Universal Design for Learning
Action Research

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In an effort to build on the established practice of differentiation in education, the New Brunswick Department of Education and Early Childhood Development supports "Universal Design for Learning." UDL is a "framework for guiding educational practice that … provides flexibility in the ways information is presented, in the ways students respond or demonstrate knowledge and skills, and in the ways students are engaged (National Center on Universal Design for Learning, 2011)."

New Brunswick curricular development is informed by universal design values, and teachers are encouraged to incorporate the following into their program of study:

- Multiple means of engagement: tap into learners' interests, offer appropriate challenges, and increase motivation.
- Multiple means of representation: provide diverse learners options for acquiring information and knowledge.
- Multiple means of action and expression: provide learners options for demonstrating what they know.

As a means to deepen understanding of Universal Design for Learning and to expand the leadership capacity for UDL school-based educators, school-based teams were invited to apply to become part of an action research network.

Teams submitted proposals outlining the following:

- A rationale for why the school-based team is well positioned to provide leadership in the area of Universal Design for Learning.
- An action research plan developed by all team members to be implemented throughout the school year, including a minimum of 2-3 measurable outcomes.

Fourteen school-based leadership teams were chosen to design and implement an action research project based on Universal Design for learning principles and monitor the progress toward research goal(s).The product of their work over the course of two years was captured in a research paper format and reflection. All participants were invited to submit their papers for publication; nine of the fourteen teams accepted the invitation.

A partnership was established with the Faculty of Education at the University of New Brunswick and a model of support was implemented to provide ongoing feedback and coaching to ensure educators understood the core tenets of conducting ethical action research and opportunities for them to get specific feedback on their progress with university-based researchers.

Two professional learning sessions were offered initially- one to explore the current understanding of promising approaches in action research and the other to create and refine a specific research question to guide the work of the teams.

Once the research questions were defined, teams implemented their innovations and monitored impacts on student achievement, engagement, and behaviour. The results of their findings provide insight into how an intentional adjustment to teaching practice has varied impacts on students, and implicitly, the teacher.

Educators were asked to include their reflections of the process as they submitted their findings. The power of engagement for both students and teachers was echoed in the reflections of a number of teams.

> *Seeing firsthand how increased engagement via UDL project caused the students to produce higher quality and more creative results has changed our teachers' teaching… It is suggested that in the future educators remember that in order for students to retain and later apply the information presented the student's emotions must first be activated. Once emotions are activated through factors that increase engagement there is a chance that real learning and future real life application can result from teacher lessons.*

The following sheds light on the fact that the work started by this and other schools continues to evolve, and questions of how to enhance the process for future research and practice are valid.

> *I hope that the work of all the action research teams throughout the province inspires others – where a buzz begins in the staff room about how UDL is helping promote student engagement, and gradually teachers will come on board and try something new. I think our work on this action research project was valuable, but could be better with more time to develop our projects so that we can refine our work and make it more 'share worthy', so then other teachers may be more likely to follow our lead. I also think all teachers would benefit from opportunities to learn more about UDL in methods of their choosing, whether it is from an 'expert', a local action research team, or through self-study. (Nicol, 2014).*

Next steps required consideration on the demands that teacher researchers encounter. For the majority of the participants in the project, this marked the first opportunity to engage in research that examined their practice.

> *To begin, taking part in this project has given me the opportunity to reflect on my teaching practices and evaluate changes that could be made to enhance my overall*

classroom environment. It also initiated research on ways to increase the level of understanding and engagement of my students. When I first began the project, I thought I had a good understanding of what UDL was all about; however, each time I attempted to plan a lesson, I found myself very overwhelmed. I had a long way to go towards understanding the principles of UDL and how to implement them into my teaching. (Goguen, 2014)

This research reflects beginning steps in moving toward more reflective and informed planning and practice in classrooms. Next steps will include ways to highlight the expertise built with these teams so they may mentor and encourage others to conduct action research.

These findings reflect a two year process that was strengthened through the ongoing partnership with the Department of Education and Early Childhood Development, University of New Brunswick, four school districts and fourteen schools. All participants are to be congratulated on the success and integrity of their work. It is hoped that this monograph will provide exemplars for those attempting and implementing action research in various learning environments.

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The Impact of Universal Design for Learning Principles on Student Engagement in Project-Based Learning

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Abstract

The effects of Universal Design for Learning (UDL) principles on student engagement in projects were examined in this research project. Pre- and post-project student engagement surveys, student interviews and teacher observations were used to determine the impact UDL had on mandatory service learning objectives. Gever Tulley's (2007) Brightworks' Project Arc was also studied through the lens of UDL with significant findings.

Introduction

This study examined the grade 6 through 8 student body of Caledonia Regional High School. Students were encouraged to complete a service learning project during the 2013-2014 school year as part of our school improvement goal. Student projects were supported at each opportunity using UDL principles. Projects were divided into three stages: Exploration, Expression and Exposition. These stages allowed students and staff to view the scope of large projects in manageable pieces. Students determined which project to complete using a variety of methods including what engaged them most. The expression stage allowed for a variety of action methods and the exposition stage allowed students to reflect and report on their projects and learning in a method of their choice. Deviating from the traditional service learning framework allowed flexibility and student voice at every stage of the project. The three subsections of projects were taken from Gever Tulley's (2007) Brightworks' Arc used at the Brightworks progressive school in the United States.

A total of 123 students, representing 98.4% of population completed service learning project stages that were designed using UDL strategies. The percentage of respondents who claimed to enjoy the increased flexibility was 97%. 64% of the students completed projects indoors while 46% completed projects outside. Math and Language Arts were among the top subjects that students chose to apply in their projects. In total there were 62% of students who chose to work in groups while the remaining students thought it would be ideal to complete the project individually. 123 students successfully completed the project.

Five main aspects of UDL enhanced student engagement in projects including student choice, extended timelines, flexible evaluations, maximizing student skills and interests, and the inherent presence of digital technologies in universally designed lessons. An additional discovery was that Tulley's (2007) Learning Arc could benefit from having an additional stage titled "Evaluation" added throughout each of the other stages. A large percentage of students show increased engagement in the exploration, expression and exposition stages of the project. Students also spoke favorably of the differentiated approach to evaluation employed. In our opinion, educators will see student engagement improve from the inclusion of UDL strategies when employing project based learning opportunities in the learning environment.

Context

Our primary research question was "How will Universal Design for Learning principles incorporated into projects increase student engagement?" We identified an important secondary question which was "How will Tulley's (2007) Brightworks' Arc be improved when applying Universal Design for Learning principles?"
Caledonia Regional High School (CRHS) is a rural, grade 6 to 12 Centre of Excellence located in Hillsborough New Brunswick. The school population is 300 students with 125 of those students in middle school. Class sizes in the study were between twenty and twenty-nine students. The majority of the exploration and exposition stages of the service learning projects were completed through the technology programs which all students are enrolled. The expression or action stage was completed outside of class with an adult providing supervision and a signature to confirm student participation.

The action research study was completed between October 2013 and May 2014. Extensive professional development was provided for project lead educators who met regularly to discuss progress, students who needed guidance, and to review data. Time was allowed by the New Brunswick Department of Education and Early Childhood Development to allow lead educators to create media rich reports regarding study findings. Students were informed that the school's improvement goal for the year was "Each student at Caledonia Regional will complete a service learning project and subsequent reflection by June 2014." Students were told that this project would be approached differently than typical project based learning. Students would have more flexibility, voice, and choice in all aspects of the project's completion. This project also had support and assistance from the school's administration.

Literature Review

Current research on how the student brain recalls and holds onto knowledge allowing for future application has indicated that student emotions are the key. By activating the part of the brain that is involved with allowing students to choose strength and interest areas, teachers are allowing for life-long learning and understanding. In a recent publication titled "We Feel, Therefore We Learn: The Relevance of Affective and Social Neuroscience to Education" by Immordino-Yang and Damasio (2007) they address this essential engagement piece required for true student learning.

> "In teaching children, the focus is often on the logical reasoning skills and factual knowledge that are the most direct indicators of educational success. But there are two problems with this approach. First, neither learning nor recall happen in a purely rational domain, divorced from emotion, even though some of our knowledge will eventually distill into a moderately rational, unemotional form. Second, in teaching students to minimize the emotional aspects of their academic curriculum and function as much as possible in the rational domain, educators may be encouraging students to develop the sorts of knowledge that inherently do not transfer well to real-world situations."

Student emotions are directly related to how engaged they are in the learning process. This suggests that if the causes of increased engagement can be found both teachers and curriculum creators can begin to target student emotions and activate true learning. By triggering emotions through engaging lessons students will retain acquired knowledge for longer periods of time.

Deci (2000 p.227) discusses the Self Determination Theory (SDT) which examines what makes people strive to preform the best they can extrinsically but more so intrinsically. Deci states the following regarding personal motivations.

> "Conditions supporting the individual's experience of autonomy, competence, and relatedness are argued to foster the most volitional and high quality forms of motivation and engagement for activities, including enhanced performance, persistence, and creativity. In addition, SDT proposes that the degree to which any of these three psychological needs is unsupported or thwarted within a social context will have a robust detrimental impact on wellness in that setting."

This suggests that when students are given more choice and autonomy over reaching set goals they will work harder and reach higher levels of creativity and quality. This was seen in this action research project by several staff employing UDL strategies.

The importance of searching for what engages students and how UDL enhances student engagement is addressed in a report by Akey (2006 p.32). "Teachers are key players in fostering student engagement. They work directly with the students and typically are the most influential in a student's educational experience. Creating a culture of achievement in their classroom, developing interactive and relevant lessons and activities, and being encouraging and supportive to students are all ways in which teachers can foster student engagement in the classroom." The direct relationship between student engagement and student achievement is present throughout this study which supports the search for how UDL enhances this essential engagement factor.

Gever Tulley (2007) created the San Francisco progressive school Brightworks. Tulley developed a project framework that identified and defined 3 separate stages

for projects that he calls the "Project Arc." This school defines a grand but general learning unit topic in line with student interests and then allows them to complete an exploration stage where they research the topic using various methods. At the end of the exploration stage students declare their intentions moving forward in regards to their real life solution or creation they wish to pursue. Students complete the expression or action stage and then present findings in the form of a blog for their portfolio. This school has earned confirmation from leading American universities who have said they will welcome with open arms "Students who can get stuff done." (Tulley 2007)

Methodology and Data Collection
In October 2013, middle school students at Caledonia Regional were told that one of the school improvement goals involved applying school knowledge in some way to help their school-community. Students would have greater flexibility than before on many project elements. Students were asked to complete an Introduction Survey in their technology class which gathered baseline data involving student engagement and current level of choice. The survey also investigated which courses students favored, what made projects fun for them and personal learning environment preferences when working. Some of these results will be addressed in the Findings section.

Students were asked to use any method of research sources and idea gathering to spark ideas for their project. Newspaper, guest speakers, Youtube and many other sources were suggested and used by students. Following Tulley's first stage came the expression or actions stage. This stage took four months as teachers conferenced with students and encouraged them to find the ideal personal project. In early May students began a two-part reflection stage which utilized the multiple means of representation strategy in UDL. Students could share their story and results in any method that they found suited their skills and interests. They could draw a series of pictures, they could write a song, they could do an interview or radio show, and they could make a video. Over one hundred students chose from a host of unique methods to present and submit their final presentation. This was followed by a UDL Exit Survey which was similar to October's Introduction Survey. Students were surveyed twice and evaluated at three stages of their projects. Specific highlights were used to create a video for the experience and also shared provincially with decision makers at the Department of Education (http://www.

crhs.ca/udl2).

Findings
Graph 1a shows the demographic age wise that took part in the project. It was approximately evenly split among the three grades.

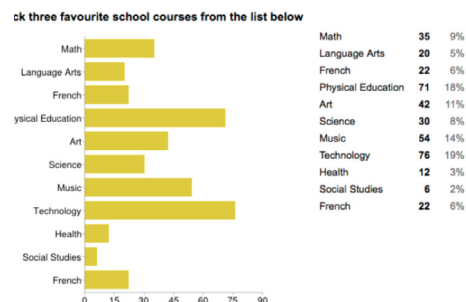|		
6	39	31%
7	41	33%
8	45	36%
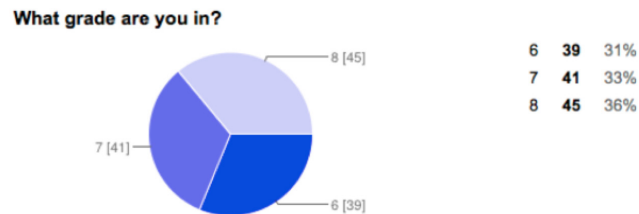
Graph 1a: Age Demographic of Study Population

Graph 1b represents data from the pre-project survey asking if students would like to have more choice within their projects and learning tasks.
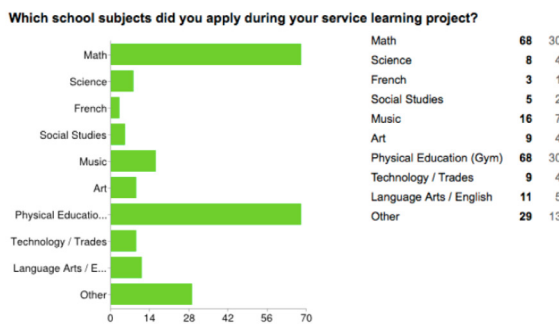

NO	20	16%
YES	103	84%
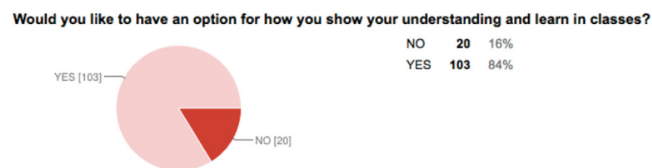
Graph 1b: Responses for Students Asked If They Would Appreciate More Choice in Projects

In Graph 2a and 2b there is an interesting fact that presents itself. In Graph 2a student were asked to pick their favorite topics in school and it is clear that math is not popular. In Graph 2b however students were asked which subjects they applied when completing their service learning and math makes a giant leap in popularity when it comes to its application strength in real life problems.

Math	35	9%
Language Arts	20	5%
French	22	6%
Physical Education	71	18%
Art	42	11%
Science	30	8%
Music	54	14%
Technology	76	19%
Health	12	3%
Social Studies	6	2%
French	22	6%

Graph 2a: Student Choices of Favorite Subjects

Which school subjects did you apply during your service learning project?

Subject	Count	Percent
Math	68	30%
Science	8	4%
French	3	1%
Social Studies	5	2%
Music	16	7%
Art	9	4%
Physical Education (Gym)	68	30%
Technology / Trades	9	4%
Language Arts / English	11	5%
Other	29	13%

Graph 2b: Student Choices for Which Subjects Were Applied During Projects

In Graph 3a below students had a chance in the post-project survey to indicate what about the application of UDL involved made the project engaging.

Which of the following made this project FUN for you?

|	Count	Percent
I had a lot of time to complete it	27	22%
I was physically active	30	24%
I got to solve a problem	1	1%
I helped my community become better	5	4%
It was something I was good at	15	12%
I learned something new	7	6%
I could choose what I did	21	17%
I could choose how I presented it at school	6	5%
I had choice about how I thought of the project idea	1	1%
I had support from a teacher	1	1%
I had support at home	0	0%
I knew it was the right thing to do	11	9%

Graph 3a: Graph 3a: Student Indications of Causes of Engagement

Graph 3a demonstrates that extended timelines, student choice, physical activity and applied student skills and interests were keys to student engagement allowed for by UDL. Solving problems, teacher support and the chance to learn something new did not result in an increase in student engagement.

In Graphs 4a and 4b the progress of the school goal and action research project can be seen clearly. Only 67% of students looked forward to helping their school-community using lessons from school in the pre-project surveys. In Graph 4b students were asked if they would do a service learning project again and the results show positive growth in student engagement with a 92% response. This can be attributed to the novel and pedagogically sound approach to learning that UDL allowed the teachers to employ.

Do you look forward to using your school lessons to help the community?

YES	83	67%
NO	40	33%
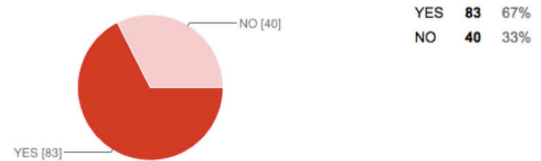
Graph 4a: Students are Asked If They Look Forward To Helping Community

Would you do this again next year?

Yes	115	92%
No	10	8%
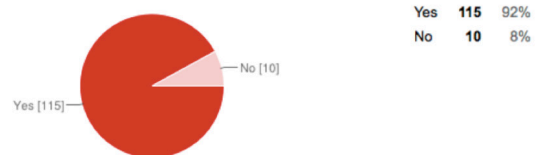
Graph 4b: Students are Asked if They Look Forward To Doing Another Service Learning Project

Finally, in Graph 5a students were asked if they have completed a service learning project for the school year. Two students accidentally indicated "No" and that is why the totals jump to 125 from 123 students. 100% of the middle school did something to help their school-community from October 2013 to May 2014. They were allowed flexibility, choice, and voice throughout the process and thanks to UDL the students empowered to help the school reach its goal.

It became apparent when employing Tulley's learning Arc in the project base learning setting that something was missing. Though the Brightworks framework was followed the students began the project feeling guidance was lacking. One student asked "How are you marking us on this?" At first the question was brushed aside due to the nature of a service learning projects being not typically associated with traditional assessment. This allowed for closer inspection of the learning arc. The action research team identified what appears to be a major missing link in the Brightworks framework.

