the playground. Be sure to discuss the historical importance of the tipi – watch video on raising a tipi on the Aboriginal Perspectives website.
<u>*Culminating Activity*</u> Instruct students to add an explanation of pi to their posters. Have students create their own word problem related to pi.	
<u>*Closure*</u> Review material and write discoveries on the board or classroom poster.	

LESSON 3: Circumference of a Circle

UNIT: Circles

GRADE: 7

EQUIPMENT: Problem Sheet #1, calculator, measuring tape/trundle wheel, rubric for problem solving

LEARNING OUTCOMES:

- Solve problems involving circles
- Develop an understanding of nets (3-D objects)
- Using problem solving in everyday life

LESSON CONTENT - ACTIVITY	TEACHING POINTS AND ORGANIZATION
<u>*Introductory Activities*</u> 1) Provide students with a leveled problem sheet. Note: The skating rink in our town is a typical half cylinder shape. 2) Allow students time to plan how they will solve the problem and how they will collect the needed information. 3) Provide time to solve the problem(s) and be available to answer questions. Answers will likely be written in a more concrete form. At the closure of the activity teachers will need to bridge between what the students have learned and formulas etc.	This problem is designed to stimulate student's problem solving ability. Two problems have been provided; teachers may assign both or have the class select a question. For organizational purposes the whole class should work on the same problem. After students have been given the question, turn them loose. Be available to teach, but prompt students with good questions, related to what they already know, try not to tell them how to do the problem. The goal is for students to make their own discoveries and to construct knowledge. Note- The first problem was designed for the community I work in. Look around your community for similar problem solving opportunities. Students can be challenged to create and solve their own problems! Depending on students' ability level it may be prudent to turn them loose for a time and then pull them together to pool their information.

Skill Development/Concept Review calculations for the circumference of a circle and the area of a rectangle.	
Culminating Activity Suggestion: If possible have a local handyman come in and discuss how they would calculate the area of the roof and the cost of the shingles.	
Closure Have students turn in their solutions, write about any discoveries in their journals	

LESSON 4: Area of a Circle

UNIT: Circles

GRADE: 7

EQUIPMENT: Bannock, knives, compass, ruler

LEARNING OUTCOMES:

- Draw a circle with a specific radius or diameter with and without a compass.
- Develop and practice using formulas for the area of a circle

LESSON CONTENT - ACTIVITY	TEACHING POINTS AND ORGANIZATION
Introductory Activities Set up stations which have students constructing circles, given specific radii, using a variety of methods, including: -A string and thumb tack -A compass	
Skill Development/Concept Develop and guide students through the process finding the area of a circle. Information for this lesson follows *MathLinks 7*. 1) Estimate the area of the bannock using a grid paper transparency. 2) Cut the bannock into eight equal sections. Ask students how to find the dimensions. 3) Measure the radius 4) Calculate the circumference using $C=\pi D$ 5) Place the wedges together to form a parallelogram 6) Use the formula b x h to calculate the area. In this case the height is the same as the radius and the height is half of the circumference 7) Compare this to the formula for the area of a circle, $A = \pi r^2$ 8) Students will find that both formulas will provide the same answers	Middle Years students love when Math and eating are combined in a lesson. This lesson would be a great opportunity to make bannock, which is circular shaped round bread. I've also made pizza, as per a class' request. Both work.

Culminating Activity -Find 5 items in the classroom that are circular and find the area of each of them. -Find the area of an item brought from home.	
Evaluation On their poster – have students add – how to construct circles with a given radius and how to find the area	

Supporting Material

Curriculum Outcomes

The following are the outcomes and indicators related to circles outlined in the Saskatchewan curriculum document:

Demonstrate an understanding of circles including circumference and central angles.

Identify the characteristics of a circle.

Define and illustrate the relationship between the diameter and radius of a circle.

Answer the question "how many radii does a circle have and why?"

Answer the question "how many diameters does a circle have and why?"

Explain (with illustrations) why a specified point and radius length (or diameter length) describes exactly one circle.

Illustrate and explain the relationship between a radius and a diameter of a circle.

Generalize, from investigations, the relationship between the circumference and the diameter of a circle.

Define pi (π) and explain how it is related to circles.

Sort a set of angles as central angles of a circle or not.

Demonstrate that the sum of the central angles of a circle is 360°.

Draw a circle with a specific radius or diameter with and without a compass.

Solve problems involving circles.

Develop and practice using formulas for the area of a circle.

Black Elk Quote

I am now between Wounded Knee Creek and Grass Creek. Other's came too, and we made these little gray houses of logs that you see, and they are square. It is a bad way to live, for there can be no power in a square.

