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Guitars and Makerspace: Examining the Experience of First Nations Students

Guitares et laboratoires ouverts : examen de l'expérience d'élèves des Premières Nations

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Abstract

This research project examined the impact on student engagement of a makerspace approach in an all-First Nations high school. First Nations learners have many factors limiting their success in the K-12 system such as lack of connection to the curriculum, limited cultural relevance of course content, and poor attendance. A common concern for those working with First Nations students is how to deliver a learning experience that is engaging and assists students in earning enough credits to graduate. In this case study, a makerspace approach to learning was used to engage and support learners. A makerspace is a learning context where participants are supported and encouraged to design and create as part of required learning, to meet curricular objectives, or to creatively explore their own ideas. The program at the focus of this research introduced students to 3D computer design technology and (computer numerical control) CNC wood milling technology to make electric guitars. This project used a case study design to determine ways to improve the school experience of First Nations students through unique course design. The findings show that the experience for students was positive, engagement increased, and attendance showed improvement.

Résumé

Ce projet de recherche s'est penché sur l'incidence d'une approche « Makerspace » (laboratoire ouvert) sur l'engagement des élèves dans une école secondaire fréquentée uniquement par des membres des Premières Nations. Plusieurs facteurs limitent la réussite des apprenants des Premières Nations dans le système scolaire de la maternelle à la 12^{e} année, comme un manque de connexion au programme, la pertinence limitée du contenu des cours et un haut taux d'absentéisme. Les personnes qui travaillent auprès des élèves issus des Premières Nations ont comme préoccupation commune l'offre d'une expérience d'apprentissage qui engage les élèves et les aide à obtenir suffisamment de crédits pour obtenir leur diplôme. Dans cette étude de cas, une approche de laboratoire ouvert a été utilisée pour faire participer les apprenants et les appuyer. Un laboratoire ouvert est un contexte d'apprentissage dans lequel les participants sont soutenus et encouragés à concevoir et à créer, que ce soit en vue de l'apprentissage requis,

pour atteindre des objectifs du programme ou pour explorer avec créativité leurs propres idées. Le programme au cœur de cette étude a fait connaître aux élèves la technologie informatique de conception en 3D et la technologie de fraisage du bois par CNC (commande numérique par ordinateur) pour fabriquer des guitares électriques. Ce projet a utilisé une conception d'étude de cas afin de déterminer des façons d'améliorer l'expérience scolaire des élèves des Premières Nations par l'entremise d'une conception de cours unique. Les conclusions démontrent que l'expérience a été positive pour les élèves, que leur engagement a augmenté et que leur taux de présence s'est amélioré.

Introduction

This research project examined the impact on student engagement of using a makerspace approach to Practical and Applied Arts (PAA) courses. This offering, at Oskāyak First Nations High School in Saskatoon, was based on a belief that combining two courses around creativity would engage students and also provide them with the opportunity to earn multiple course credits. A common concern for teachers working with First Nations students is delivering a learning experience that is engaging, well suited to cultural and practical lifestyle needs, and is simultaneously providing students credit for the work they are completing. The course design was supported by the understanding that makerspaces in PAA education have the potential to enrich a traditional classroom experience. The program at the focus of this research introduces students to 3D computer design technology and CNC wood milling technology. Students learn to design from blueprints and other reference materials and then create projects using the technology in the classroom. The final product is a working electric guitar. It is hoped that studying the design and delivery of this program will increase general understanding about the nature of the First Nations students' experience and ways to design more engaging learning environments.