Evaluation was clearly not evident in the framework and not in a UDL friendly format. It was determined that a rubric had to be created for each of the project's three stages. Due to the flexibility and student choice the rubrics would have to be robust enough to handle all learning scenarios. The missing evaluation aspect was implemented and students had the guide they needed to manage themselves as they worked to meet the school's goal. In our opinion, evaluation should be considered for each stage of the learning arc when applied to project

based learning.

Limitations / Barriers

In this project our sample size was reduced due to incomplete data caused by student relocation throughout the project. The Department of Education provided 0.5 days a month for team to meet and review progress and data. This amount of time proved insufficient but the action team found addition time to complete the project.

Students indicated in the intial surveys that they would rather work outside. In the post-project survey, the statistics reflected the opposite and it can be deduced that the harsh Winter months encouraged students to complete indoor projects.

Implications for Personal Teaching Practice

Seeing first hand how increased engagement via UDL project caused the students to produce higher quality and more creative results has changed our teachers' teaching. Studies had shown that when you activate student emotions terrific things can happen in a classroom and UDL allows for this in the project based learning atmosphere. Tulley's Brightworks Arc has a spectacular appeal to it and it will continue to be heavily emulated. Discovering the weak point of the arc when applying UDL has made it even more valuable for teachers and students. Allowing students to have multiple means of engagement, expression and representation works perfectly with Tulley's exploration, expression, and exposition stages. Our study indicated that students will also be able to benefit from co-construction of criteria for differentiated instruction. Many of our students enjoyed being full participants while constructing the evaluation piece of the project. Tulley's Arc is less valuable without UDL frameworks in place and that revelation allows future application to be smoother in the learning environment

Now that the top five forms of engagement have been identified when using UDL it allows for targeted interventions emotionally as well as academically. It allows teachers to seek grants which will support these strategies and modern teaching practices further at C.R.H.S. and in New Brunswick.

Recommendations for Instructional Practices

In our opinion, educators who wish to employ project based learning will see increased student engagement if they include both Universal Design for Learning strategies and Tulley's Learning Arc. Both have benefits to the student's learning and together they create learning environments for all courses and subject matter. We suggest that in the future educators remember that in order for students to retain and later apply the information presented the student's emotions must first be activated. Once emotions are activated through factors that increase engagement there is a chance that real learning and future real life application can result from teacher lessons.

Additional research in this area could include Universal Design for Learning application in project based learning regarding student achievement. Tulley's work should also be examined for potential increase or decrease in student achievement on traditional assessments and alternative assessments. These two frameworks work very well together in regards to student engagement but little is known about student achievement.

Another project that C.R.H.S. would embrace is the how UDL supports Bloom's Taxonomy of learning. Bloom's taxonomy is an incredible learning framework and seeing what Universal Design for Learning reveals about Bloom's Taxonomy when applied is definitely something the C.R.H.S. UDL team feels is worth exploring should future support become a reality.

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Companion Video Resource for Project http://www.crhs.ca/udl2

eBooks: Explorations in efficiency with English Language Learners

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Abstract

In this action research project, a team of educators examined ways in which teachers used iPads efficiently to differentiate support for English Language Learners' (ELLs) development of reading comprehension, within a universal design for learning framework (UDL) in sheltered English classes. This collaborative action research study uncovered three over-arching themes: (a) barriers to efficient use of technology, (b) implications for student engagement in reading, and (c) insights on the positive outcomes of eBook and iPad integration in schools they relate to UDL principles. The discussion focuses on the implications of these devices for classroom practice as a tangible outcome for practitioners and the conclusion points to further avenues to explore in research.

Introduction

Newcomers who arrive to Canada at high school age often land in school contexts that struggle to align 3 different considerations –1) limited English Language proficiency of the students, 2) their developmental status as adolescents, and 3) instructional resources that are engaging and meaningful, in light of the first two considerations. As it pertains to balancing these needs in relation to literacy development, English as an Additional Language (EAL) teachers have had limited options for levelled readers. The advent of mobile technologies, particularly those on tablet and e-reader platforms, has enabled the creation of dynamic, multimodal levelled texts that provide more engaging options for fostering English literacy skills in the newcomer population. This study examines how teachers can maximize the potential of this emergent technology in a public school setting with their language learners.

Context

Students attending Fredericton High School (FHS) were born in at least 79 different countries, and newcomers who have entered the Canadian school system in the last three years comprise more than 20% of the present FHS population. In 2013-14, over 130 foreign-born students enrolled at FHS. In the 2011-2012 school year, over 25% of the new international students at FHS who were 17 to 18 years of age and over 50% of these entered high school with no foundation in English or early language skills, as documented with the Woodcock-Muñoz Language Survey. In response to the demand for EAL instruction, FHS has developed comprehensive EAL supports for students in their movement towards a NB high school diploma, including sheltered EAL classes. Efforts are made to place students according to their level of English language proficiency, which may well be the only common denominator. This spaces can be considered hyper-diverse, in terms of the classroom composition because of:

- Age – typically ranges from 14-19
- Status – permanent residents including refugees or provincial nominee program candidates, children of temporary workers, children of visiting scholars to the universities, fee paying international students living in homestay arrangements and temporary exchange students on cultural visits, students from any of the aforementioned backgrounds arriving from feeder middle schools or transferring from other communities or other provinces.
- Origin – national, ethnic, cultural, religious, linguistic, etc.
- Educational background – private, public, interrupted, limited or no schooling

This rapidly growing population proved to be mismatched with many of the available resources for teaching English to this age group. Prior to the project, teachers endeavoured to target instruction to suit the needs, interests and literacy levels of students without access to appropriate, relevant, and attractive print resources for them. Teachers tried to adapt a singular text to work with multiple language levels within a class, as levelled print readings were impossible to locate and/or create within the time constraints of the classroom.

Teachers had a range of experience in technology integration in public school settings, so decided to collaborate to determine if this platform offered a more efficient mechanism for securing and using levelled texts. Specifically, teachers were curious about the feasibility and efficiency of using levelled e-books available for use on iPads to support the reading development of this varied student population. Further, the use of this technology provided a path for implementing the principles of UDL in the classroom more easily, as e-texts could be assigned with more of a proactive consideration of reading levels than previously offered. The e-books available on iPads offered multi-modal inputs as well, including audio accompaniment of print text and simultaneously highlighting of the sentences being read to the students.

The overarching research questions for this study can be summarized as:

> How can teachers in Sheltered EAL classes efficiently integrate eBooks (as found on iPads) into a differentiated model of instruction that is mindful of the tenets of UDL?
>
> How can the eBooks efficiently (as perceived by the teachers) support the development of the reading skills of the students?

It should be noted that the initial intent of the study was not in determining the effectiveness of eBooks for developing the students' reading comprehension. The team was first interested in ensuring the logistics of the approach could be efficiently managed in classrooms in a context where iPads also needed to be shared across classrooms. Further, because students in the EAL program had largely not been assessed in English reading skills prior to program placement, there was a general reluctance to measure the effectiveness of tools without a baseline understanding of reading skills. It was hoped this project would also enable teachers to better understand their students' reading skills in English.

eBooks and UDL
As technology evolves, so do the words used to describe innovations. The term, "e-text" is no exception to this, and in this study, "eBooks" are defined as "self-contained digital texts whose basic structure mimics traditional books, are viewed on an electronic display, and are used by students" (Felvegi & Matthew, 2012, p.41). There is a growing body of research that indicates that e-texts

have had a positive influence on reading skills, engagement, and motivation of struggling and/or reluctant readers, among them ELLs (e.g., Kelley & Clausen-Grace, 2009; Miranda, Johnson, & Rossi-Williams, 2012; Miranda, Williams-Rossi, Johnson & McKenzie, 2011) as the "affordances of touch technology allow for multimodal, multidirectional reading paths" (Simpson, Walsh & Rowsell, 2014, p.123). Several features of e-texts have been cited as reasons for success. There is the interactivity of technology that enables word-look ups, animated highlighting, and adjusted fonts. Further, e-texts can embed comprehension questions and learning activities, with immediate corrective feedback, which cue readers to revisit areas of the text where assessment revealed a misunderstanding. More recently, technology has developed to enable texts to be narrated within the book file, providing simultaneous oral and written language support. Other differences from print texts include "animations, videos, interactive games and music" (Zucker, Moody & McKenna 2009 as cited in Felvegi & Matthew, 2012, p.41).

From a UDL standpoint, such innovations in eBooks provide "multiple means of representation" (CAST, 2011), facilitating options for language and symbols. In this way, eBooks have the potential to allow readers to engage with texts through multiple "ways in which students can obtain the information and skills they need in order to accomplish the learning outcomes" (Dunn, 2014), diminishing some of the barriers to learning. This approach under the New Brunswick Model of UDL (New Brunswick, n.d.) ensures instructional materials provide "options in the ways students can interact with instructional materials" (p. 2).

Potential benefits of the eBooks for EAL students could not be ignored, but for teachers implicated in the project—several of whom reported extensive experience teaching with technology—the first question that needed to be considered was the efficiency of their use in the context. Logistical considerations, including sharing iPads across classrooms, an awareness that even in different classes (with different course codes) students were on the same level in English, and no prior classroom management experience with iPads, motivated teachers to focus on the rollout of technology, rather than its effectiveness. Hew and Brush (2007) analysed barriers cited in research literature on technology integration for the decade prior and found no fewer than 120 unique barriers to technology use in the classroom; they classified these

reasons into broad categories of assessment, attitudes and beliefs, institution, knowledge and skills, resources, subject culture. Yet, for teachers in this study, logistical concerns (which formed part of the 'knowledge and skills' subset) about the efficiency of tablets needed to be addressed before they could move on to questions about the value of tablets.

Ertmer and Ottenbreit-Leftwich (2013, p. 181) have suggested that one possible way to overcome the reluctance to incorporate technology into the classroom is to re-orient how it is viewed as a part of instruction. Much of the technology-based educational paradigm has been focused on devices/software that can be used in the classroom (e.g., what is termed as 'technology integration'), rather than considering teaching and management practices that are required to meaningfully incorporate technology into a classroom (e.g., what is termed 'technology-enabled' learning). For teachers in this study, this new paradigm seemed to be more in-line with their questions and more importantly, consistent with the principles of UDL.

The Project

The UDL-informed change teachers sought to make in their classes was to use eBooks on iPads to address the penury of available print materials, with the exception of existing black and white photocopies and some old novels. The project followed a cyclical model of action research, which is later described in the methodology, in order to implement changes in classrooms. In the first instance, the team acquired a synch cart, iTunes account, selected the series of readers to purchase and activated 18 devices. It should be noted that a considerable amount of the teachers' time was dedicated to the writing of funding proposals and several grants facilitated the purchase of resources in combination with school funding. Teachers chose the series Black Cat READERS due to their electronic design and platform that enabled them to be downloaded to iPads. Additionally, the series included an accompanying placement test students could take in order to select texts at an appropriate level; this kind of data were lacking about many of the EAL students prior to the study. As the iPads were not available at the time of the initial placement test, other team members supported the first teacher's attempt in working with students while they did placement test in a computer lab. Students' reading levels were recorded and the teacher decided to limit the text choice according to

reading levels as indicated on the placement assessment.

Once the iPads were activated and the eBooks were accessible, the teacher provided instruction on actual iPad and touch screen use. It also became apparent that students required parameters in terms of appropriate use of devices during independent reading, so mini-lessons were developed to provide scaffolds for students. The duration of this unit was a little over two months of school and each class included sustained silent reading. As time passed and students became more at ease with using the technology and reading on mobile devices, the teacher limited the sustained reading periods to two-to-three classes per week.

After discussions with colleagues about the first cycle of the project and accompanying research, a second teacher decided to use eBooks with students who also had limited English proficiency. It should be noted, however, that the context this teacher was working was a group with younger students ranging in age from 14-19 years of age. She, too, provided direct instruction on iPad use, but also made the decision to use a gradual release of responsibility model in that she chose the first book for the whole class based on her assessment of the cohort's general reading level. In her instructional approach, she shared, then guided, and eventually facilitated independent and sustained reading with her students of the same eBook. After the first novel, students were able to select a text of their own interest appropriate for their proficiency.

This teacher's approach was similar to the first teacher in that she provided accompanying scaffolds to students on the use and care of iPads within an educational setting. Where she differed from the first approach is that she opted to have another teacher work alongside her in a co-teaching environment for the initial weeks of incorporating the new resources into her classroom. As the unit progressed the co-teacher was not always present in the room, and students began to support one another in the use of devices. The teacher's work with iPads spanned over one month, and followed the experiences of the initial teacher. Also notable, was that the second teacher also chose to incorporate the viewing of the film, "The Secret Garden", to provide an additional opportunity for her students to further understand what they had read once they all had the chance to finish the novel which they had studied as a class.

When looking at both cases of eBook integration from a UDL lens, one would note that although both teachers addressed differentiation and engagement, they did so with subtle differences. Table 1 highlights these differences:

Teacher A	Teacher B

7. Provide options for recruiting interest
    Options that increase individual choice and autonomy
	8. Provide options for sustaining effort and persistence
	        Options that foster collaboration and communication

8. Provide options for sustaining effort and persistence
    Options that vary levels of challenge and supports
    Options that increase mastery-oriented feedback
	9. Provide options for self-regulation
	        Options that scaffold coping skills and strategies

Table 1: Multiple Modes of Engagement (CAST, 2011)

The next section describes the methodological framework for the collaborative nature of the research which underpinned the project.

The Study

The teachers involved in the project were also collaborators in the action research component that complemented their work as classroom teachers. Action research is a very broad form of inquiry, in that many social science orientations fall under this mainly qualitative "family of approaches" (Reason & Bradbury, 2006, xxii). Notwithstanding the breadth of this term, the central aim is to "improve and to involve" (Carr & Kemmis, need year,as cited in Henning, Stone & Kelly, 2009, p.6). With this in mind, in the case of educational contexts, this methodology focuses on improving and understanding practice and the "situation in which the practice takes place" (Carr & Kemmis, need year, as cited in Henning, Stone & Kelly 2009, p. 6). Often educators undertake this mode of inquiry, as "classroom action research typically involves the use of qualitative interpretive modes of inquiry and data collection by teachers (often with help from academics) with a view to teachers making judgments about how to improve their own practices" (Kemmis & McTaggart, 2005, p. 561). The collection and analysis of data is recursive and iterative as both processes may occur simultaneously or in a "spiral of self-reflective cycles" (Kemmis & McTaggart, 2005, p. 563). These cycles occur typically following a process as outlined by Sagor (2005) of identifying a focus of interest, articulating a theory of action, implementing action, collecting data, reflecting on results, and planning further action. Action research provides the professional with the opportunity to concurrently look back at what has been done and yet still be looking ahead (Riel, 2010).

When groups of educators and professionals conduct action research as teams, they engage in cooperative inquiry in which, "everyone is involved in the design and management of the inquiry; everyone gets into the experience and action that is being explored; everyone is involved in making sense and drawing conclusions; thus everyone involved can take initiative and exert influence on the process" (Heron & Reason, 2006, p.144). Glickman, Gordon and Ross-Gordon (2010) use the term "collaborative action research" to describe this form of research in that it is a "transitional form of teacher inquiry" because the supervisor "engages in joint decision-making with teachers" (p.387). As such, the roles of the various agents in this dialogical process were fluid and dynamic. Social constructivism (Vygotsky, 1962) is the paradigm in which this study was situated, because the goal of research is "to rely as much as possible on the participants' views of the situation" (Creswell, 2007, p. 21) through professional dialogue and reflection. Teachers continually revisited the central question of this inquiry, discussing the implications of incorporating iPads in their classroom. With the regular meetings and sharing of data and reflection on practice, the data collection and analysis was truly "an ongoing process, integral with reflection during data collection" (Noffke & Somekh, 2011, p. 97). Additionally, an interview protocol for teachers and students were devised in order to draw out more detailed perceptions about the pedagogical change. These questions can be found in the appendices of this paper. The interviews were recorded on video in the first cycle of research. In the second cycle after having viewed the type of responses which the student interviews had elicited through the spoken word, the teacher devised her own simplified open-ended question and asked her students to reflect on their experiences with eBooks and iPads in a written statement. She adjusted her prompts in order to meet learner needs and language abilities. Her prompts are found in Appendix A.

From the onset of the project, the teachers' intentions were to increase learner engagement by way of incorporating eBooks as a means of differentiating materials to support the development of reading comprehension, but their first concern was one of efficiency in technology integration. In this way, teachers were able to explore both the concepts of learner engagement and efficiency of differentiation through this study.

Participants

The students participating in this project have limited reading skills, most of whom are able to read simple texts in English independently and had varying degrees of literacy in their first language(s); they were students from two EAL classes at FHS. The pilot group, or first cycle, was a class of 10 learners of adolescents above the age of 17 and young-adult learners who were primarily, but not exclusively, from refugee backgrounds from a variety of countries. In the second cycle of research, an additional class and teacher were added to the project, and 10 students from a variety of ages and backgrounds were in that class. Both classes were mixed gender groups and the total class size fluctuated on any given day.

In terms of the non-learner participants, four classroom teachers were involved directly in working with students, three additional teachers facilitated various aspects of the research project, and two researchers acted as consultants in framing the initial study and participated in the discussions in shaping the questions and observational protocols.

Data collection and analysis

Teachers used various methods to engage in data collection for this inquiry. Each teacher who implemented the iPads, and eBooks in particular, wrote daily reflections on the experience, which they shared with the group. Each month, teachers met to discuss and make changes to improve efficiency in using the devices. Additionally, one researcher video recorded interviews with the teachers and students in cycle 1, to gain further insights into the implications of this change to pedagogical process (See Appendix B and C for interview protocols). This researcher interpreted the video interview data, seeking themes that emerged from these one-on-one interviews. These video data were shared with the entire group midway through the second cycle of research, which was as a springboard for further exploration of the key question. "The process of data collection, data analysis, and report writing are not distinct steps in the process – they are interrelated and often go on simultaneously in a research project" (Creswell, 2007, p. 150).