You have noticed that everything an Indian does is in a circle, and that is because the Power of the World always works in circles, and everything tries to be round. In the old days when we were a strong and happy people, all our power came to us from the sacred hoop of the nation, and so long as the hoop was unbroken, the people flourished. The flowering tree was the living center of the hoop, and the circle of the four quarters nourished it. The east gave peace and light, the south gave warmth, the west gave rain, and the north with its cold and mighty wind gave strength and endurance. This knowledge came to us from the outer world with our religion. Everything the Power of the World does is done in a circle. The sky is round, and I have heard that the Earth is round like a ball, and so are all the stars. The wind, in its greatest power, whirls. Birds make their nests in circles, for theirs is the same religion as ours. The sun comes forth and goes down again in a circle. The moon does the same, and both are round. Even the seasons form a great circle in the changing, and always come back again to where they were. The life of a man is a circle from childhood to childhood, and so it is in everything were power moves. Our teepees were round like the nests of birds, and these were always set in a circle, the nation's hoop, a nest of many nests, where the Great Spirit meant for us to hatch our children.

But the Waischus (whitemen) have put us in these square boxes. Our power is gone and we are dying, for the power is not in us anymore. You can look at our boys and see how it is with us. When we were living by the power of the circle in the way we should, boys were men at twelve or thirteen years of age. But now it takes tem very much longer to mature.

Well, it is as it is. We are prisoners of war while we are waiting here. But there is another world.

Neihardt, 1961, p150-151

What do you think, is there power in circles?

Why does Black Elk think that circles are important?

Are circles dominant in nature?

In Aboriginal classrooms…do you agree with the comments made by Black Elk?

Does he accurately portray religion?

Formal Definitions

Circle:	a line forming a closed loop, every point on which is a fixed distance from a center point. (Math Open Reference)
Diameter:	a line segment that joins two points on the circumference of a circle and passes through the centre; the length of the line segment; the diameter is the longest line segment that can be drawn inside the circle's circumference. (Math Focus 7)
Radius:	a line from the center of a circle to a point on the circle. (Math Open Reference)
Circumference:	the boundary of a circle; the length of this boundary (Math Focus 7) The distance around the edge of a circle. Also 'periphery', 'perimeter'.
Sector:	the part of a circle enclosed by two radii and their intercepted arc; a pie-shaped part of the circle. (Math Open Reference)

Activity Card: Circles in the snow

Create an accurate circle.

How did you ensure that your circle was accurate?

Is there a relationship between the distance from the center of the circle to the outside of the circle?

How could you measure the distance?

From edge to edge through the middle?

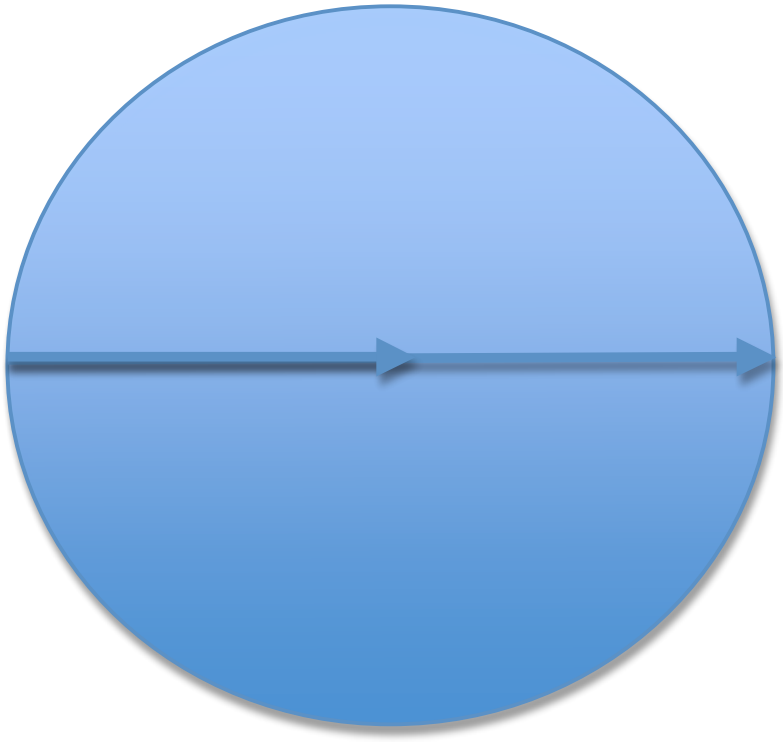
From edge to edge and around the outside?

Measure the following parts of the circle and record your measurements.

Halfway Across: _____

Total Distance Across: _____

All the way around the outside: _____



Exploring the relationship between circumference and diameter

Item	Diameter (length)	Circumference (approximately)	Observations

What do you notice about the relationship between the diameter and the circumference?

What results do you get if you divide the circumference by the diameter?

History of Pi

Did you know that the idea of pi dates back thousands of years? It is even mentioned in the Bible. Many different civilizations had ideas about pi. Here is a sampling of some cultures and the values that they used:

- Babylonians - 3 1/8
- Egyptians - $(16/9)^2$
- Chinese – 3 and Hebrews - 3

Answer each of the following questions; include explanations for each of your answers.