Background

The course, *Construction Carpentry/Computer Assisted Design – Guitar Making* was re-designed to teach the construction carpentry and computer assisted design curriculum to students through project-based learning, specifically guitar design and construction. Students could receive a credit for both construction carpentry and computer assisted design upon completion of this class. There was a 60/40 split between computer designing and woodworking. The skill level for computer design was moderate to advanced and students had no pre-requisite courses. The intent of the combined courses was to engage learners with interesting content and provide them with maximum educational reward for their time. The classroom site allowed for a direct study of the possible benefits on engagement and retention of a specific population of students. All students in the course and in the school are First Nations. The learning approach utilized 3D computer modelling software and CNC wood milling technology. Students learned 3D modelling and design software to design from blueprints and other reference materials. They then used the CNC milling machine to create the design by cutting it out of wood in the classroom and completed the project by adding necessary electronics and finishing work. The classroom was a small main floor portable classroom that had served previously as a computer lab. The main modifications to the space were additions of the CNC cutting machine, the 3D printer, the laser engraver, and several benches that housed different assembly and production stages such as

drilling, sanding, and staining. A dust collection system was added but there was no fume hood for staining and lacquering guitars.

Literature Review

The major reason for the design of the course was to find a way to engage First Nations learners and support their success. Students who attend Oskāyak have unique cultural backgrounds, histories, and support needs. Poor attendance and poor academic performance are issues for the students, teachers, and administrators at the school. A technology-supported makerspace could attend to student needs and improve the experience. If properly planned and supported, a makerspace environment might be of great benefit to all learners in developing hands-on skills. Although new to some, the notion of making and creating has been a part of the school experience since the beginning of formal education and informally long before that time. By providing learner choice and the opportunity to personalize what they were doing, students may engage more deeply in the course and receive much needed graduation credits.

Supporting First Nations Students

All educators must work towards developing a deeper understanding of the needs of their students. Increasing understanding is especially challenging when working with students from cultures and traditions with which teachers may not be familiar. Preston, Claypool, Green, Rowluck, and Martin's (2015) research with school principals identified pedagogical and curricular issues as a key area where Aboriginal learners are challenged. Flexibility in programming and the need to understand the unique situation of Aboriginal students is important. A range of curricular options with real world experiences also needs to be presented to students. Preston et al. (2015) also reported that school transition and transiency is impacting Aboriginal students' attendance. Finding ways to creatively provide credits either for previous work or in a format that maximizes the return for students is lacking. They feel teachers also need to understand the complex lives of their students and respond in a flexible or innovative manner. There is also a need for schools to demonstrate a belief in students, promote student belonging and relationships, and build school experiences that are culturally relevant (Preston, Claypool, Rowluck, & Green, 2017).

Improving Aboriginal high school graduation rates has become a priority with Canadian policymakers (Council of Ministers of Education Canada [CMEC], 2012). Part of the Aboriginal Education Action Plan is to improve graduation rates through providing positive learning experiences and improved attachment to the labour market (CMEC, 2008). Raham (2009) identified a number of best practices for improving retention and graduation. In conjunction with a strong cultural and language program, creating new course options, providing experience for potential careers, and hiring of caring staff contribute positively to First Nations student success.

Oskāyak is a very unique environment for which teacher training does not fully prepare graduates. In this context, awareness of First Nations history, culture, and Aboriginal ways of knowing need to be respected and incorporated. Teachers need to be open and receptive to different ways of engaging students from cultures that are not their own. As positive changes in curricula and teaching practices are being made, administrators look to others for guidance and input. Documents such as the *Truth and Reconciliation Commission Calls to Action* (Truth and

Reconciliation Commission of Canada, 2015) and *Beyond Shadows* (Toulouse, 2013) are foundational in our understanding of meeting Aboriginal students' needs. These reports bring the important voices that are often missing from curricular planning into the process, making it more respectful of the needs of all learners. The researchers approached the study with a heightened sense of awareness and openness to the cultural needs of the participants.

Engagement

In any context, when learners are motivated and feel invested in what they are doing they can be engaged (Barkley, 2009). This is especially important for First Nations students in an educational system that struggles to support all types of learners. A wide range of factors impact engagement such as: time on task, conduct of the teacher, social engagement, and sense of belonging of the student in the context of the classroom and the activities (Hume, 2011; Spivak & Cianci, 1987; Willms, 2003). Johnson (2012) believes engaged students are active participants in their classes. Therefore, as a first step to increasing student engagement one must increase student participation. The ability of the teacher to engage youth in meaningful ways plays a significant role with regards to student success in school, as "youth who are cognitively engaged…who are willing to invest time and efforts…achieve better outcomes" (Archambault, Janosz, & Chouinard, 2012, p. 319).