At the end of the second cycle, analysis followed by whole-group discussion occurred through returning to the central question and revisiting the fieldnotes, the video from the first cycle and the written learner feedback from the second. Warren and Karner's (2005) memoing technique was used to identify categories through collaborative analysis and whole-group dialogue. Further

discussion and a return to the literature on the integration of eBooks and technology in educational contexts revealed three over-arching themes: (a) barriers to efficient use of technology, (b) implications of eBooks for student engagement in reading, and, (c) insights on eBook and iPad integration in schools they relate to UDL principles.

Findings

After examining the data, teachers confirmed initial perceptions how technology integration in the school can be a rewarding, yet, challenging undertaking. There were fourteen instances of hindrances to various types of logistical or technological challenges in the fieldnotes, as teachers cited the following reflections: "(weather) storm delay", "computer lab availability", "number of available devices (2)", "did not have network IDs", "3-day span to initialize the set of iPads", "take a picture of their finished worksheets to mark progress", "re-synch with a Mac (2)", "purchase earbuds", "the comprehension checks did not allow you to save your work", "one (exercise) that did not work", "iPads had to be reset… (x) is coming to my room this PM to set them up", and "we'll need a new lock or combination for the lock". These barriers, to one degree or another, mimicked those found in Hew and Brush (2007) and more recently, Padmavathi (2013). These barriers came to be focused on the notion of 'technology-integration,' even though the initial intent of the project was more consistent with the newer construct of technology-enabled instruction (Ertmer & Ottenbrien-Leftwich, 2012). At minimum, this project demonstrated that so long as logistical issues occur, teacher may have difficulty in viewing and applying technology from an 'enabling,' not 'integrative' perspective.

The second take-away from this research was the degree to which learners engaged with the technology during their time on task. Task engagement, in the eyes of the participating teachers, was viewed as an extension of the efficiency question, if for the simple reason that the idea of "time on task" has been long-cited in the second language acquisition research literature as a key factor in promoting meaningful development (e.g., Cummins, 2001).

Examples which stood out from the fieldnotes and which were subsequently echoed in discussion, were comments such as "Engagement was high and the room was silent with the exception of the occasional burst

of laughter" (Teacher B), or "Students are able to get started right away, thus maximizing the time spent reading with minimal assistance from the teacher. Students are familiar enough with the devices now that there are almost no technical questions or issues anymore" (Teacher A). Also, the students' curiosity was piqued because of the hidden interactive features built into the eBooks, "The students who were here all had the hang of it and were reading quietly on their own. There are secret things to 'click' on in the pictures that do extra stuff and this was quite popular to try to find them all" (Teacher A). These comments also echoed the findings in the previously-cited research literature as to why eBooks are effective for struggling readers, and have given the teachers the confidence to perhaps extend this study in the future to actually measure the effectiveness of the tool.

From a student perspective, during the video recordings, most students spoke of the interactive features of the text and the benefits of simultaneously having the text read to them, while they followed along silently. Although there were some minor technical issues, which both teachers and students worked to overcome, on the whole, students expressed that reading eBooks with iPads allowed them to decode and repeat sections of text that they did not understand. Also, the written feedback from the second class from cycle two, revealed both positive and negative aspects of the technology. Instances of this which stood out during memoing, are listed in table 2 below:

Positives of reading eBooks on iPads	Negatives of reading eBooks on iPads
✓ It is very convenient to use with iPads and answer question. We can say that [sic] a next generation.	• I [sic] not like in the iPad suddenly doesn't work.
✓ I like when I don't know a word and just know it now.	• Suddenly turn page.(4)
✓ I like that the iPads can make a noise. (speech) [sic] Then I can better understand.	• The iPads book [sic] not very easy to make note. [sic]
✓ I like that the iPads not let me feel boring. [sic]	• I don't like about the reading with the iPad because it [sic] bad for my eyes.
	• I don't like because I don't [sic] can't listen and I listen and read two time. [sic] I don't like audiobook.

Table 2: Positive and Negative Aspects of Technology Feedback

The final aspect which teachers found noteworthy was the degree to which this project facilitated a number of offshoot initiatives and/or professional practices, which were consonant with UDL principles. Some examples include:

1. The use of iPads and Google Forms to conduct and analyze student self-assessments about literacy skills (Multiple Means of Engagement, Options for self-regulation).
2. The facilitation of student collaboration "Students helped each other with the exercises after each chapter. I asked if there were any problems or if they did not understand the directions, but they reached out to one another" (Teacher B) (Multiple Means of Engagement, options for recruiting interest).
3. The facilitation of student choice through gradual release of responsibility "When the students finish their book, they will be able to choose one of their choice" (Teacher B), (Multiple Means of Engagement, options for recruiting interest).
4. The facilitation of student self-pacing during reading "One of my most basic EAL students still is having difficulty getting started, but once he seems to be able to move through the chapter at his own pace" (Teacher B) (Multiple Means of Engagement, options for recruiting interest).
5. The use of iPads to access authentic texts (video, graphic and written) paired with communicative activities to express understandings or the use of applications to develop language competence "We have moved from using the e-readers exclusively to using other apps that we uploaded to our iPads. The apps are all related to ESL and language acquisition" (Teacher A). (Multiple Means of Action and Expression, options for expressive skills and fluency).

In the end, the action research took on different shapes in different classrooms, as teachers developed their competency with the devices and adapted other uses of the iPads for additional pedagogical purposes.

Implications
This study and resulting collaborative dialogues have revealed the following insights, which will inform future cycles of action research, particularly with regards to efficient use of eBooks, and iPads in general:

1. Classroom management is a consideration: 1:1 ratios are best to maximize instructional time, assign specific devices to designated students, provide explicit explanations for behaviour (e.g., no eating, elbows on desks, no water, no walking with the devices, everyone sitting in chairs so that teacher may monitor use, etc.) monitor for students trying to change language settings or for other "off-task" behaviours, ensure students have a set of ear buds, assign one same device to each student to track any damage. Reinforce the message that an iPad is not a toy, but a learning tool that can be fun. Wrap up classes earlier than usual and count all devices.

2. Use a gradual release of responsibility approach to guide students through the task: Devote at least one class to direct instruction and modeling on how to use the technology prior to engaging in an actual reading task. Model the act of reading in hyper-text, guide students in their initial reading, and then allow students to take ownership of the process by demonstrating that they know how to navigate the text autonomously.

3. Provide limited choice for novice readers as to not lose too much time with book selection.

4. Preparation is key: Download all books or apps and test-run all devices prior to using with a class.

5. Avoid task-fatigue: Using shorter reading blocks over a continual period in time or varying the genre of text may help maintain engagement to preserve the novel effect of the technology.

6. Don't do it alone until you are ready: Consider requesting support from a colleague to assist until you're autonomous and proficient if you are uncomfortable with this new role.

The team also underscored that when working with emergent technology, such as eBooks, it is important to not work in isolation in order to allow for personal reflection followed by collaborative discussion and the re-visioning of teaching. Finally, collaboration was a means to overcome barriers to teachers in using the technology for pedagogical purposes within a school context.

Limitations
There were some broader contextual factors, that limited this project and shaped its evolution. Due to large class sizes and limited amounts of technology, the team was unable to conduct a third research cycle in a whole-class context where there was a 1:1 availability of the devices. Data analysis was limited due to time constraints imposed by working as teacher-researchers within a school setting during instructional hours. Finally, the group had to juggle the multiple research and reporting deadline requirements of the various projects that were in progress that facilitated the purchase of the devices that school-year.

Conclusion
There is much work to be done in the area of classroom action research with emergent technologies, and eBooks in particular. In New Brunswick, using eBooks on mobile devices as a means to assist EAL students in developing reading comprehension in the secondary years warrants more attention, as teachers are seeking efficiencies to differentiate instruction to address learner needs. Recent developments in technology lead to changes in modality, which resulted in a form of reading called "hyperreading" (Uso-Juan & Ruiz-Madrid, 2009) which have entailed some readers to develop new strategies or "reading paths" (Simpson, Walsh & Rowsell, 2013), which in turn may have implications for pedagogy (Felvegi & Matthew, 2012).

As Felvegi and Matthew (2012) state "research on successful integration practices would provide educators with specifics about pedagogical practices of using eBooks at different grade levels and in various content areas" (p.46). In the second cycle of this research, the teacher sought a co-teaching arrangement in order to facilitate technology integration, but not all teachers involved were able to do so. The school is now reconceptualising instructional approaches to facilitate co-teaching models. One question that warrants exploration is about how a co-teaching environment may improve efficiency of differentiation when teachers use eBooks with students when working in collaborative teaching contexts.

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Appendix A

Student Open-Ended Written Response Questionnaire (Cycle 2)

1.   What did you like about the eBooks and iPads?
2.   What did you not like about the eBooks and iPads?

Appendix B

Student Interview Protocol (Cycle 1)

1. What did you like about reading on the iPad?
    a. Listening to the story as you read the words
    b. Answering questions after reading the story
    c. Using the interactive features (things that move, etc.)
    d. Holding the iPad

2. What did you not like about reading on the iPad?
    a. Listening to the story as you read the words
    b. Answering questions after reading the story
    c. Using the interactive features (things that move, etc.)
    d. Holding the iPad

3. How is reading on an iPad different that reading a paper book?

4. If you had a choice, would you rather read a story on an iPad or a paper book?

5. Is there anything that you would like to tell me about your feelings about this project?

Appendix C

Teacher Interview Protocol

1. What is "efficiency in the classroom" in your experience? How do you know you have achieved efficiency in your teaching?

2. How is classroom management different and/or similar when the iPads are in use?

3. What are some things that would improve your efficiency in using these devices in your classroom?

4. What are some of the challenges you faced in implementing the iPads as an instructional tool to differentiate reading comprehension activities with EAL students?

5. What are some of the benefits that you saw from the use of the iPads in the classroom?

6. What are the differences you see between the efficiency of texts on the iPads versus traditional (paper) texts specifically as it pertains to differentiation?

7. From your standpoint, how do you see the UDL principles of multiple means of representation, expression, and strategies for encouraging participation reflected in the iPad Ereader experience that you have not seen in your experiences in working with traditional print text?

Implementing Universal Design for Learning Principles in Grade 9 Math Classrooms

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Abstract

This paper aims to support the use of Universal Design for Learning (UDL) principles to enhance traditional teaching methods and the assessment of students' learning while meeting specific curricular outcomes in grade 9 math.

The research team consisted of two Mathematics teachers and two Education Support Teachers – Resource. Together the team researched and developed instructional strategies and assessment tools for the math 9 classroom, focusing on three units: polynomials, linear relations, and equations and inequalities. The team also researched methods of helping students prepare for final summative assessments.

An increase in student achievement and engagement was observed supported by the data. Grade 9 math teachers are better equipped to teach to multiple ability levels, use multiple teaching strategies and are more at ease with UDL principles. This demonstrates that when UDL principles are implemented properly, student learning increases, making the time and effort necessary for effectively utilizing UDL strategies worthwhile.

Introduction

At the grade 9 level math has traditionally been a difficult area for both teachers and students. Students often struggle with the complexity of the mathematical concepts while teachers are frustrated with the lack of student progress. Our project attempted to answer the question:

What pedagogical approaches can we use to enhance traditional teaching methods in the presentation of the curriculum and the assessment of students' learning in multiple ways while still meeting specific curricular outcomes in grade 9 math?

Context

Harbour View High School is a large high school located in Saint John, New Brunswick. Saint John is an industrial city populated by those with a deeply rooted traditional mindset. The blue collar influence on both student and staff has a great impact on the day to day activities of the school. It affects the possibilities and positive impacts that a UDL project such as this one could have on instructional practices. Coupled with the generally more narrow minded population of Saint John and specifically Harbour View (staff and students), the majority of the school's population reside in rural communities, which could contribute to a person's willingness to try new things and their open mindedness.

Harbour View High School houses 898 students from grades 9 through 12 with approximately 224 at the grade 9 level, 71 in French Immersion (29 early, 42 late) representing 25% of the school's population. Twenty two percent of the school's population follow a Personalized Learning Plan (PLP) compared to 22% at the grade 9 level. Only 6% of FI students are on a PLP for accommodations only. Each English math 9 class contain between 1 and 9 students who are following a modified math plan.

Literature Review

Universal design is the creation of products and environments to be usable by all people, to the greatest extent possible, without the need for adaptation (Connell et al, 1997). "Universal design allows for universal access; that is, allowing people with and without disabilities to have access to facilities" (Jordan, 2007, p. 182). There are various products that we encounter daily which have been universally designed. Curb cutouts, closed captioning, glasses to correct vision, power doors, escalators, elevators and adaptable seating are just a few examples.

The theory of Universal Design has been applied effectively to classrooms. Universal Design for Learning (UDL) is a "set of principles for curriculum development that give all individuals equal opportunity to learn"

(National Center on Universal Design for Learning [NCUDL], 2012). "The more universal and accessible [teachers'] designs for instruction, the wider the array of students they will impact" (Jordan, 2007, p.183). There is a wide range of needs and ability levels in classrooms today. The introduction of Policy 322 for Inclusive Education in New Brunswick will only increase these demands even more. "Not only do learners compose an increasingly diverse group, but they are also young people who live in a world of personalization" (Tomilson and Imbeau, 2010, p. 4). Teachers need an effective and efficient method by which to reach all learners in an inclusive environment. Universally designed lesson plans and projects provide a framework that can be accessed by all students. It eliminates the segregation of particular students in the classroom who are studying a different curriculum. This will lead to increased learning through social interaction with peers as well as better engagement in the classroom.

According to the NCUDL, "UDL provides a blueprint for creating instructional goals, methods, materials, and assessments that work for everyone—not a single, one-size-fits-all solution but rather flexible approaches that can be customized and adjusted for individual needs." When the principles of Universal Design are applied in the classroom, learning is more accessible for everyone. Eventually, these principles can become part of the teacher's routine teaching style (Jordan, 2007).

When applying the principals of UDL, teachers demonstrate knowledge and skills in multiple ways and design multiple means for students to demonstrate their learning. Learners differ in the ways they perceive and comprehend information that is presented to them as well as how they can express what they know. There is not one means of presentation or expression that will be ideal for all learners. Providing options is essential and is at the core of a universally designed program (NCUDL, 2012). Teachers also offer multiple ways of engaging students in the lessons, focusing on their interests and motivation (Jordan, 2007). Learners differ significantly in what attracts their attention and gauges their interest (NCUDL, 2012). Universally designed lessons benefit all students in the classroom, not just those who are struggling or working below grade level.

When applied simultaneously, these multiple representations increase student engagement with the learning materials. Learners differ greatly in the ways in which

they can be engaged in a lesson or motivated to learn (NCUDL, 2012). Low student engagement is the first challenge in any math classroom as the relevance and usefulness of the mathematical concepts are always questioned by students. Information that is not attended to is inaccessible (NCUDL, 2012). Therefore, math teachers devote considerable time and effort to recruiting student attention and engagement. Offering learners choice can develop self-determination and increase the degree in which they feel connected to their learning. Choosing authentic, meaningful classroom activities also recruits interest (NCUDL, 2012).

An important aspect of universally designed math lessons is repetition. Universally designed teaching focuses on repeating "important information that assists students to learn and over-learn the material, leading to better retention" (Jordan, 2007, p. 186). Retention is crucial for success in the math classroom. Students must practice the skill they are learning to be able to master it and connect it to future math learning. However, rote drill is not always an effective method for having students repeat skills. Teaching the same concept or skill in multiple ways allows students practice the math concepts while maintaining interest.

Students benefit from responding to the material in multiple ways in the math classroom, allowing them to demonstrate what they know while circumventing the challenges of a traditional paper and pencil test (Jordan, 2007). A central goal of teaching is to maximize the capacity of each learner by ensuring that each student experiences the best curriculum with necessary supports. However, we fall short of this goal when we accept a single performance level as adequate information about whether a student has mastered a curricular outcome (Tomilson and Imbeau, 2010). Learning in a math classroom occurs when students make connections within and between concepts (NCUDL, 2012). Students need to represent their learning in multiple ways to be able to demonstrate that they understand the interconnectedness of the mathematical concepts.

Methodology and Data Collection Process
In the beginning stages of the research project, the team considered the math 9 curriculum as a whole. All units and specific curricular outcomes were considered and the team chose to focus on those outcomes we felt were vital for future courses. This is not to say that the math 9 curriculum is not important as a whole, but there are

certain content areas that are more critical for future learning. Polynomials, linear relations, and equations and inequalities were chosen as focus areas. The rational numbers unit was discussed however this action research project began after the unit was completed so the team decided not to include as a focus area.

In chosen units, the focus was two major pedagogical areas. The first was on finding and creating instructional materials including SMART Board lessons, curriculum based games/activities, manipulatives, video resources and other non-traditional (pen and paper) tools. The team purchased class sets of algebra tiles to provide the opportunity for teachers to access manipulatives and provide consistency between classes. The instructional tools prompted students to activate prior knowledge fostering a better connection to the math 9 course. This approach was used to create a better understanding for students who may struggle in math and to create a deeper understanding for students who "get it" from the beginning. See Appendix A for a detailed list of the instructional tools that were created.

The second focus area was assessment, including researching and developing assessment tools teachers use for both formative and summative assessments. The overall goal of the assessment component was to create assessment tools different from the traditional pen and paper tests typically used in mathematics classrooms. Many of the non-traditional assessment tools developed resulted in literacy-based assessment tools, creating a cross-curricular culture. The team also looked into improving the way teachers can help students prepare for their final math 9 examination. The team prepared a practice exam and, with the help of the subject coordinator of numeracy, the data will be analyzed to help teachers make decisions about which concepts to review in class and any students who require interventions.