Which is the closest approximation? How do you know?

When could we use an approximation for pi?

When would an exact value be required?

Why pi is useful?

Is pi important?

Problem Sheet

Rink Problem

Level 1: Find the circumference of the rink. Remember that it is a half circle.

Level 2: What is the area of the roof?

Level 3: If you were a contractor, how much would it cost to shingle the roof?

Tire Problem

Level 1: How many times would a bike tire rotate in one km?

Level 2: How many times would a bike tire rotate between your school and your house?

Level 3: Approximately how many times would a tire rotate if you rode your bike to school everyday?

Problem Solving Rubric

CATEGORY	4	3	2	1
Contributions	Routinely provides useful ideas when participating in the group and in classroom discussion. A definite leader who contributes a lot of effort.	Usually provides useful ideas when participating in the group and in classroom discussion. A strong group member who tries hard!	Sometimes provides useful ideas when participating in the group and in classroom discussion. A satisfactory group member who does what is required.	Rarely provides useful ideas when participating in the group and in classroom discussion. May refuse to participate.
Focus on the task	Consistently stays focused on the task and what needs to be done. Very self-directed.	Focuses on the task and what needs to be done most of the time. Other group members can count on this person.	Focuses on the task and what needs to be done some of the time. Other group members must keep this person on-task.	Rarely focuses on the task and what needs to be done. Lets others do the work.
Problem-solving	Actively looks for and suggests solutions to problems.	Refines solutions suggested by others.	Does not suggest or refine solutions, but is willing to try out solutions suggested by others.	Does not try to solve problems or help others solve problems. Lets others do the work.
Attitude	Never is publicly critical of the project or the work of others. Always has a positive attitude about the task(s).	Rarely is publicly critical of the project or the work of others. Often has a positive attitude about the task(s).	Occasionally is publicly critical of the project or the work of other members of the group. Usually has a positive attitude about the task(s).	Often is publicly critical of the project or the work of other members of the group. Often has a negative attitude about the task(s).

Designed using Rubistar, accessed at http://rubistar.4teachers.org/, an online rubric-creating tool.

Poster Assignment

This assignment is to be completed as you make new discoveries about circles.

1. Begin by selecting a fairly large circular object from home. It should be something that isn't valuable and can be left at school for a little over a week. If you are using something very large, please check with your teacher first. Some examples include, a bike tire, bottom of an ice cream pail, a circular floor mat.
2. At the end of each lesson, you need to record what you have learned on the poster. Your poster becomes a piece of evidence of your learning.
3. See the poster rubric for further details.

Poster Rubric

CATEGORY	4	3	2	1
Required Elements	The poster includes all required elements as well as additional information.	All required elements are included on the poster.	All but 1 of the required elements is included on the poster.	Several required elements were missing.
Use of Class Time	Used time well during each class period. Focused on getting the project done. Never distracted others.	Used time well during each class period. Usually focused on getting the project done and never distracted others.	Used some of the time well during each class period. There was some focus on getting the project done but occasionally distracted others.	Did not use class time to focus on the project OR often distracted others.
Knowledge Gained	Student can accurately answer all questions related to facts in the poster and processes used to create the poster.	Student can accurately answer most questions related to facts in the poster and processes used to create the poster.	Student can accurately answer about 75% of questions related to facts in the poster and processes used to create the poster.	Student appears to have insufficient knowledge about the facts or processes used in the poster.
Attractiveness	The poster is exceptionally attractive in terms of design, layout, and neatness.	The poster is attractive in terms of design, layout and neatness.	The poster is acceptably attractive though it may be a bit messy.	The poster is distractingly messy or very poorly designed. It is not attractive.
Graphics - Clarity	Graphics are all in focus and the content easily viewed and identified from 6 ft. away.	Most graphics are in focus and the content easily viewed and identified from 6 ft. away.	Most graphics are in focus and the content is easily viewed and identified from 4 ft. away.	Many graphics are not clear or are too small.

Designed using Rubistar, accessed at http://rubistar.4teachers.org/, an online rubric-creating tool.

Resources for Teachers

University of Regina Website – Aboriginal Perspectives –

A rich website looking at many cultural games and aspects of First Nation's, Inuit and Métis heritage:

http://aboriginalperspectives.uregina.ca/introduction.shtml

University of Minnesota

Title of the Lesson: Canoe Study – A Math Lesson

Grade level – 7

This lesson has students draw a life sized canoe.

http://intersectingart.umn.edu/?lesson/13

Saskatchewan Indian Cultural Center

Offers a rich source of information on the First Nation's culture in Saskatchewan.

http://www.sicc.sk.ca/

Birch Bark Biting Lessons

Video interview of a woman who creates birch bark bitings and lesson plans

http://aboriginalperspectives.uregina.ca/rosella/lessons/math/

Heirloom Geometry

http://ebookbrowse.com/heirloom-geometry-lesson-plan-doc-d103138282

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