To understand the impact on student behaviour it is necessary to distinguish engagement in three dimensions: social, academic, and intellectual (Hume, 2011; Willms, 2003). "Social engagement" consists of two elements: prosocial (following rules and positive interactions) and antisocial behaviour (withdrawing from interactions and engaging in disruptive acts) and refers to the manner of individual student interactions with the teacher or with fellow students (Spivak & Cianci, 1987). Academic engagement is often used to refer to student behaviours related directly to the learning process, for example, time on task, participation in learning activities, and effort and initiative taken in the classroom. The final dimension referred to as "intellectual engagement" aims to increase the students' ability to understand and solve complex problems, construct new knowledge, and use higher-order thinking skills (Willms, Friesen, & Milton, 2009). Not only as a means to improve learning, engagement itself can be viewed as a positive outcome and is associated with performance and students' long-term learning achievement.

Although based on post-secondary research, another framework used to promote engagement, as proposed by Zepke and Leach (2010), is based on a meta-analysis of previous research. Four elements for successful engagement were determined: student motivation; transactions between teachers and students; institutional support; and engagement for active citizenship. Not only are these categories presented but they are also supported with proposals for action to achieve success with all four. This work has application for all levels of teaching and learning.

Makerspaces

When teachers look to address issues of engagement they often look for what is "new". Much is being made about the new idea of makerspaces but the concept has been around for a since the 1870s. What is new is the range of sophisticated tools available and the relatively low cost of these tools. According to Peppler and Bender (2013) "The maker movement consists of a

growing culture of hands-on making, creating, designing, and innovating. A hallmark of the maker movement is its do-it-yourself (or do-it-with-others) mindset that brings together individuals around a range of activities, including textile craft, robotics, cooking, woodcrafts, electronics, digital fabrication, mechanical repair, or creation — in short, making nearly anything" (p. 23. Another perspective on the concept is put forward by Sheridan et al. (2014) who state that "Makerspaces are informal sites for creative production in art, science, and engineering where people of all ages blend digital and physical technologies to explore ideas, learn technical skills, and create new products" (p. 505). Although not as diverse of a group as mentioned in this definition, the Oskāyak students brought a range of experiences and talents to the makerspace environment. The blend in the classroom was most certainly a mix of digital and physical and included a range of disciplines.

When looking to set up a makerspace in a classroom there are a number of factors to consider. If we look at the work of Hetland, Winner, Veenema, and Sheridan (2013) in the area of visual arts they identified four key "studio structures" as central to the design of learning environments that support makerspaces

> (1) in *demonstration-lectures*, teachers pose open-ended challenges, show exemplars, and demonstrate processes to engage and inform students, (2) in *students-at-work*, students work on their art and teachers circle the room observing and giving "just-in-time" instruction, (3) in *critiques*, the working process is paused as the group collectively reflects on student work, and (4) in *exhibitions*, students' work is shared with a community beyond the studio classroom. (p. 5)

Another term used to describe this approach to instruction is design studio learning (Kuhn, 2001). Design studio learning is a broader term used in the area of makerspaces. An influencing factor in this case was the teacher's experience in design studio learning. Design studio learning has migrated from creative disciplines such as art and architecture to find a home in school classrooms. Many key aspects of new makerspace environments are encompassed by design studio learning. Wilson (2016) shares research findings that demonstrate how creating video projects can benefit from an environment that uses the design studio approach. This work shows the positive impact in a classroom of giving and receiving feedback from the teacher, other students, and the broader community. In this type of learning environment, a community of practice (Wenger, 1998) forms, providing support and insight during the student's creative learning journey.