Student achievement on summative assessments and teacher opinion were the sources of data. To collect student achievement data, last year's unit tests were compared to the current year's tests. Unit tests are the only assessments that are common to all math 9 classes and were also administered the previous year. Two different calculations were taken to compare achievement results; average test mark and percentage of students who passed the unit test.

To collect qualitative data, teachers were asked the questions below on the process and products resulting from these UDL lessons:

1. Did you try any of the activities that the UDL team has sent you throughout the year? Or anything else that is a UDL lesson? If no, why not? If you said yes to question 1, keep going.
2. Did you try any activities that you would try again? Anything you really disliked?
3. Did you find any improvement with student engagement while trying the UDL activities?
4. Do you feel that students understood any topics better with the UDL activities?
5. Any other comments?

Findings

The average test marks and class pass rates were calculated for all units of grade 9 math and compared to previous year's results. This included units we created UDL materials for, as well as those units which occurred before the project began (See Appendix B for detailed tables).

Topic	2012/2013	2013/2014	Change
Pre-UDL Project			
Rational numbers	68	68	0
Exponents	73	70	-3
Square roots and surface area	68	72	+4
During UDL Project			
Polynomials	63	70	+7
Equations and inequalities	69	70	+1
Linear relations	62	71	+9

Table 1: Average unit test mark

Topic	2012/2013	2013/2014	Change
Pre-UDL Project			
Rational numbers	79	74	-5
Exponents	86	78	-8
Square roots and surface area	74	77	+3
During UDL Project			
Polynomials	70	75	+5
Equations and inequalities	72	72	0
Linear relations	65	75	+10

Table 2: Unit test pass rate

The average test scores and pass rates were calculated for units which were taught before the UDL Action Research Project began. This data will be used to inform future lesson planning and instructional practices. Rational numbers and exponents units both showed a decrease in the average test mark and pass rates over the previous year. The square root and surface area unit had an increase in both average test mark and pass rate. Inconsistency in the data is primarily due to the small sample size. Analysis of this data has influenced the math teachers at Harbour View High School to focus implementing UDL principles into the rational number and exponents units in future years. This has prompted a purchase of equivalency cubes to use in an intervention with rational numbers.

The data for the Polynomial unit test shows an increase in average test mark from the previous year of 7%. Data also shows the average percentage of students who received a passing grade (60% or higher) on the test increased by 5% in one academic year. The data for the Equations and Inequalities unit test did not show as much of an increase. The average test mark only increased by 1% and the average percentage of students who received a passing grade stayed the same as the previous academic year. The data for the Linear Relations unit was the most dramatic. The average test mark increased by 9% and the average percentage of students receiving a passing rate increased by 10%. Overall, this data is a positive reflection of the work that the UDL team has done.

Summary of Teacher Opinions
Of the materials the UDL team provided, algebra tiles, "Equations Boxes" and in-class games were the most used. Almost every math 9 teacher used algebra tiles to introduce polynomials and many continued to use the tiles throughout the entire polynomial unit as well as the equations unit. Teachers offered the algebra tiles to students as a constant option on all classwork, assignments, tests and exams. Almost every teacher taught the concept of solving linear equations by having students build equations using "Equations Boxes Worksheet". This method has students using order of operations to create the equation they are solving and then reverse all operations to find the solution. Teachers stated this method greatly deepened the students understanding of equations and the concept of inverse operations. Several in-class games were used by teachers to reinforce, review or introduce a concept. The most popular game was

"Guess that Polynomial", where students use mathematical vocabulary to determine the algebraic expression another student has hidden.

All teachers who utilized the UDL materials stated student engagement increased in the classroom, when compared to previous years. The amount of time students worked on difficult problems increased. Having manipulatives and visuals helped students to continue to struggle with solving a problem, instead of giving up quickly. Teachers also responded that students developed a deeper understanding of concepts when they used UDL materials to teach. Students understood and used the mathematical jargon for each unit in the classroom correctly, which is especially important in the French Immersion classrooms. A few teachers responded that the UDL materials have helped them to grow professionally as teachers and that they will continue to find alternatives to "chalk and talk" methods and traditional tests.

Limitations
The team began with the selection of certain curricular outcomes from the grade 9 mathematics course. This proved to be challenging as some curricular outcomes and content areas are more difficult than others to apply the UDL principles to while maintaining the integrity of the course. This is likely due to the fact that some mathematical concepts simply require drill work.

Relevancy balanced with time constraints also proved to be a challenge throughout the research project. The team felt that it was necessary to ensure curriculum-based games/activities remained both relevant and meaningful for students. Although UDL pedagogical principles are vital, they can quickly become irrelevant if teachers are conducting games/activities just for the sake of doing them. When this occurs, teachers may not see the value or benefits in certain games/activities which can lead to concerns related to time constraints. There are only so many instructional hours within a course and if teachers do not find the proper balance between the meaning and relevancy of said games/activities and time constraints, they become ultimately useless to the overall goal – to increase test pass rates and student understanding. This will also affect teachers' willingness to try different instructional practices and assessment tools in their classrooms due to the fact that these games/activi activities are not perceived as valuable in student achievement.

Teacher comfort levels are another limitation we faced when attempting to get teachers on board to try some of the new instructional practices and assessment tools. In general, most of today's educators grew up in a different time where vastly different pedagogical practices were used. Today's teachers are students of the traditional instructional practice of "chalk and talk" and were mainly assessed using the "pen and paper" method. Classrooms have evolved and while educators recognize the benefits and added-value in UDL principles, not everyone is comfortable taking the leap into the somewhat unknown territory. Teachers are likely to be most comfortable teaching those students whose learning style is most like their own. Having to venture outside of their comfort zone is challenging and time consuming.

The idea of comfort levels for educators spills over into class composition. UDL principles may work better in certain classrooms, depending upon the learning styles, academic level and behaviour issues, among other factors. Teachers may be more willing to attempt something new and foreign to them if they have a well-behaved class or if they feel that the learning styles in a particular class are more compatible with the particular instructional practice or assessment tool. The same could be said about students' comfort level and the success this project. In order for new UDL principles to work, educators need student participation as well.

Classroom dynamics are also a factor when it comes to the success of this research project. Trust is an intangible and immeasurable component to be considered. This comes with positive teacher-student relationships and is vital when it comes to attempting new pedagogical methods. Teachers will feel more at ease attempting these new approaches with a class they are more comfortable with and students will be less likely to resist participating.

Data collection and the reliability are also concerns. While the unit tests themselves are almost exactly the same, there are variations in teachers. This would affect the data since, as mentioned above; some teachers are more resistant to try new instructional practices. Class composition also factors into the reliability since we are collecting data from a completely different group of students. The length of time of this action research project also affects the reliability of the data collected. The comparison between two academic years is not enough to demonstrate whether implementing UDL practices

increased student achievement.

Implications
This research project has proved to be worthwhile for both teachers and students. Teachers are better equipped to provide multiple instructional practices in the math 9 classroom and are likely able to extend some of the instructional practices and assessment tools to other curricular areas.

The possible positive cross-curricular outcome for teachers is two-fold. First, if math 9 teachers who participated in this research project find value in the UDL principles they may be likely to implement them in other subject areas as not all grade 9 math teachers solely teach math. Second, if other teachers on staff at the school who were not involved in the research project hear about and see the positive impact that UDL principles can have, they may adopt some of the fundamentals in their classrooms. This may not be limited to the teaching staff at this school as we often participate in professional development with other teachers in the district.

Students appear to have a deeper understanding of certain curricular areas and it would appear from the data collected that there is a general increase in student achievement. Student engagement is increasing as we are able to accommodate for more learning styles using UDL principles.

Recommendations and Future Research
This research project began after the most vital unit was completed, rational numbers. Given this timeframe, the team focused on units that were still to come. The team has purchased manipulatives that fit well with the rational numbers unit so teachers will be able to implement UDL principles in the rational numbers unit in future years.

Beyond the rational numbers unit, the team hopes to examine other units to develop more instructional strategies and assessment tools that adhere to UDL principles. The benefits are apparent given the data collected for the units where UDL principles were used this year.

The team would also like to continue to use data to make instructional decisions, in a similar way that the practice exam data was used. The team would like to create benchmarks that could be administered throughout the year which would provide information on students'

understanding of numeracy when they enter high school and at certain points throughout their grade 9 year. This data would help educators and administrators make decisions about student programming, class compositions and interventions that could help students meet high school math with success.

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Appendix A

UDL instructional materials and assessments created:

Polynomial Instruction
- Smart Notebook files – There are several Smart Notebook files that focus on the essential vocabulary of the unit, including the always popular question "What is a like term?" and combining like terms. We focused on these two concepts, since they are critical to understanding algebra in general.
- Algebra tiles – There is a Smart Notebook algebra tiles file, as well as class sets of algebra tiles.
- Games – Class sets were created for each of the following games: Evaluate This, Guess that Polynomial, Polynomial War and Race to the Top
- Videos – Several links for videos and online games to introduce the concept of like terms and adding them
- Enrichment – Practice with multiplying binomials and factoring polynomials

Polynomial Assessment
- Polynomial Story - Create a story, using correct mathematical terminology, about Captain Polynomial whose job is to reunite like terms who have drifted apart.
- Dictionary - Create a dictionary (in groups or alone) that contains all the vocabulary from the unit
- Instructions - Create a set of instructions on how to do some operation (collect like terms, add, subtract, multiply, divide polynomials)
- Online Dating Profile - Create an online dating profile for one polynomial who is searching for another.
- Wanted Poster - Create a Wanted Poster for a polynomial who has broken a math law.
- Puzzles - There are puzzles for collecting like terms, adding and subtracting polynomials. The puzzles for collecting like terms are printed, laminated and ready to go. The others are not.

Equations/inequalities Instruction
- Inequality statements – Write the algebraic inequality for the sentence.
- Blank number lines – These are number lines without any numbers filled in, for questions where they have to graph the inequality.
- Equations/inequalities Jeopardy
- Inequations Bingo – also for review, when you finish with inequalities.
- Around the room – also review towards the end of the unit. These are questions, typed with large print on equations and inequalities. Cut the questions out, tape them around the room, students divide their papers into 12 sections and answer each question.

Linear Relations Unit
- Introduction activity: whole class, demonstrating how to create table and linear equation by adding desks
- Dinner assignment – plan dinner for x number people, create equation

Appendix B

One teacher's class was excluded from the data for the 2013-2014 school year. Due to the particular composition of this class, the teacher does not give unit tests. Instead, he assigns frequent short quizzes.

Pre UDL Project

Rational Unit

2012-2013

Class	Average Test Mark	Pass Rate
Teacher A – 29 students	79%	90%
Teacher B – 22 students	64%	77%
Teacher B – 24 students	57%	67%
Teacher C – 12 students	52%	84%
Teacher C – 12 students	69%	67%
Teacher D – 20 students	56%	60%
Teacher D – 24 students	57%	71%
FI Teacher E – 22 students	81%	91%
FI Teacher E – 21 students	76%	90%
FI Teacher F – 21 students	84%	90%
Average of classes	**68%**	**79%**

2013-2014

Class	Average Test Mark	Pass Rate
Teacher J – 25 students	79%	92%
Teacher A – 19 students	64%	68%
Teacher A – 18 students	53%	62%
Teacher C – 19 students	67%	63%
Teacher D – 21 students	62%	76%
Teacher H – 28 students	69%	75%
FI Teacher E – 26 students	93%	100%
FI Teacher F – 21 students	63%	62%
FI Teacher F – 22 students	61%	68%
Average of classes	**68%**	**74%**

Exponents Unit

2012-2013

Class	Average Test Mark	Pass Rate
Teacher A – 29 students	91%	97%
Teacher B – 22 students	65%	82%
Teacher B – 24 students	62%	79%
Teacher C – 12 students	49%	84%
Teacher C – 12 students	72%	92%
Teacher D – 20 students	67%	70%
Teacher D – 24 students	72%	84%
FI Teacher E – 22 students	85%	95%
FI Teacher E – 21 students	83%	81%
FI Teacher F – 21 students	84%	95%
Average of classes	**73%**	**86%**

2013-2014

Class	Average Test Mark	Pass Rate
Teacher J – 25 students	77%	88%
Teacher A – 19 students	63%	58%
Teacher A – 18 students	55%	62%
Teacher C – 19 students	75%	89%
Teacher D – 21 students	53%	71%
Teacher H – 28 students	78%	89%
FI Teacher E – 26 students	92%	100%
FI Teacher F – 21 students	69%	76%
FI Teacher F – 22 students	68%	73%
Average of classes	**70%**	**78%**

Square Roots and Surface Area Unit

2012-2013

Class	Average Test Mark	Pass Rate
Teacher A – 29 students	80%	83%
Teacher B – 22 students	70%	95%
Teacher B – 24 students	64%	83%
Teacher C – 12 students	39%	50%
Teacher C – 12 students	61%	50%
Teacher D – 20 students	58%	50%
Teacher D – 24 students	62%	62%
FI Teacher E – 22 students	79%	86%
FI Teacher E – 21 students	81%	90%
FI Teacher F – 21 students	89%	95%
Average of classes	**68%**	**74%**

2013-2014

Class	Average Test Mark	Pass Rate
Teacher J – 25 students	68%	64%
Teacher A – 19 students	75%	89%
Teacher A – 18 students	55%	39%
Teacher C – 19 students	68%	74%
Teacher D – 21 students	67%	67%
Teacher H – 28 students	82%	93%
FI Teacher E – 26 students	95%	100%
FI Teacher F – 21 students	75%	81%
FI Teacher F – 22 students	64%	86%
Average of classes	**72%**	**77%**

Polynominal Unit

2012-2013

Class	Average Test Mark	Pass Rate
Teacher A – 29 students	80%	93%
Teacher B – 22 students	59%	63%
Teacher B – 24 students	60%	67%
Teacher C – 12 students	38%	58%
Teacher C – 12 students	60%	67%
Teacher D – 20 students	49%	55%
Teacher D – 24 students	46%	37%
FI Teacher E – 22 students	78%	91%
FI Teacher E – 21 students	75%	76%
FI Teacher F – 21 students	84%	90%
Average of classes	**63%**	**70%**

2013-2014

Class	Average Test Mark	Pass Rate
Teacher J – 25 students	86%	96%
Teacher A – 19 students	66%	68%
Teacher A – 18 students	47%	45%
Teacher C – 19 students	78%	95%
Teacher D – 21 students	62%	62%
Teacher H – 28 students	68%	79%
FI Teacher E – 26 students	92%	100%
FI Teacher F – 21 students	68%	62%
FI Teacher F – 22 students	62%	68%
Average of classes	**70%**	**75%**

Equations and Inequalities Unit

2012-2013

Class	Average Test Mark	Pass Rate
Teacher A – 26 students	85%	92%
Teacher B – 22 students	67%	82%
Teacher B – 19 students	64%	58%
Teacher C – 8 students	68%	75%
Teacher C – 11 students	59%	63%
Teacher D – 19 students	58%	58%
Teacher D – 21 students	53%	38%
FI Teacher E – 22 students	75%	86%
FI Teacher E – 21 students	72%	77%
FI Teacher F – 21 students	85%	90%
Average of classes	**69%**	**72%**

2013-2014

Class	Average Test Mark	Pass Rate
Teacher J – 27 students	93%	79%
Teacher A – 17 students	65%	71%
Teacher A – 15 students	61%	60%
Teacher C – 19 students	62%	67%
Teacher D – 20 students	56%	75%
Teacher D – 22 students	59%	72%
FI Teacher E – 27 students	94%	100%
FI Teacher F – 20 students	64%	55%
FI Teacher F – 22 students	71%	72%
Average of classes	**70%**	**72%**

Linear Relations Unit

2012-2013

Class	Average Test Mark	Pass Rate
Teacher A – 26 students	77%	85%
Teacher B – 22 students	74%	91%
Teacher B – 19 students	61%	58%
Teacher C – 8 students	40%	38%
Teacher C – 11 students	50%	46%
Teacher D – 19 students	48%	21%
Teacher D – 21 students	48%	43%
FI Teacher E – 22 students	68%	86%
FI Teacher E – 21 students	62%	83%
FI Teacher F – 21 students	87%	95%
Average of classes	**62%**	**65%**

2013-2014

Class	Average Test Mark	Pass Rate
Teacher J – 27 students	73%	81%
Teacher A – 17 students	72%	77%
Teacher A – 15 students	71%	80%
Teacher C – 19 students	63%	67%
Teacher D – 20 students	49%	50%
Teacher D – 22 students	50%	41%
FI Teacher E – 27 students	91%	96%
FI Teacher F – 20 students	82%	90%
FI Teacher F – 22 students	86%	95%
Average of classes	**71%**	**75%**

Engaging Students in the Social Studies Curriculum Using UDL Pedagogy: How Will UDL Practices Increase Student Engagement?

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Abstract

Universal Design for Learning (UDL) is a framework for including all learners, which contributes to increasing student engagement. This research examines whether or not student engagement in both English and French immersion middle level Social Studies classrooms would be increased through the use of UDL pedagogies. A common UDL lesson planning template allowed the researchers to put UDL practices at the forefront of their unit planning. It was hypothesized that planning curriculum units with a focus on UDL framework, would help teachers be more cognizant of planning for all learners, which in turn would increase student engagement. Surveys and interviews were used for data collection about how students perceived engagement. Findings suggest that student engagement increased when UDL pedagogies were used.

Introduction

Universal Design for Learning (UDL) is a set of principles that provides teachers with a structure to develop instruction to meet the diverse needs of all learners. A research-based framework, UDL suggests that each student learns in a unique manner, so a one-size-fits-all approach is not effective. By creating options for how instruction is presented, how students express their ideas, and how teachers can engage students in their learning, instruction can be customized and adjusted to meet individual student needs.

UDL pedagogies not only make classroom learning more accessible to all learners, but have also increased engagement of students. "Principles of effective UDL provide all students, not just those with disabilities, multiple ways to access the general education curriculum, to present knowledge, and to motivate the students to learn" (Elder-Hinshaw, Manset-Williamson, Nelson, & Dunn, 2006, p. 7). When a teacher uses UDL practices in the classroom, students have more choice, can learn through their intelligences and make connections to their world,

motivating them to become active participants in their learning. "Teachers who create multiple means of engagement [author emphasis] support affective learning by tapping into learners' interests and offering appropriate challenges to increase their motivation" (Jiménez, Graf, & Rose, 2007, p. 45).

For this action research project, researchers asked if student engagement in grades seven English and eight French Immersion Social Studies classes would be improved through the use of UDL practices, using a common UDL lesson planning template. Action research is a process of systematic inquiry into a self-identified teaching or learning problem to better understand its complex dynamics and to develop strategies geared towards the problem's improvement. (Hamilton, 1997, p. 3). The methodologies involved interviews, surveys, anecdotal observations, student products and professional dialogue.

Harvey High School is a rural school located 30 minutes southwest of Fredericton, New Brunswick. In the fall of 2014, Harvey High had an enrollment of 265 students in both the English Prime and French Immersion programs. For the 2014-2015 school year, the school was home to fourteen classes, ranging from grade six to grade 12 and 24 teachers. We decided to use the grade seven English and grade eight French Immersion Social Studies classes for the purposes of this research. The grade seven English Social Studies class was comprised of 22 students (12 boys and nine girls), including three students on a Personalized Learning Plan (PLP). The grade eight French Immersion (FI) Social Studies class was comprised of 15 students (seven boys and eight girls). No students in this class had a PLP.

Analysis of Harvey High School's 2013 Tell Them From Me survey (TTFM) and 2010 Student Perception Survey, indicated that student engagement was low. Harvey High's TTFM indicated that 40% of students felt engaged in their learning. Data from the Student Perception Survey showed 57% of students felt they were

learning things at school that would be useful. Furthermore, 34% said teachers provided choice and 40% felt teachers made work interesting (The Learning Bar, 2013, pp. 1-4).

Literature Review

Research on student engagement indicates a significant drop between the elementary and middle school levels and that this trend continues through the high school years.

> A study conducted by the Canadian Education Association, in collaboration with Galileo Educational Network and The Learning Bar, found that all three types of engagement markedly decline as students progress through middle and secondary school. For example, in Grade 6 about 60% of students were considered to be intellectually engaged, but by grade 9 the percentage was about 30%. (The Learning Bar, 2013, p. 1)

This data is particularly important to middle school teachers because, when engaged, students are less likely to cause disruptions in the classroom and exhibit negative behaviours. "Some disengaged students are disruptive and disrespectful, and prone to participating in risky behaviours, including smoking, excessive drinking, drug use, and unsafe sexual practices" (The Learning Bar, 2013). The result of these negative behaviours is likely to affect a student's academic success and impact their relationships with others. Pisha and Coyne (2001) highlighted that one of Vygotsky's (1979, 1986) three conditions for learning to occur is that students "be engaged both by the strategies and the sensory data to which he or she is applying them. If any of these conditions [is] missing, learning will be suboptimal at best" (p. 198).

Research also indicates that increasing student engagement is not an easy task as it involves a whole-school approach. "Five school-level factors were consistently related to student engagement: quality instruction, teacher-student relations, classroom learning climate, teacher expectations for success, and student advocacy" (The Learning Bar, 2013, p. 3). For teachers, increasing student engagement requires educators to make a change from a traditional, one-size fits all teaching approach to one that is accessible to all learners. "Increasing the intellectual engagement of students is perhaps more difficult to achieve as it requires a marked change in classroom

practice" (The Learning Bar, 2013, p. 1).

Methodology

We adapted a UDL instructional planning template (Appendix A), originally designed by the New Brunswick Department of Education and Early Childhood Development (EECD), which is available on the New Brunswick Education teacher portal. The template was used to plan a UDL Social Studies curriculum unit. The grade seven unit focused on Canadian Confederation and the grade eight class focused on how contemporary Atlantic Canadian Culture has been shaped by First Nations, Acadians, Loyalists and Irish settlers. Before beginning the UDL units, students completed a multiple intelligences survey. Additionally, they were asked ten survey questions to measure how they perceived their own engagement in their Social Studies class. Pre and post surveys were administered via Survey Monkey using a Likert scale (Appendix B). The pre-survey questions asked students to reflect on their Social Studies class from September to February, while the post survey questions asked students to focus on the Canadian Confederation or Atlantic Culture UDL unit recently taught.

Students were also interviewed individually by the researchers to gain insight as to how they felt their Social Studies teachers supported all learners. Initial interview questions asked students to identify how they best learn, how their teachers differentiated lessons, and if they had suggestions as to what kind of activities would make their learning more interesting. At the end of the units, students completed the survey a second time and were re-interviewed. The post-interview questions were specific to the Canadian Confederation and Atlantic Canadian culture units. Students were asked to provide specific examples where they given the chance to complete classwork based on how they learn best. They were also asked how their teachers supported different learning styles and if they noticed a difference in how lessons were presented during the UDL units compared to previous units taught that year. It is important to note that students were not interviewed by their own teacher, in order to reduce teacher bias in reporting and to encourage students to openly share their thoughts.

The teachers planned their units using the newly created UDL planning template. Team members met regularly throughout the project to share observations, to co-plan lessons that utilized UDL practices.

Discussion
Results show an improvement in student engagement. On average, results showed a positive increase in student engagement by 15.5% after the UDL practices were implemented in the classroom (Table 1).
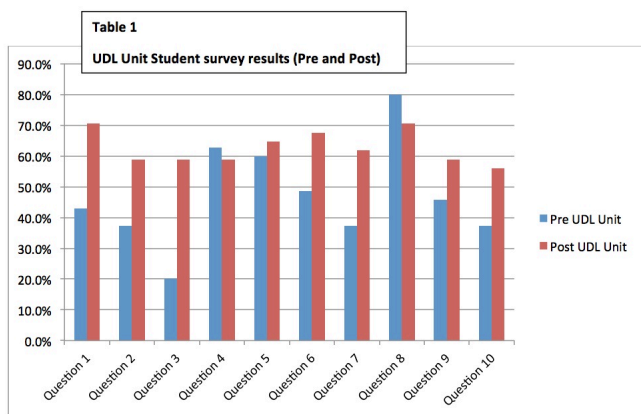

Table 1: UDL Unit Student Survey Results (see Appendix B for additional details).

Individual student interviews indicated that student engagement was low before the implementation of UDL practices. Students referred to the monotony of textbook work, frequent use of PowerPoint presentations and the amount of assignments that were traditional in nature (e.g. read and answer questions) in prior units. In the post-UDL unit interviews students were more enthusiastic and admitted to being more engaged. Students were quick to point out they noticed a difference in teaching methodology during the UDL unit, which resulted in a feeling that their voice mattered. For instance, when asked if they noticed a difference between previous units and the unit using UDL focused unit, one student is quoted as saying, "last ones [previous units] were a lot more taking notes . . . but it's almost like the notes were taken in our heads by this learning." (Table 1)

We observed a difference between the perceptions of female and male students as to their engagement. Male students were more apt to identify areas in which they were not engaged and what could be done to improve them. Female students were more accepting of current methods and less likely to provide suggestions for improvement.

Data collected demonstrates some discrepancies in the research methodology. Some of the pre and post interview questions did not align. Question eight asked students about the relationship between having choice and the effort that they put forth into their work. When analyzing results from this question, researchers noted a marked decrease in the results. Researchers feel this could be attributed to three factors: students feeling overwhelmed with the amount of independent thinking required when given choice, students and teachers having different understandings of what choice is, and attendance issues resulting in students losing the ability to choose to work independently, with a partner or in a group.

When using a UDL framework, it is important to give students choice on how they demonstrate their learning so they feel more invested. Students are used to demonstrating their learning using traditional methods such as writing an essay or designing a poster. Therefore, they may be reluctant to try something new. The teacher's role then becomes that of a facilitator, helping students to recognize how their strengths and interests can be used to represent their learning.

Limitations
The UDL researchers discovered various limitations during their project; however time was their main restraint. During the months of February and March, when the UDL units were taught, there were numerous snow days. This, along with March Break, school assemblies, field trips and teacher and student absences made it difficult for the researchers to effectively and efficiently carry out their UDL unit. As a result the continuity of instruction was interrupted.

Recommendations for Instructional Practices and Future Research
Teachers are encouraged to consider all learners in advance of planning curriculum units. This can be facilitated by the use of a UDL unit template, allowing teachers to identify various ways to present content and ensure students have opportunities to demonstrate their learning through various forms. Students' interests, skills, strengths and challenges should be considered throughout the planning process. The teachers participating in this research project became aware that there are people within the school community with a variety of skills and interests that could be incorporated in the form of cross-curricular co-teaching or enrichment opportunities.

When new to using UDL practices, teachers may want to start small, selecting a specific outcome or learning goal before expanding to a full unit. Once a teacher be-

gins to feel more comfortable with UDL, opportunities for cross-curricular activities, co-teaching and co-planning are limitless. It is suggested that teachers collaborate and find opportunities to share their own interests and skill sets.

Conclusion

The results of this research demonstrate that student engagement was increased as a result of UDL practices. Not only was enthusiasm and productivity increased for students, but the teachers were excited at the new direction their lessons took. As teachers we looked forward to what students would create and how this allowed them to share their interests. The positive results encouraged the teachers to share their findings and experiences with their colleagues.

Due to the fact that this research project only focused on the grade 7 and grade 8 Social Studies curricula, we were left wondering how UDL practices might increase student engagement in other grade levels and subject areas. The UDL planning template was universally designed, but given that all teachers plan differently, modifications to the template may be needed before others. By making a digital template available, the researchers would be interested in seeing how teachers of different curricula and different grade levels adapt and use the template. The research team would like to work with students on co-constructing criteria to create an outcome based common rubric for assessing multiple ways of representation.

Continued professional development would benefit teachers as they as they begin to use a more UDL focused approach in their planning and teaching. Schools may consider offering opportunities for co-planning and co-teaching in the early stages of applying a UDL framework. It is important for teachers to recognize that implementing UDL is a learning process for both educators and their students. While it requires additional time with upfront planning, the long term benefits are worth the journey.

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Universal Design for Learning Unit Plan Template

Class: _____	**Date(s)**: _____
Unit / Individual Lesson	

Universal Design for Learning
Representation

__ Oral Directions
__ Whole Class Discussion
__ Small Group Discussion
__ Video
__ Video Captioning
__ Glossary of Terms
__ Highlighted vocabulary/
   notes
__ Smart Board Tools
__ Manipulatives
__ Computer
__ Audio Version
__ Handouts to accompany
   oral instructions
__ Preview of key ideas (oral /
   written)
__ Student Copy of Notes
__ Pictures/Graphs/Symbols
__ Graphic Organizers
__ Hands on Activities
__ Other
_____

Action and Expression

What ways can students demonstrate their understanding of concepts taught?
(Ex. Oral, video, hands on, technology based, group work option, written format, artistic, pictorial)

Engagement

How will I actively involve students in their learning?
* Make information relevant to students (ex. Personalized to students' lives, socially relevant, age/ability appropriate)
* Option to increase individual choice (Ex. Involve students in setting their own behaviour/academic goals, tiered levels of challenge)
* Reduce perceived pressures and distractions

Curriculum Outcomes / Unit or Lesson Goals

Required Materials, Tools and Technology

Assessment (as applicable)
Formative

Summative

Accommodations / Modifications (Student Specific)

In-Class Support
_____ Educational Assistant
_____ Resource
_____ Literacy Lead
_____ Guest Speaker
_____ Other _____

Starter	__ minutes

Detailed Lesson Plan	__ minutes

Closing Activity / Exit Slip / Homework	__ minutes

Reflection (How did it go? / Changes for next time)

Appendix B
Survey Questions

Question 1
    My Social Studies teacher plans for all different types of learners.

Question 2
    My Social Studies teacher gives me choice in how I show my learning./In the last unit my Social Studies teacher gives me choice in how I show my learning.

Question 3
    In Social Studies I like to work by myself. / In the last unit I was given the choice to work by myself, with a partner or in a group.

Question 4
    In Social Studies I like to work with a partner./After completing the last unit in Social Studies I discovered that I like to work with a partner.

Question 5
    In Social Studies I like to work in a group./After completing the last unit in Social Studies I discovered that I like to work in a group.

Question 6
    My teacher helps me make connections between what I learn in Social Studies and real life, now or in the future/ My teacher helped me make connections

Question 7
    In Social Studies I have choice in the way I show what I have learned./ In the last unit in Social Studies I had choice in the way I showed what I learned.

Question 8
    I put more effort into assignments when I have choice./ I put more effort into assignments in the last Social Studies unit than I have put into past assignments.

Question 9
    My Social Studies teacher conferences with me or provides written feedback about ways to improve before marks are given./ In the last Social Studies unit, my teacher conferences with me or provided written feedback about ways to improve my assignments before they had to be passed in for marks.

Question 10
    My voice matters when deciding on the types of activities we do in Social Studies./ My voice mattered when deciding on types of activities we did in this last unit on Social Studies, between what I learned in the last unit in Social Studies and real life, now or in the future.

Universal Design for Learning Promotes Student Engagement – An Action Research Project at Island View School

Jana Nicol, Island View School, Saint John, N.B.

Abstract

This paper will present the findings of an action research project on Universal Design for Learning (UDL) that was undertaken by a team of four elementary school teachers at Island View School in Saint John, New Brunswick. The goal of this project was to determine what tools will help facilitate teacher buy-in and the implementation of Universal Design for Learning in elementary school classrooms to improve student engagement? To answer this question, team members completed a review of current research, conducted surveys, collected student work samples, and created and executed universally designed lesson plans and templates.

Results indicated that teachers have positive feelings toward UDL, but that more professional development and access to resources was needed to facilitate implementation of UDL on a wider scale. Team members adopted UDL practices gradually throughout the 2013-2014 school year. Teacher observations and reflections, and student data indicate that it positively impacted student engagement.

Keywords: Universal Design for Learning, action research, elementary education

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This action research project on Universal Design for Learning (UDL) was undertaken by a team of teachers at Island View School in Saint John, New Brunswick. Island View School is an elementary school (kindergarten to grade five) with an enrollment of over 300 students from urban, suburban, and rural areas. Every classroom is equipped with a SMART board, and students have access to netbook computers. They also engage in learning through hands-on activities, an outdoor classroom, cross-curricular activities, and guest speakers.

The action research team included four teachers and represented a diverse range of grade levels (grades 2-5), disciplines (elementary education, special education, and administration), and levels of experience with UDL (ranging from novice to proficient). From October 2013 to May 2014, the team explored the following question through action research: *what tools will help facilitate teacher buy-in and the implementation of Universal Design for Learning in elementary school classrooms to improve student engagement?*

Current Research on Universal Design for Learning

Universal Design for Learning (UDL) is not a single practice, but rather a framework that utilizes existing methods relevant to its principles for enhancing the learning of all students (Jiménez, Graf, & Rose, 2007). It encompasses three guiding principles: multiple means of representation – the 'what' of learning, multiple means of expression – the 'how' of learning, and multiple means of engagement – the 'why' of learning (CAST, 2011). These principles are based on extensive research on the cognitive sciences and learning theory to make learning accessible to the maximum number of students (Stockall, Dennis, & Miller, 2012).

UDL values diversity; individual differences are not only expected, but celebrated. Lessons are designed to meet the needs of students with a wide range of linguistic, sensory, motor, cognitive, and intellectual abilities and disabilities (Strobel, Arthanat, Bauer, & Flagg, 2007). UDL acknowledges the diverse ways that the brain processes information in the process of learning, which creates opportunities for all learners to experience success (Ender, 2007). This is accomplished through the use of "materials and activities that make learning goals achievable by individuals with wide differences in their abilities to see, hear, speak, move, read, write, understand English, attend, organize, engage, and remember" (Doyle & Giangreco, 2009, pg. 27). It is no longer adequate to design instruction for two groups – 'regular' and 'special', as this oversimplifies the differences that exist within classrooms (Meo, 2008).

UDL represents a paradigm shift from accommodation to full inclusion. Meeting the educational needs of a diverse student population allows all students to participate in the common learning environment with fewer

special accommodations. This saves teachers the time and effort needed to arrange accommodations for specific students who have learning difficulties (Shaw, 2011). Implementing accommodations that are accessible to everyone will not eliminate the need for special supports, but it is more inclusive than the traditional accommodations process (Izzo et. al., 2008). If a lesson is designed with diverse learning styles, interests, and abilities in mind, the need for special accommodations will be reduced or even eliminated, resulting in increased student understanding and engagement (Shaw, 2011).

Instruction can be made more accessible to students by scaffolding learning, which engages students because it builds on background knowledge (Flores, 2008). It is not unusual for learners to have gaps in background knowledge. Information is more likely to be assimilated when it is presented in ways that activate and build upon prior knowledge. Teachers can scaffold learning by pre-teaching vocabulary, breaking down complex terms into simpler words or symbols, and using illustrations and videos (CAST, 2011). Tasks are simplified when needed, helping students develop more confidence to take risks in their learning. Scaffolds are gradually withdrawn as students develop a better understanding of content (Coyne et. al., 2010).

UDL includes the use of technology to engage students in the delivery of curriculum, and as one of many tools used to demonstrate their learning (Ender et. al., 2007). Technology is not synonymous with UDL; however, technology plays a valuable role its implementation (CAST, 2011). Technology is an integral part of UDL because it enables teachers to present information to students in multiple ways, while increasing their independence and engagement, thus positively impacting the learning of all students (Stockall et. al, 2012).