Creativity

John Dewey (1934) identified long ago that creativity is a key element of learning and also fosters engagement. Creativity was originally part of how we discovered, built, learned, and contributed to the greater society. "Technologists, converting their nonverbal knowledge into objects … have enabled others to build what was in their minds, have chosen the shape and many of the qualities of our man-made surroundings" (Root-Bernstein, 2015, p. 204). As put forward in a Science Technology Engineering Math (STEM) environment, creativity can be a key innovation in all classrooms.

> Arts and crafts can provide STEM students and professionals with:(1) mental skills such as observing, imaging and abstracting; (2) sensual and manipulative skills; (3) analogies that provide novel approaches to solving STEM problems; (4) experience with materials, structures, phenomena and techniques; (5) practice with the creative process; and (6) recreation to relax and re-energize their minds. (Root-Bernstein, 2015, p. 207)

Three things that should be considered for programs promoting creativity are: First, that they be diverse enough to introduce students to the broadest range of options so that individual preferences can be discovered; second, that the curriculum have enough time and flexibility for students to explore and develop their interests to a deep and personally meaningful level; and third, that opportunities be presented within the context of how exemplary creative professionals have used such skills and knowledge. Essentially, any educational system that we devise to promote creativity should be structured to promote surprises and to provide exemplars of how such surprises have successfully been overcome previously (Root-Bernstein, 2015).

Rose (2016) pointed out how creativity can be negatively impacted when we try to find a common or average expectations of an individual. Despite making the process more streamlined, these "industrial" approaches to learning ultimately have a negative impact on the learner, their success, and their self-concept. Rose based his idea on Benjamin Bloom's work on giving students extensions to complete creative tasks, allowing them to be more successful. Flexibility in pacing is also important and a key part of what happens at Oskāyak. A fully-supported, individualized setting provides a range of options to work through material, each person is differently skilled at each task in unique contexts. Development of creative skills is not just for making and building. These approaches have the potential to develop a different mindset in students. In her book, Dweck (2006) looks at how teachers can create a climate to build a different notion of self in their students. By showing that rather than being helpless or following a pre-ordained path, students can demonstrate growth and reinvent themselves. Being creative and embracing individual creativity supports this growth and frees the learner from obstructive labels and self-concepts. By extension, if the creative processes can "stimulate scientific creativity in the various ways just suggested, then it follows that formal education in arts and crafts should benefit all students" (Root-Bernstein, 2015 p. 208).

Another reason to introduce creative tasks into the classroom is to aid the development of spatial reasoning ability, improving students' ability to see objects in multiple dimensions, and to imagine what they look like as they are rotated or moved. This is especially important if the learner is designing an artifact or object from scratch. As creativity is learned through example and practice, and is not a natural psychological trait, it is the ability to see and do in different ways that facilitates growth and builds understanding (DeHaan, 2009).

Methodology

This research used a qualitative case study approach to understand what was taking place in the classroom (Denzin & Lincoln, 2011; Stake, 2000). Merriam (1988) promoted the use of a case study to look at a bounded example or problem that needs to be studied. The case is situated in a real-life context (Punch & Oancea, 2014) and examined a single instance of how the experience effected the students. Unpacking and sharing this experience may lead to deeper

understanding and positive change but it is only one example. This research is not intended to be generalized, but rather confines itself to one particular instance.

The data collection employed "a combination of methods to explore" (Punch & Oancea, 2014, p. 148) setting, context, and informants (Denzin & Lincoln, 2011) and was intended to create a comprehensive look at a single case. As is the case with participants in all research, they must feel that it is safe to share their experiences. When engaging First Nations students it is even more important to realize that the data collection process is difficult. Reciprocity and understanding must take place before sharing occurs (Kovach, 2010); a trusting relationship needs to be established. To foster trust, the research was broadly introduced and a discussion took place of the purpose and roles of the students in the work. A 24-question anonymous online survey was used to allow participants to comment in an environment that was free of pressure. The survey was based on the classroom teacher's wonders and on research which focused on ways students demonstrate engagement in their learning. A focus group was also viewed as culturally appropriate as it was a form of talking circle where each participant was invited to share, or not, based on their needs. A series of classroom observations was intended to provide context but not interact directly with the participants, again paying heed to the notion of respect. The research involved 20 participants who ranged in age from 15–19; all were enrolled in the guitar design and construction course. Ethical approval was sought and granted by both the University of Saskatchewan Research Ethics Board and the Greater Saskatoon Catholic Schools Ethics Board.