Offering choice in how students express their learning is a key component of UDL. Students are given choices how to best express their learning in a variety of formats, such as: essays, speeches, scrapbooks, art work, videos, or any format that fits their interests (Morra & Reynolds, 2010). Students are more likely to experience success if they are free to choose among "learning modalities that capitalize on their individual strengths" (Izzo et. al., 2008, pg. 68). According to CAST (2011), it is vital to provide a variety of instructional strategies to attract the attention of students and engage them in learning.

Methodology and Data Collection

In our team's efforts to answer the question what tools will help facilitate teacher buy-in and the implementation of Universal Design for Learning in elementary school classrooms to improve student engagement?, we created universally designed lessons, facilitated the lessons in our classrooms and evaluated their effectiveness through observations, reflections, and feedback from students. We searched for tools and materials online and through resource catalogues. We also created lessons plans, supporting materials, and a lesson plan template designed to help teachers create lessons and materials that follow the principles of UDL. All of the materials that we created can be found on our website http://theudlproject.com. We also wrote reflective journals about our experiences throughout this project.

Student Engagement

In efforts to measure student engagement, we collected data from students in our own classrooms (88 students). In November 2013 and in April 2014, students were asked to describe how they felt about school and/or learning in one word, which they recorded onto an index card. They were asked for only one word to make it easier to tabulate their responses as quantitative data. In November 2013 students were also given the following writing prompt: 'describe what the best day would look like in your favourite subject'. When we collected data again in April, instead of repeating the writing prompt from November 2013, students were asked to 'describe what the best day would look like in your Math/Language Arts/Science/Social Studies classes'. The purpose of changing the writing prompt was to find out which aspects of these subject areas students found most engaging.
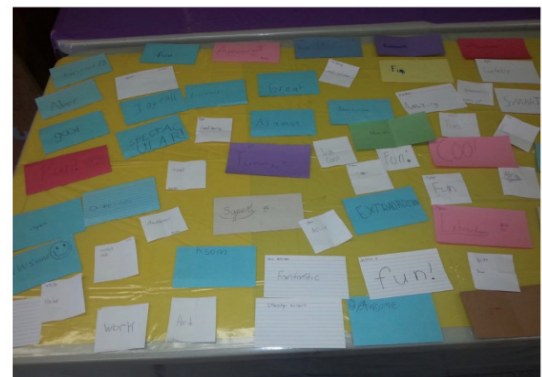

Image 1: Sample of student responses to prompt "How do you feel about school/learning in one word?"

Colleague Readiness

The team wanted to determine our colleagues' level of readiness for implementing UDL in their own practices. We felt that this was important to examine, as readiness is a vital prerequisite to executing any given teaching practice. We collected data through an online survey using Survey Monkey, and emailed it to teachers in our school in November 2013. Most teachers (85%) responded to the survey. Teachers were asked about their level of knowledge about UDL, how often they implement UDL in their practices, perceived obstacles to implementing UDL, whether or not they would implement UDL more often if they had sample lessons to follow, and their feelings about UDL. Another online survey was administered in January 2014 to obtain more information about the obstacles faced by teachers in the areas of planning and preparation, which were identified in the results of the previous survey.

Findings

When students were asked to describe how they felt about learning in one word in both the November and April surveys, 85% reported having positive feelings. More than half used words that were synonymous with 'awesome', a quarter of the students used words synonymous with 'fun', and five percent used words synonymous with 'creative'. Five percent of students found school to be difficult, and the remaining students used words which were unclear (e.g. 'busy', 'math'). Results were almost identical in both sets of data (collected in November 2013 and April 2014), but more students used the word 'fun' to describe learning in the second data set. It is noted that students who reported positive feelings about school used better quality words in the second data set. While many students used words like 'good' in November, this word was rarely used in April, and was replaced by words like 'spectacular', 'fantastic', and 'interesting'. This data may indicate that students were more engaged in learning in April 2014 than they were in November 2013.

In November 2013, students engaged in a writing activity responding to the prompt 'describe what the best day would look like in your favourite subject'. Most students wrote about Physical Education or Art. It is noted that there was a gender divide among the responses. Students who wrote about Physical Education were generally boys, and students who wrote about Art were generally girls. Many upper elementary students wrote about cross-curricular activities (some used creative words like

'Mart' for Math/Art). Students across all grade levels expressed a desire to have choices in what they were doing and/or who they could work with.

In April 2013, students engaged in a writing activity responding to the prompt 'describe what the best day would look like in your Math/Language Arts/Science/ Social Studies classes'. The team decided to use this writing prompt to help students focus on specific subject areas to determine what students found most engaging about these subjects, and also to guide our instruction so that we could increase engagement in all areas of the curriculum. Recurring themes across all grade levels included preferences for: partner and group activities, having choices of activities, using manipulatives, technology, hands-on activities, playing games, and reading.

Image 2: Students using manipulatives to sort geometric solids by a given set of attributes.

Image 3: Students engaged in hands-on activity for science class

Iamge 4: Studetns participating in the Hour of Code - learning how to use coding

According to the results of the online teacher surveys, most teachers (83%) believed that UDL is a step in the right direction, while the rest thought of it as just another passing fad. Levels of knowledge about UDL and how to implement it in teaching practices varied, ranging from knowing a little bit about UDL (12%) to being very knowledgeable about UDL and how to implement it in the classroom (29%). The majority fell in the middle, reporting that they had a good understanding of UDL but were unsure of how to effectively implement it in their teaching practices (59%). All respondents implement UDL in their teaching practices at least some of the time, and indicated that they would implement UDL practices in their classrooms more often if they had sample lessons to follow. Time, planning and preparation were considered to be the largest obstacles to implementing UDL (indicated by 90% of respondents). This included: finding, creating, and adapting resources, collaborating with colleagues, teaching to diverse learning styles, and finding or creating templates to facilitate the implementation of UDL.

In order to facilitate the implementation of UDL practices among our colleagues, team members created sample lessons, gathered supporting materials, and made them available to all staff. We posted all of the materials that we created on our project's website (http://theudl-project.com). We found many activities and readings that are in digital format online, and placed them in an electronic library that can be accessed by all staff on a shared drive. We were also able to purchase books in a wide range of reading levels to supplement our Science and Social Studies units, so that the content could be more accessible to students whose reading levels vary. Team members found that having access to these resources made it much easier to plan lessons that followed the principles of UDL, and and that students were more engaged when participating in these lessons. Additionally

the increased availability of UDL resources in the school made it easier for other teachers in the school to implement them into their own lessons.

Recommendations
Teachers can promote student inclusion and engagement through a UDL framework by integrating opportunities for arts-based education and physical activity in all subject areas. It is recommended that lessons and activities appeal to different sensory modalities, and multiple intelligences/learning styles. Team members observed that students seemed more engaged when movement and arts were integrated into lessons of all subject areas. Students commented that they enjoyed being provided with choices in activities and assessments. They should also be given opportunities to learn individually, in partners, and in small groups. Therefore, offering choice helps promote engagement in learning. It is recommended that teachers integrate technology throughout the curriculum into lessons (e.g. videos, SMART board activities) and activities (e.g. online games, PowerPoint presentations, photo editing, etc.).

Efforts to increase teacher readiness for implementing UDL can be enhanced by improving access to resources and professional development. School resources, such as manipulatives, artifacts, and visual aids should be well-organized, and be kept in known locations that are easily accessible by all teachers. It is also suggested that schools create data-banks of digital and web-based resources, which are categorized by grade level, subject, and unit. Resources for each unit of study should be accessible to students of diverse abilities to facilitate differentiating instruction. For example, students can access books to read about any given Science unit at a variety of reading levels so everyone can access the content whether they are an emerging or proficient reader. Teachers should be able to easily access UDL lessons, instructional materials and templates to help facilitate the implementation of UDL in their classrooms. Many such tools and sample lessons have been compiled and published on our website (http://theudlproject.com), and it is recommended that this website be shared with teachers.

Image 5: Books for grade 5 Science units (simple machines, forces, and matter) – reading levels range from A-T.
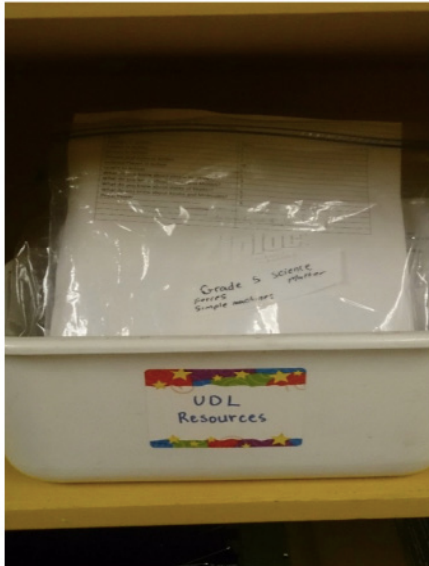

Image 6: UDL library of books for Science and Social Studies (grades 3-5) in multiple learning levels. Library is accessible to all teachers in our school.

Teachers would also benefit from more professional development on UDL and multiple intelligences. Results from the teacher surveys also indicate a need for more time to plan and collaborate. It is vital that teachers are given adequate time to plan, so that they may incorporate this new learning into their teaching practices, and so they can plan effective lessons and create assessments that follow the principles of UDL.

Limitations

Our main limitation was time. A significant amount of time needs to be spent planning UDL lessons, and finding and creating materials to facilitate the implementation of UDL in classrooms. This can be challenging to accomplish, considering that teachers already have many demands on their time. Having such demanding schedules can make it difficult for some teachers to buy-in to taking on new things.

Teachers do not have much access to professional learning opportunities about Universal Design for Learning. Increased access to professional development on UDL may increase teacher comfort with implementing UDL in their own classrooms. Even when teachers are willing to adopt more UDL practices in their own classrooms, they are more likely to experience success with this endeavor after having exposure to quality professional learning opportunities on the topic.

Conclusion

The participants in this project learned more about UDL, and we are gradually incorporating more UDL lessons and practices into our teaching. Students have benefited from this shift in our teaching practices and are engaged in learning. We have shared our learnings with colleagues, and made all of the materials we found and created available to them. In order to maximize teacher buy-in, it is strongly recommended that teachers start small as they begin to adopt UDL practices into the design of lessons, materials, and activities. More professional development opportunities on UDL, and time to collaborate and plan is vital to help teachers effectively implement UDL into their practices.
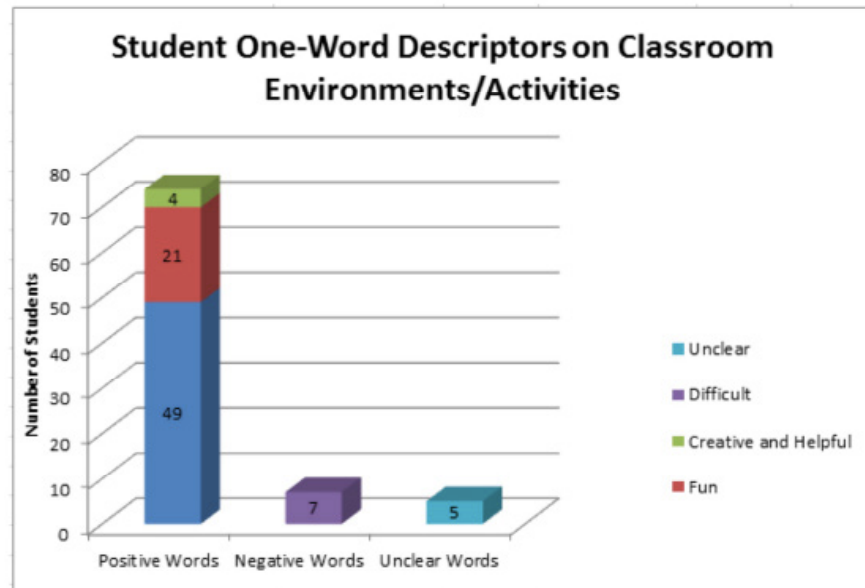
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Appendix A

Student Data – Collected November 2013

Student One-Word Descriptors on Classroom Environments/Activities

Number of Students

■	Unclear
■	Difficult
■	Creative and Helpful
■	Fun

Positive Words: 49, 21, 4
Negative Words: 7
Unclear Words: 5

Students responded to the following writing prompt: Describe what the best day would look like in your favourite subject

Recurring themes:
- Most students wrote about Art or PE (gender divide)
- Many students wrote about wanting to choose their activities or who they could work with
- Some students expressed a desire to win (a game), and/or wanted their work to be 'the best in the class'
- Upper elementary students expressed interest in cross-curricular activities

As a result of student data that was collected, here are some recommendations that will promote student engagement:
- Design lessons to incorporate more opportunities for art-based learning (in all subjects)
- Integrate Physical Education into other subjects
- Take time to showcase student work
- Acknowledge individual students' accomplishments to the class
- Provide choices in how students demonstrate learning
- Consider differences based on gender in the lesson planning process (e.g. majority of students who preferred Physical Education were boys; majority of students who preferred Art were girls)

Appendix B

Student Data – Collected April 2014
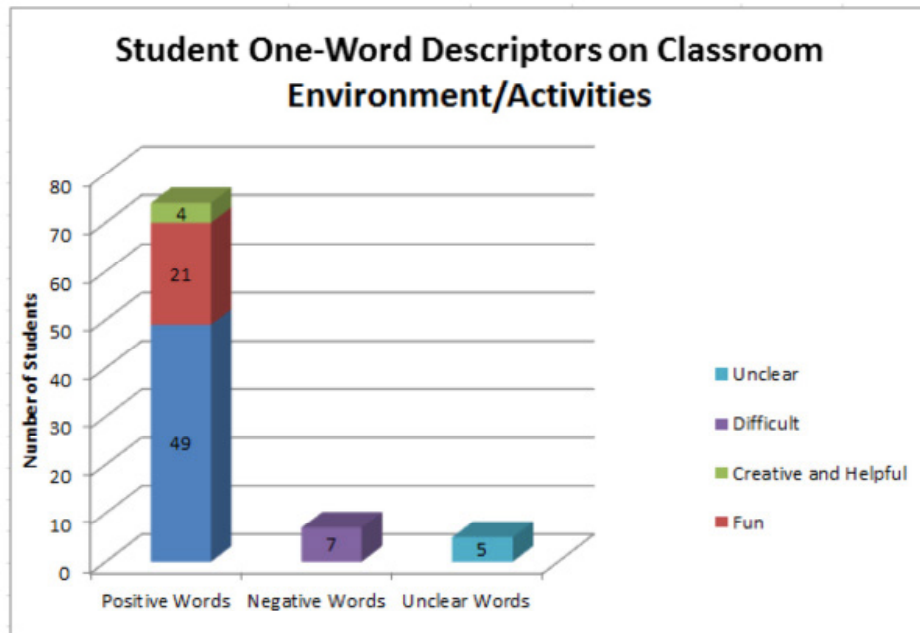
Student data collected:

- Students were asked to write one word on an index card that indicated how they felt about learning in school
- Students* responded to the following writing prompt: Describe what the best day would look like in Math, Language Arts, Science, and Social Studies**

    *Grade 2-4 classrooms participated in this activity. Although Grade 5 students responded to the writing prompt in November 2013, they did not this time because this class is now in Intensive French, therefore they have a different teacher.

    **The writing prompt was changed because when it was open-ended – describing the best day in their favourite subject – most students wrote about Art or Physical Education. We changed the writing prompt to determine which parts of Math, Language Arts, Science, and Social Studies students found most engaging to guide our instruction in those subject areas.

Recurring themes:
Students wrote about the best day in their Math/LA/Science/Social Studies classes:
- Many students expressed an interest in working with partners and groups
- Most students enjoyed having choices between activities
- Many students enjoyed hands-on activities and using manipulatives
- Most students like to learn with technology (videos, computers, SMART board, digital microscope, etc)
- Most students like to play games (online games, board games, card games)
- Most students love to read (to self or to someone)

As a result of student data that was collected, here are some recommendations that will promote student engagement:

- Integrate opportunities for movement in all subject areas
- Integrate arts (visual, music) in all subject areas
- Provide choices in how students demonstrate learning
- Incorporate games cater to different sensory modalities (auditory, visual, tactile) and multiple intelligences/learning styles
- Provide opportunities for students to learn individually, in partners, and in small groups
- Incorporate technology into lessons (e.g. instructional videos, SMART board activities) and into activities (e.g. online games, PowerPoint presentation)

Appendix C

Teacher Data – Collected November 2013 – Online Survey

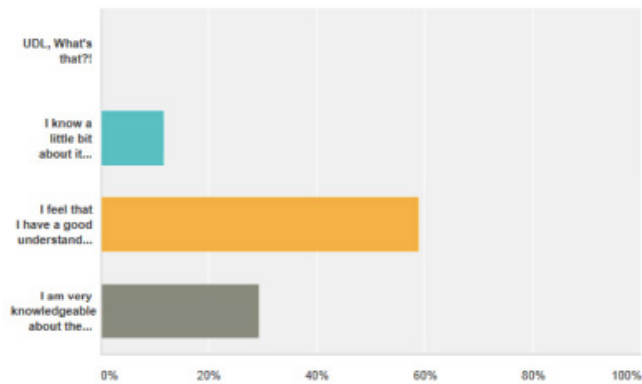### What do you find hardest about implementing UDL in the classroom?