During the last week of classes, participants were asked to complete an online survey that took approximately 20 minutes to complete. Eight of the 20 students in the course completed the survey. On the final day of classes, participants were invited to a focus group that took approximately 45 minutes during the school lunch hour. Eight of the 20 students in the class participated in the focus group. The students were encouraged to take ownership of what was being discussed.

Five observations took place in the classroom during instructional time. The first observation session directly followed the introduction of the research to the students. The subsequent sessions were spaced out over a four-week period. The five classroom observations were conducted by the University Researcher (UR). During the observations, a large amount of information was collected through field notes. The UR watched the students, the teacher, and engaged occasionally with the students to ask what they were doing or why they had made a particular decision. Part of the curriculum at the school was to follow cultural protocols which included regular prayer and smudging. The UR attended smudging ceremonies three of the five observation times.

Upon completion of all data collection, analysis took place. Survey results, focus group transcripts, and observation field notes were examined and coded for themes using a qualitative analysis model (Miles, Huberman, & Saldaña, 2014). Both the UR and the classroom teacher reviewed the data separately and their results were compared and discussed. Recurring language, outcomes, and ideas were identified and combined to form common themes. As well, aggregated average student achievement scores and attendance rates were examined and compared.

Research Questions

This project examines evidence to determine if the engagement of First Nations students can be improved through unique course design.

The research was designed to specifically address the following questions unique to this case:

- What can an innovative course design do for First Nations students?
- In what ways will introducing learners to new ways of learning impact performance, student attendance, and course credit acquisition?
- In what ways does the infusion of innovative teaching practice in PAA increase engagement?
- How does the teacher impact engagement?

Results

The resulting data from the three collection methods revealed the experiences of the students as they demonstrated, reflected, and discussed what it meant to be in the course and how they were impacted. Several clear themes emerged based on their student survey responses.

Positive Experience

Participants agreed that the experience had a positive impact on them. Creating the guitar was the reason that every participant involved in the research took the course. Many looked forward to making another instrument in the future, others looked forward to playing them or furthering their understanding of music or musical talents. Many expressed they did not think initially they could complete the process and were surprised to be successful. The guitars were a great source of pride and each had a different plan for what they had designed and made. They all shared about showing their guitars off and used social media to post pictures of their work, receiving positive feedback from these experiences. For the students, the creative process was important because they were left with something tangible and valuable when it was done. The guitars represented extensions of personality and demonstrated what they valued. The personality showed in the choice of colour, pictures, laser engraving, etc. The other common outcome was the number of other students not in the class but in the school who would come in to see what the class is all about. Many would ask *"*Can I take this*?"* with an emphasis on *"*I*"*. Many of the students felt they were doing something really unique, that they were special, and they were willing to share the feeling. They recognized that no one else was offering a program such as this and that they should take advantage of it.

Skills Development

One of the opportunities in the course was to be able to learn new hands-on skills. There was interest in not only learning but doing more with the skills they developed. There were some who wanted to make another or a different guitar, or were interested in building traditional drums. Some liked the design aspects of the process whereas others enjoyed assembling the parts. Students had some previous experience with hands-on learning such as welding or basic construction. However, previous experiences were built around existing plans, with little

opportunity to be creative or fully personalize what they were doing. Everyone discovered an aspect or skill that they felt was not part of who they were before the course. Student learning was evident in the form of hand tools, power tools, sanders, drills, soldering irons, and paint brushes. It was the first time that many of them had created something of value for themselves, but they quickly became confident with the tools. When they were not confident with a tool, task, or skill they asked the teacher. The students admitted to making a number of mistakes but the teacher and the others did not make them feel bad about it. Everyone worked at a personalized pace, charting their own way through the learning process. They learned how to use video tutorials created by the instructor to develop an understanding of the process and later use them to guide what they were doing. Due to the self-paced and self-directed nature of the work it was clear the videos were a fit with the approach used.

Impact of the Teacher

Students spoke highly of their teacher and felt he was one of the main reasons the program was successful. The teacher was a guide, an advisor, a motivator, and a sharer of knowledge. Much of the help they reported was with a specific technique that he himself had taken the time to master. The student/teacher connection was a key part of the interaction taking place in the room. The teacher's nature and depth of knowledge helped students feel comfortable. The teacher made his way around the room interacting one-on-one with every student providing formative assessment using the time to share wisdom through his strong interpersonal skills. When students had a question, they asked. The teacher explained about design, about wood, about stain, or about grain. There was no economy of scale for the instruction. As a result, it is hard to quantify the time spent instructing but when students ran into a problem or had a question they called on the teacher knowing they would be helped.

Student-Friendly Context

The purposeful creation of a welcoming and functional location for the makerspace was evident. The space was cluttered, in a good way, with evidence of creativity and building. The class was quiet and productive, some students would be early and others would trickle in, as was the case in other classes in the school. They set right to work once they had arrived. Small group or one-on-one teaching was constantly taking place including interaction between neighbours. During class time, students were free to come and go. Every student appeared to be on task and had access to an iMac workstation for designing. Most listened to music while they worked. Earphones allowed for a focused environment for those who were designing, drilling, sanding, staining, etc. Headphones were used for those who were learning to play their guitar. Most guitars were hung from the ceiling during the cutting, finishing, and assembly process. Students who were in the final phases of completing their work would come in, take down the guitar, and begin their work. At the end of the class or a stage of construction they would hang up the guitar. There was nowhere to store the projects, they were just hanging up their work for everyone to see, allowing progress to take place in front of everyone.

Student Voice

To honour the trust that was given to the researchers, they felt it was important to give the last word in the focus group session to the learners. What participants said was directed towards

teachers and students. They wanted to see a greater effort on the part of teachers to be innovative. It was important to say that you get out of it what you put into it. They also felt that the more innovative the teachers are, the more engaged students will be. They encouraged future students to take their time and follow the videos. They believed that future students should make every effort to come to school. They also stressed it was important for students to complete their designs.

Attendance and Performance

Once the school year was finished, both attendance and performance of the students participating in the course were analyzed and compared to other course offerings in the school. The results were provided by the school administration, aggregated, and used to draw general comparisons. Note that the school year is divided into quarters or "blocks" at Oskāyak.

Attendance statistics for the guitar building course in blocks 2 and 3 compared favourably to other electives offered in those same blocks. Ten electives were offered for grades 10, 11, 12 in block 2 with an average attendance of 70% overall. The guitar building course attendance for both grade 11 and 12 was 73% total, 3% higher than average.

Examining the grade 11 course, compared to only grade 11 electives, shows the guitar building course attendance was 1 % lower than the average. When looking closer at the grade 12 electives, the guitar building course was 12 % higher than the average attendance of the other electives in grade 12.

When examining the guitar building course in block 3 the attendance was higher. Eight electives were offered for grades 10, 11, 12 in block 3. The average attendance for these courses was 64%. The block 3 attendance for the guitar building course for both grade 11 and 12 was 79%. This represents a 15% increase in overall attendance.

Block 3 statistics represent the second time the course had been offered to grade 11 and 12 students. The average mark for the grade 11 electives was 65 % and the average for the grade 11 guitar building course was 83%, or was 18% higher. The grade 12 average for electives was 66% and the grade 12 guitar building course was 74 %, an 8% difference. Although not tested fully, we see positive trends in both the attendance and performance of the students in the guitar building course.

Discussion

The approach to the course was intended to provide students with an opportunity to receive course credit, increase attendance, and improve course engagement. There is evidence of success in all three areas. All students completed the work, passed the course, and received two high school credits. Every student in the course successfully completed the requirements and attendance was stable or improved as a result of the way the course was offered. Average student grades in the course were higher, especially at the grade 12 level.