Answered: 17   Skipped: 0
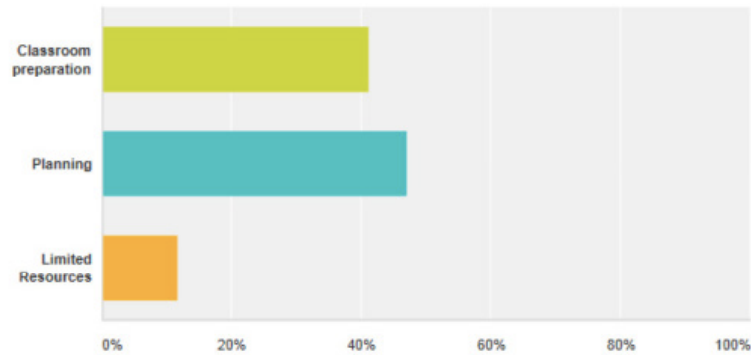
Answer Choices		Responses	
Classroom preparation		41.18%	7
Planning		47.06%	8
Limited Resources		11.76%	2
Total			17

How would you best describe your knowledge about UDL?

Answered: 17   Skipped: 0

Answer Choices	Responses	
UDL, What's that?!	0%	0
I know a little bit about it...	11.76%	2
I feel that I have a good understanding of UDL but I'm unsure of how to implement it in my classroom.	58.82%	10
I am very knowledgeable about the principles of UDL and how to implement it in my teaching.	29.41%	5
Total		17

What are your feelings about the N.B. Dept. of Education's mandate to promote Universal Design for Learning in schools?
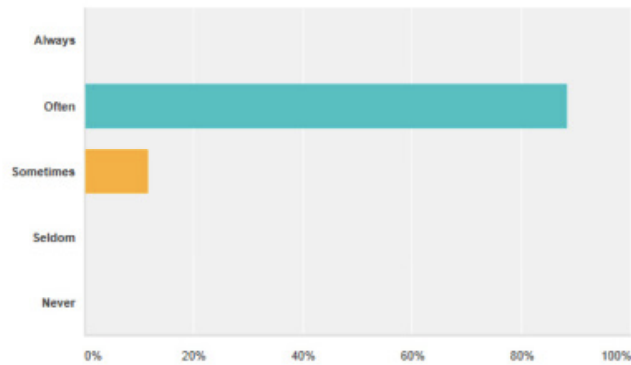
Answered: 17   Skipped: 0
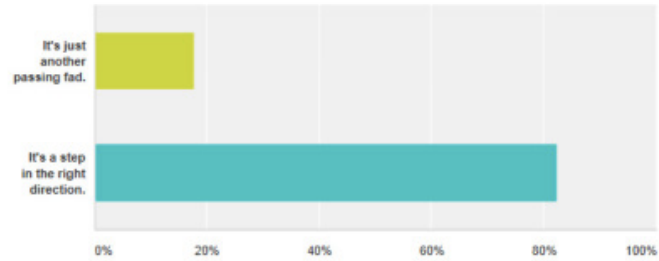
Answer Choices	Responses	
It's just another passing fad.	17.65%	3
It's a step in the right direction.	82.35%	14
Total		17

How likely would you be to implement UDL in your classroom planning and instruction if you had sample lessons to follow?
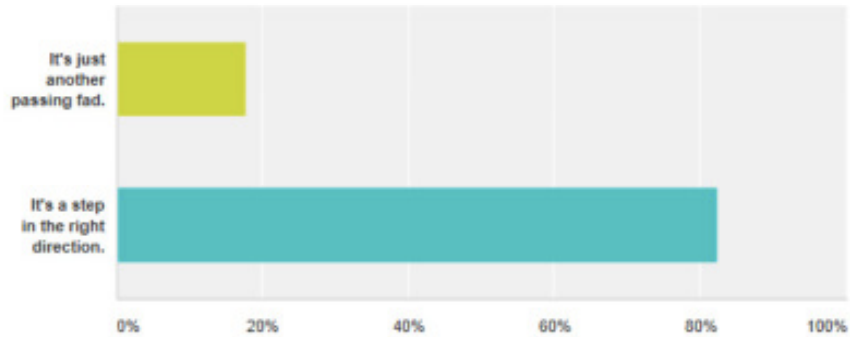
Answered: 17   Skipped: 0

Answer Choices	Responses	
Always	0%	0
Often	88.24%	15
Sometimes	11.76%	2
Seldom	0%	0
Never	0%	0
Total		17

What are your feelings about the N.B. Dept. of Education's mandate to promote Universal Design for Learning in schools?

Answered: 17   Skipped: 0

Answer Choices	Responses	
It's just another passing fad.	17.65%	3
It's a step in the right direction.	82.35%	14
Total		17

Teacher Data – Recommendations – November 2013

- Classroom preparation and planning were both considered to be large obstacles to implementing UDL. We would like to further probe this question – to determine what the specific needs of teachers are in the areas of classroom preparation and planning. To this end, we will create another survey, which asks teachers to complete a checklist of what things would help them in terms of classroom preparation and planning. We will create the survey during our next meeting in January, and send it to teachers.
- Overall, staff are willing and ready to implement UDL. It is noted that 58% of respondents are not quite sure of how to implement UDL, even though they have a good understanding of the principles of UDL. Teaching staff requires support and/or professional development to help them effectively plan and implement UDL practices in their teaching.
- 88% of respondents indicated that they would find it helpful to have sample lessons to follow in implementing UDL in their own classrooms. We will continue to create universally designed lessons and share them with colleagues.
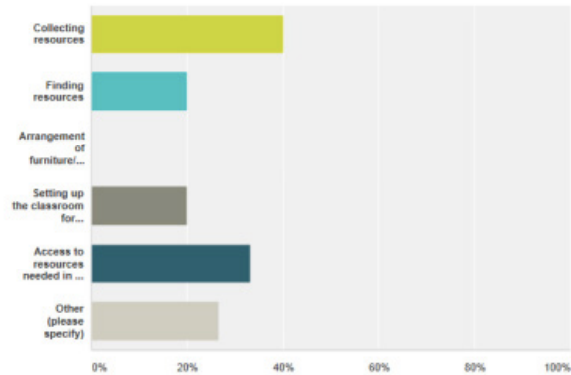
Appendix D

Teacher Data – Collected January 2014 – Online Survey

In the previous survey, when asked, "What do you find the hardest about implementing UDL in the classroom?", most respondents identified "classroom preparation" and "planning" as obstacles.

In terms of classroom preparation, of the following do you find the most challenging?

Answered: 15   Skipped: 0

Showing 4 responses

Time to do all of the above.
1/28/2014 6:17 AM   View respondent's answers

finding time to create individualized resources
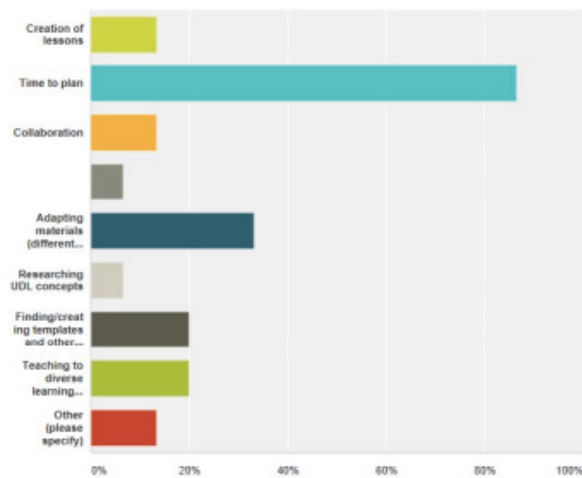1/27/2014 7:42 PM   View respondent's answers

Time
1/27/2014 1:36 PM   View respondent's answers

The resources are in the school but have to be hunted down in many cases. Not enough organization/consistency in org.
1/27/2014 11:22 AM   View respondent's answers

In terms of planning, which of the following do you find the most challenging?

Answered: 15   Skipped: 0

Showing 2 responses

especially with teams
1/27/2014 2:50 PM   View respondent's answers

assessment
1/27/2014 11:22 AM   View respondent's answers

- Most respondents expressed that finding and collecting resources to use in their classroom was a challenge. It is strongly recommended that we better organize the resources we already have in the school so that teachers can easily find what they need. This would reduce time spent on planning and looking for resources, so that teachers could better focus on instruction.
    - School staff should collaborate to determine which resources need to be kept in every single classroom, and find a centralized location for resources that we do not need to use frequently, and also create an efficient sign-out system for those resources.
- The majority of respondents (86.67%) indicated that time to plan was a challenge. In the first question, in response to "Other", 20% of respondents voiced that time to plan was an area of concern. At the school level, there is little that can be done to give teachers more time to plan.
- 20% of respondents indicated that they found it difficult to find or create UDL templates and tools. It is recommended that the action research team share the lessons, tools, and templates that they have found or created with the staff. We can direct teachers to the website http://theudlproject.com to locate all the resources.
- 20% of respondents found it challenging to teach to diverse learning styles. We could refer colleagues to http://theudlproject.com to find resources on Multiple Intelligences (MI). It is also recommended that staff members who use MI share ideas at staff meeting and PLCs, and that professional development opportunities on MI are offered to all staff.

Recommendations from Island View School

Based on Student Data	Based on Teacher Data
Promoting Student Engagement • Integrate opportunities for movement in all subject areas • Integrate arts (visual, music) in all subject areas • Provide choices in how students demonstrate learning • Incorporate games cater to different sensory modalities (auditory, visual, tactile) and multiple intelligences/learning styles • Provide opportunities for students to learn individually, in partners, and in small groups • Incorporate technology into lessons (e.g. instructional videos, SMART board activities) and into activities (e.g. online games, PowerPoint presentations, using engaging websites for writing such as http://storybird.com and http://thinglink.com)	Schools should develop a bank of resources that support the implementation of Universal Design for Learning • School resources are in known locations and easily accessible to all teachers • A list of resources (manipulatives, artifacts, varied levels of books, instructional videos, digital resources, and online resources) is made available to teachers UDL Instructional Materials and Practices • Share our website with teachers http://theudlproject.com, because it features a variety of UDL resources • Teachers would benefit from professional development on Multiple Intelligences and UDL practices • Teachers can gather information on students' learning styles and interests early in the school year to create lessons that incorporate their interests and learning styles More time is needed for teachers to plan and collaborate. Together they can plan lessons and find/create materials that will help them implement UDL in their own practices.

Menus - More Than Lunch: Options for Recruiting Interest and Increasing Engagement in Inclusive Education

Wendy Cornfield, Sonya Fox, Erika Nelson and Monica Watson-Bedard, Millidgeville School, Saint John, N.B.

Abstract

The purpose of this study was to explore the use of learning menus or choice boards and its effect on student engagement. Within the Universal Design for Learning (UDL) framework, one UDL principle, of interest to our group, was Providing Multiple Means of Engagement, specifically looking at optimizing individual choice and autonomy. Middle school students seem to be less engaged and more passive in their learning. We wanted to explore ways of getting past students apathy and plea of, "Why are we doing this?". Clearly defined learning goals and choice, found in learning menus and choice boards, increase student engagement and learning; resulting in more active learners than passive students.

Using the UDL framework, we developed lesson plans which focused on the use of learning menus and choice boards to satisfy curricular requirements. These options for demonstrating knowledge were differentiated by learning preference, readiness and complexity which allowed the fostering of creativity, individual strengths and ownership. Data was collected through pre and post surveys, observational checklists and follow up interviews.

We found that an overwhelming 99% of students were actively participating in their chosen activities. Remarkably, this contradicts their post survey responses of how they preferred to be evaluated. Just under half of the students indicated a preference for test taking rather than choice boards. The data suggested that they wanted choice yet when given choice they struggled with independence, stamina, and thinking "outside the box".

Rationale

Our middle school students seem to be less engaged and more passive in their learning. We want to explore ways of getting past students' plea of, "Why are we doing this?" Choice boards, such as learning menus, (see Appendix A-C) are organizers containing a variety of activities that allow students choice in satisfying class requirements. They can also be structured so students are required to choose activities which focus on several different skills. These options for demonstrating knowledge should be differentiated by learning preference, readiness and complexity allowing for the fostering of creativity, individual strengths and ownership.

Research Question

Will the use of learning menus or choice boards increase middle school students' engagement and ownership of learning?

Context

Millidgeville North School (MNS) houses 398 students from grades 3-8 (Early French Immersion and English Prime) and draws from a diverse range of socio-economic areas within the city of Saint John. Our proximity to the hospital and university attracts many international families resulting in 24% of our students identified as English Language Learners (ELL). Of the 398 students, 165 are students from grades 6-8. In our middle school, students seem disengaged, indifferent and passive rather than engaged, motivated and active participants in their learning. Furthermore, it was identified in the 2012 Tell Them From Me survey (see Appendix D) data that there was a significant decrease in engagement within our school from 63% in grade 6 to 24% in grade 8. This is a huge concern for us as teachers.

Our research sample consisted of 73 students in the following 4 classes: a grade 7 French Immersion class (7N) and three grade 8 classes, two English (8C, 8F) and one French Immersion (8G). These classes were chosen to represent a cross section of our population, and different subjects taught, as Mrs. Fox taught Math to 8C and 8F, Mme. Nelson taught FI Language Arts and Social Studies to 8G and 7N and Mrs. Watson taught Language Arts to 8C, 8F and 8G.

Current Research

Existing research suggests that as students get older their engagement in schools decreases (Anderman & Midgley 1998). Middle school students are often reported as uninterested and not engaged in classroom work by teachers. Numerous studies have been conducted over the years which have looked at the engagement levels of students and as a result, the definition of engagement itself varies and can encompass cognitive, affective, behavioral, academic and social aspects.

For the most part, studies on engagement have tended to focus on quantitative data (attendance, test scores, graduation rates) which tracks levels of achievement rather than engagement in the learning (Taylor & Parsons, 2011). Although attendance, good behavior and connections to school and teachers are important, the quiet, well behaved, social butterfly can still epitomize disengagement. Schlecty (1994) offers three characteristics of engagement as (1) they are attracted to their work, (2) they persist in their work despite challenges and obstacles, and (3) they take visible delight in accomplishing their work. Similarly, Tafarodi, Mehranvar, Panton and Milne (2002) stated student engagement also refers to a student's willingness, need, desire and compulsion to participate in, and be successful in, the learning process. These two definitions express what we feel it means to have students as active participants in their learning.

According to Parsons and Taylor (2011), student engagement has become a key concern across Canada as it has become an area of improvement and focus for school reform particularly at the middle and secondary levels. According to Willms' (2003) review of PISA 2000 results on Student Engagement at School: A Sense of Belonging and Participation, Canada showed moderate success (74%), in Participation Engagement levels. However in less than ten years, Willms, Friesen and Milton (2009, p. 17) suggest that "now less than one-half of Canadian students are deeply engaged in their study of school subjects". This begs the question of why this is happening and what can be done about it?

Sousa (2001) and Jensen (1998), proponents of brain-based research, argues teachers must instruct with the brain in mind (cited in Gargiulo & Metcalf, 2011). In 1984, David Rose and Ann Meyer, co-founders of CAST, began to extend the principles of Universal Design to the learning environment. Universal Design for Learning (UDL) is a framework which recognizes the need to create opportunities for the inclusion of diverse learners through providing curricula and instructional activities which allow for multiple means of representation, expression, and engagement. Students need work that develops their sense of competency, allows them to develop connections with others, gives them some degree of autonomy, and provides opportunities for originality and self-expression (Anderman & Midgely, 1998). CAST developed a framework which is comprised of three principles which allows for flexibility that reduces barriers to learning (see Appendix E). Multiple Means of Representation consists of teachers teaching using a multimodal approach so students are provided a variety of ways to receive information (auditorily, visually and kinesthetically). Multiple Means of Expression is when students have a choice in the way they will share their learning. Traditionally, this would be pencil and paper writing tasks. Multiple Means of Engagement is linked to the affective brain network and considers different ways to motivate, challenge and boost student learning. This framework requires teachers to change the way they view the teaching- learning process, and how they initially approach lesson planning, instruction and assessment for all learners.

Supporting the UDL framework is the strategy of Carol Ann Tomlinson's theory on Differentiated Instruction (Tomlinson & Imbeau, 2010) which advocates every student is different and has different strengths. Although differentiation can occur by differing content, process, product or learning environment, for this project, we are focusing on differentiation of the product. Differentiation by product allows the students to demonstrate a learned concept in different ways. Tomlinson and Imbeau (2010) see the use of students' interests and choice as a powerful motivator in learning. Differentiated Instruction utilizes the ideas of Multiple Intelligences to aid in the planning of activities (Gardner, 2011).

The role of the teacher is essential in creating multiple means of engagement which support affective learning by tapping into learners' interests and offering appropriate challenges to increase their motivation (Jiménez, Graf & Rose, 2007). Providing choice in the form of choice boards allows for an increase in student engagement and offers a viable alternative for those learners who experience difficulty demonstrating this knowledge through more traditional means like writing a paper or completing a written examination (Jiménez, Graf & Rose, 2007).

Regardless of their name, learning menus can come in different formats such as: tic-tac-toe boards, restaurant-like menus, multiple choice grids, matrices, and tiered sections of increasing challenge. These activities differentiate for learning styles, interest and readiness. Students are much more creative and involved when they are given choices along with expectations. Multiple Intelligences inspired learning menus or choice boards allow for differentiation and engagement. Within these learning menus or choice boards, each of the activity choices should link to one of the eight intelligences outlined in Gardner's 2011 research: linguistic, logical-mathematical, musical, special, bodily-kinesthetic, interpersonal, intrapersonal or naturalist. The use of these choice boards acts as an invitation for students to take the lead in their own learning. Much of the studies on the UDL principle: Providing Multiple Means of Engagement have focused on the benefits of providing choice and greater autonomy and control. CAST suggests that providing choice is likely to lead to more engaged and active learning.

Methodology and Data Collection
Initial classroom observations, along with incomplete homework, classwork and poor quality of completed assignments, showed that the majority of students lacked independence, were passive learners, seemed disengaged with learning and lacked ownership of that learning. Data from the Tell Them From Me (TTFM) (2012, 2013) survey showed a significant decrease in engagement within our middle school. In terms of interests and motivation, there was a decrease from 63% in Grade 6 to a 24% in Grade 8 and their effort level decreased from 82% in Grade 6 to 64% in Grade 8. Based on the above factors, we felt compelled to conduct further research in this area. In our desire to find more information regarding this trend, we designed an Initial Student Survey, Observational Checklist and Post Student Survey.