The idea that a makerspace should have an extremely deep and student-driven approach was evident in this case but not to a great degree. The students did exhibit creativity in the design of their guitar bodies, the choice of finish, and the paint colours they chose. For someone

external to the school this outcome may seem limited, but for many of the students it was their first opportunity to have choice in their work. They shared that the course was a positive change from others where they did not create anything of value. The experience represented individualizing their work and it was powerful at addressing this aspect for students. Students were engaged in the process during all steps of design and construction, and learning at their own pace was enjoyable. Students took great pride in the work they did in the course and in their finished guitars. Many new practical skills were learned.

The need for more engagement was important and encouraged. In this case, the evidence supporting increased engagement is in the form of the completion of final projects and the increase in attendance. The following are elements for successful engagement: student motivation, transactions between teachers and students, institutional support, and engagement for active citizenship were all addressed to a certain degree. There was also an attempt to increase social, academic, and intellectual engagement.

Motivation was manifest in the work of the teacher and the nature of the final project in the class. Students demonstrated motivation through their attendance and completion of all required elements of the course. As was identified in the research as a key contributing aspect, a caring and connected instructor was present. His support and energy in planning a positive learning experience ensured students felt valued by the teacher. The interaction between students and the teacher was crucial to the success of the program. In every interaction with students they pointed to the work of the teacher, and how he supported, guided, and championed their work. The role of the teacher as mentor and knowledge keeper was very important. A strong trust relationship between teacher and student was developed, contributing greatly to the students' success. Students were given plenty of autonomy and creative license. Pacing was sequenced so students could learn in a manner that was most comfortable for them. Learners recognized, and took advantage of, the opportunity to control the look and design of what they were creating. Along the way they made mistakes, learned from them, and tried again. The level of personal investment ensured that they would persevere.

In regard to pedagogy, four key "studio structures" central to the design of makerspaces learning environments were present: demonstration-lectures, students-at-work, critiques, and exhibitions. Constant demonstrations were taking place by the teacher. Students would gather around to see how a particular technique was performed or they would be engaged in the step-by-step approach of the video lectures. The teacher was in constant motion providing formative feedback during every class session. He would move in expertly, providing the right amount of information or guidance to support the student and honour the learning they were experiencing. Students shared and critiqued their work and the work of others. They asked each other questions about choices that were being made or designs being contemplated. The open environment meant that everything being designed and built was on display. Students were exposed to a broad range of guitar designs and techniques so that individual preferences could be discovered. The curriculum was not prescriptive and student work schedules were determined by the learner.

What was unclear is the notion of change of mindsets. There was no immediate way to know if the students would approach future learning opportunities in the same manner with the same levels of engagement and success. It was also hard to gauge the short-term connection to

employment outside of school with the new skills. The students had just finished the courses and were not yet finished the school year, which is a time they might seek employment.

Conclusion

This project shows evidence that the engagement of First Nations students can be improved through unique course design. Evidence of a sense of pride, skill development, teacher involvement, and sharing were present. In this case, introducing learners to new ways of learning and assisting them in developing new skills had a positive impact on performance, student attendance, and on credit acquisition. It still remains to be seen if these skills will translate into improved post-school employment opportunities. Connecting with these students in the future might provide insight into this question. Even so, teachers should be encouraged and supported in their work to bring dynamic methods to their course. This research has also created important insights for those delivering PAA programming with First Nations students and supporting all learners with innovative course design. It further supports the belief that diversification of instructional strategies and ways of integrating technology into learning impact students positively. The work will also serve as a foundation for continued reflection on teacher practice in the PAA area and to teacher training programs as they look to build research capacity in the areas of curriculum and pedagogy, Aboriginal ways of knowing, and student engagement. School administrators should also be encouraged to support teachers in action research such as this project. It will not only positively contribute to improved practice, but will also build the knowledge and capacity of teachers and administrators.

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