Baseline data was collected from 73 students through an online Initial Student Survey (see Appendix E). It was designed to assess students' overall perspectives on learning, engagement, and perceived difficulty of tasks/subject.

The Observation Checklist was used to informally observe student behavior while they were completing heir menu options (by subject area) during class time in one grade 7 class and three grade 8 classes. These results were transformed into participation graphs (see Appen-
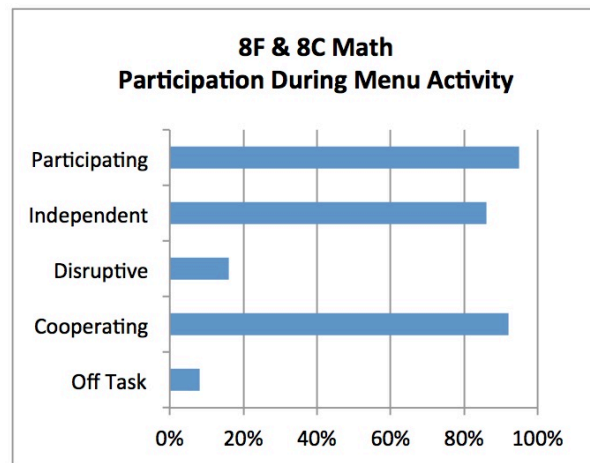
dix G). See examples below.

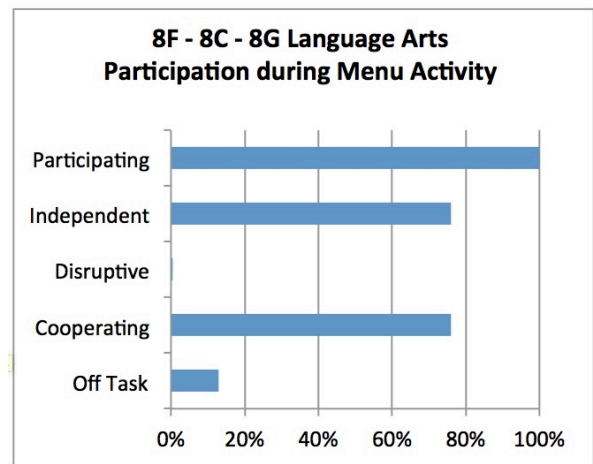*Table 1*: Participation During Menu Activity (Math)

Table 2: Participation During Menu Activity (Language Arts)

Elements of engagement in the Initial Student Survey looked at how interesting classes were, the perceived level of challenge, and their ability to cope with challenge highlighted some interesting details.

The Student Follow-up Survey (see Appendix H) was designed to assess the students' overall perception of learning menus or choice boards as a means of demonstrating their knowledge. The survey was administered to one grade 7 class and three grade 8 classes for a total of 71 students.

The pre-survey showed 56% of students are distracted on a sometimes/or a more often frequency, and 31% are not prepared for class. Interestingly, 45% of our students found their classes to be only somewhat interesting and/

or boring, 65% are only sometimes challenged and/or never challenged, and 80% of the students find their classes to be easy and/or not so difficult.

When students rated how they coped with a difficult task: 34% of the time students answered that they will sometimes/often sit there and do nothing, 48% of the time, they will sometimes/often give up easily, 38% of the time they will ask for help and 30% of the time they will sometimes/never try it on their own.

According to the Observational Checklist, the average rate of participation during the choice board activity was 99%, the average rate of independence was 76%, and the average rate of cooperation was 74%. Less than an average of 8% of students were off-task or disruptive.

Images 1 and 2: Students working on menu boards

The Post Student Survey showed 73% of the students preferred creative and kinesthetic activities (drawing, building, hands on), while their least favorite activities were reading and writing based at 51%. The rationale behind students' choice of activities was: interest at 51%, ease of completion at 26%, strengths at 21%, while 2% didn't think about it.

When students were asked which method of evaluation they preferred, 54% chose learning menus and 46% preferred tests. However, 70% preferred to have choice of assignments rather than teacher assigned tasks.

Findings

When 56% of students claim they are distracted and 31% of students are not prepared for class, this data supports our claim that many students are not taking ownership of their learning. It is not surprising that students are disengaged as 45% of students found their classes to be only somewhat interesting or boring, 65% are sometimes and/or never challenged and 80% find their classes to be easy and/or not so difficult. Therefore, is it any wonder our students are not motivated?

One of the characteristics of Schlecty's definition of engagement includes the ability to persist in challenges and obstacles. Our data suggests many of our students lack the ability to persist or even initiate the learning process when faced with a difficult task. These are our passive learners.

During the learning menu/choice boards activities, we observed only 8% of students were off-task or disruptive and never for a prolonged period of time.

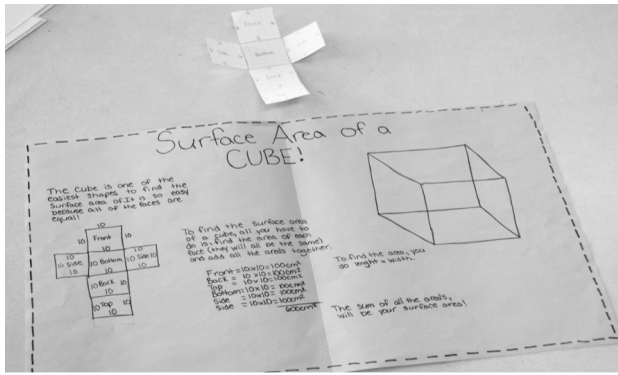*Image 3:* Examples of student work, English Language Arts
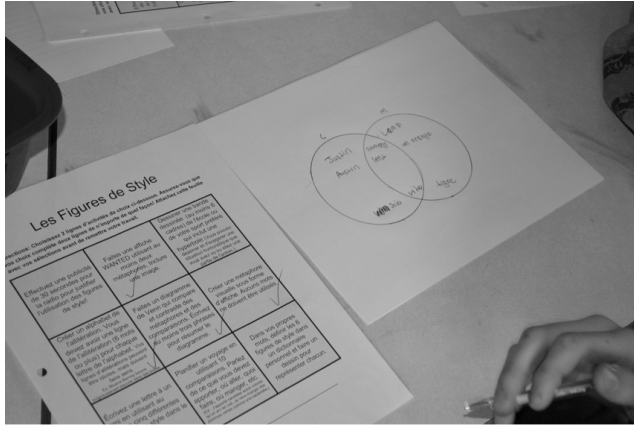
Image 4: Example of student work, Math

Image 5: Example of choice board and student work in French Immersion Language Arts

An overwhelming 99% of students were actively participating in their chosen activities, contradicting their survey responses of how they preferred to be evaluated. Just under half of the students indicated a preference for test-taking rather than choice boards. This finding led us to question why the split occurred and necessitated a follow up interview to glean more details from the students (see videos at http://prezi.com/pcho4axhu35z/?utm_campaign=share&utm_medium=copy&rc=ex0share). We found the subject area had a significant influence on their responses. For instance, tests were the preferred method of evaluation for math as the learning menus/choice boards were time consuming, required more effort and forced them to think "outside the box".

Conclusion
Engagement can be increased first by knowing students. When students interests, preferred strengths and needs are matched to learning activities motivation typically increases. It is paramount that teachers use a flexible framework to plan, teach and assess that strategically meets the needs of all students. UDL offers teachers a way to ensure that the Multiple Means of Representation, Expression and Engagement allow students to curricular goals.

Affect represents a crucial element to learning, and learners differ markedly in the ways in which they can be engaged or motivated to learn. According to CAST, there is not one means of engagement that will be optimal for all learners in all contexts; providing multiple options for engagement is essential. While we only focused on optimizing individual choice and autonomy, Multiple Means of Engagement, section 7.1 (see Appendix E), it is not enough to simply provide choice. The right kind of choice and level of independence is imperative to ensure engagement.

Although engaged during the choice board activities, students struggled with thinking "outside the box", and tended to choose activities that they perceived as easy to complete rather than supporting their strengths (see Appendix F). If the framework of UDL and the idea of choice was implemented in earlier grades, students may become more intrinsically motivated and actively engaged learners. Can you envision what students would be capable of, if choice was the rule and not the exception?

Limitations
When conducting our research, we encountered several challenges regarding baseline data collection, learning menu/choice board construction, survey development and evaluation of products.

Our intentions in creating the menu/choice boards were to align the options with various intelligences, readiness and complexities however, we realized this is certainly an area of growth and we are far from experts. Work needs to be done on the structure of the boards so the choices still challenge students to work and expand their understanding.

Another limitation was in the collection of data. We included several open ended questions which proved difficult to analyze as students gave surface level answers that didn't give a lot of detail or insight into their responses. Some of the questions were not as clear as we intended and there was some confusion between what certain questions were asking. There was very little correlation between the pre and post surveys and we still wonder if our questions adequately represent what we were trying to find out about engagement.

Recommendations for Instructional Practices and Future Research

Planning – Before the assignment is created, it is imperative to consider all the learners in the room, the goal and how this learning can be expressed. Through our research in UDL, we have learned that retrofitting is really not enough; proper design for all intelligences from the ground-up not only saves time, but also stimulates student curiosity and arouses their desire for deep understanding (Lumsden cited in Birdsell, Ream, Seyller, & Zobott, 2009) This planning takes a considerable amount of effort initially, but saves time and effort in the end as much of the difficult work is finished. To aide in our efforts to be more universal in our design, we have created a daily lesson-plan template to reflect the three principles of UDL (Multiple Means of Representation, Multiple Means of Expression and Engagement) (Appendix I).

Teaching –There is no "one-size-fits-all" method of teaching. Creativity and thinking outside of the box are not optional anymore; they are necessary to the functioning of the 21st Century learner. Presentation of material through sensory modalities is paramount to reach all students and capture their attention in an active way (Lumsden cited in Birdsell et al, 2009).

Assessment – A quote that resonated with our group, "Strict on the goal, flexible on the means," (Posey, 2013) seemed like a simple concept. However, it has been more difficult than first thought to evaluate a curricular outcome through differing means of expression. As students' products vary, it is difficult to not factor in effort and only judge based on whether they have or have not met the established goal. As our experience with choice boards continued after the project, we found co-construction of expectations for the activities to be invaluable. We formulated a general assessment rubric which allowed us to assess regardless of the product (Appendix J).
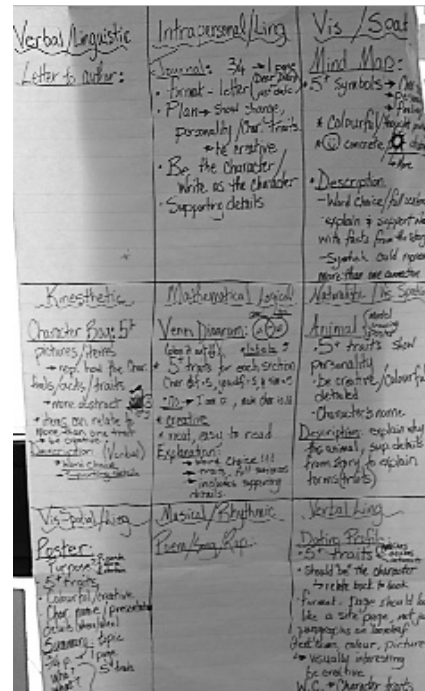

Image 6: Co-Created Expectations

Choice is just one piece of the overall engagement puzzle; there are many other factors that must be considered. To study student engagement on a deeper level, we need to be able to look at other aspects such as learning environment (atmosphere in the room), co-operative learning, teacher's role in the presentation of material, and positive feedback to fuel intrinsic motivation within middle school students. More research on the interplay between these aspects is required.

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Appendix A

Multiple Intelligences Choice Board Suggestions

Verbal Linguistic	Visual Spatial	Bodily/kinesthetic
• Prepare a report • Write a play or essay • Give directions for . . . • Create a poem or recitation • Listen to a tape or view a video • Retell in your own words • Create a word web • Retell in your own words • Debate • Create a television/radio newscast	• Create a mural, poster, or drawing • Illustrate an event • Draw a diagram • Design a graphic organizer • Use color to . . . • Create a comic strip to show • Do a storyboard • Create a collage with meaningful • Map reading/making	• Create a role-play • Construct a model or representation • Create a tableau for . . . • Manipulate materials to work through a simulation • Create actions for . . . • Dramatic re-enactments of historical or literary events
Mathematical/logical		**Interpersonal**
• Create a pattern • Describe a sequence or process • Develop a rationale • Analyze a situation • Create a sequel • Critically assess • Classify, rank, or compare • Interpret evidence • Design a game to show • Create a time line • Create patterns • Design a map . . • Graphic organizers		• Work with a partner or group • Discuss and come to a conclusion • Solve a problem together • Survey or interview others • Dialogue about a topic • Use cooperative groups to do a group project • Project a character's point of view. • Teach a cooperative game • Tutor buddies
Intrapersonal	**Musical/Rhythmic**	**Naturalistic**
• Think about and plan • Write in a journal • Keep track of . . . and comment on . . • Review or visualize a way • Reflect on the character and express his or her feelings • Imagine how it would feel if you . . • Rewrite a story from their point of view.	• Create a rap, song , or ballad • Write a jingle • Write a poem • Select music to enhance a story or event • Create rhymes that . . . • preform dance routines to act out historical or literary events	• Discover or experiment • Categorize materials or ideas • Look for ideas from nature • Adapt materials to a new use • Connect ideas to nature • Examine materials to make generalizations • Label and classify • Draw conclusions based on information • Compare/contrast • Classifying

Based on

http://daretodifferentiate.wikispaces.com/file/view/1Structures%28Choice+Boar

Appendix B

Sciences Humaines Menu Board

Nom: _____   Date: _____

Jeux Olympiques d'Hiver - tableaux des choix

Choisir trois carrées dans une ligne; le carrée au milieu n'est pas une option mais les deux autres sont votre choix. Couleriez les carrées après que vous l'avez complété.

Compare / Contraste	N'oubliez pas les paroles	Les jeux olympiques d'hiver : Critique de livre
Comparez et contrastez deux sports dans les jeux olympiques d'hiver. Créer une liste des différences et les similarités dans un diagramme de Venn ou un autre organisateur graphique.	Écrivez une chanson thème pour les jeux olympiques d'hiver pour les athlètes de chanter, ou un poème à être lu par un athlète lors de la cérémonie d'ouverture. Votre pièce doit inclure 4-5 faits sur les Jeux olympiques d'hiver.	Écrivez une critique de livre sur un livre à propos des jeux olympiques ou un olympien (nne). Inclure un résumé et donnez un une note sur 5 étoiles et les raisons pourquoi.
Créer une mascotte	**Ligne de Temps Olympiques**	**Lettre à un athlète**
Compléter de recherche sur la location des jeux olympiques. Avec ce que tu as appris, créer une mascotte pour les jeux olympiques d'hiver. Dessinez une image et écrivez une paragraphe qui décrit votre mascotte et la signifiance.	Créer une ligne de temps avec 10 faits ou évènements de l'histoire des jeux olympiques. Utilisez les livres et les site-webs pour soutenir vos faits.	Écrivez une lettre a une athlète que tu admire est leur dites pourquoi tu les admires. Demandez au moins 5 questions que tu n'as pas apprises pendant les jeux olympiques.
rapport 3-2-1	**#slogancanadienne**	**Extra! Extra!**
En utilisant les informations de votre recherche, compléter un *3-2-1 rapport* des Jeux olympiques d'hiver. Partagez vos découvertes, des questions et des faits que vous avez appris.	Créer un remue-méninge de ce qui inspirent les Canadiens et trouver au moins 5 choses que nous avons tous en commun. Utilisez ce remue-méninge pour créer votre propre slogan olympique et Twitter hashtag qui peut être utilisé pour l'équipe olympique canadienne.	Vous êtes un journaliste des jeux olympiques. Écrivez un article qui partage le QUI, QUOI, QUAND, COMMENT, et POURQUOI de seulement un évènement ou sport dans les jeux olympiques.

Appendix C

Figurative Language Choice Board

Directions: You must complete one descriptive writing activity and 3 activities from the choice board. Place a check (√) in the box you choose. Turn in this paper with your activities.

Descriptive Writing Options: choose one (you must include 6 examples of figurative language, at least 3 different kinds of figurative language.

1. You have just arrived home from a distant place and everyone can't wait to hear what it is like! Write a clear description of this place (real or imaginary) to give your readers a vivid picture of what it is like.
2. You are walking home from a late movie, and you have to cut through a cemetery. Describe your experience.
3. Describe your feelings on waking up and seeing snow on the ground on a school day.

Choose Three of the following:

Perform a one minute puppet show that teaches about one type of figurative language.	Make a Wanted posted using your picture or draw a picture and use figurative language (must include 3 types).	Draw a cartoon about school or your favorite sport that includes a hyperbole (you might draw and exaggerate a humourous situation that you saw or were a part of the action). Write the hyperbole in a different colour.
Interview a figure of speech of your choosing and write the transcript.	Create a picture dictionary illustrating seven figurative language terms.	Create either a 6 panel comic strip with examples of onomatopoeia in each panel or find at least 5 examples onomatopoeia in the comic strip section of the paper.
Create your own crossword puzzle of the eight types of figurative language simile, metaphor, hyperbole, personification, idiom, oxymoron, alliteration and onomatopoeia.	Make a Venn diagram that compares and contrasts metaphors and similes. Write at least two examples of each and three sentences to summarize the diagram.	Create a funny poem that uses metaphors to describe a day at school Ideas may include: classrooms, books, length of the day, tests, homework, lunch, staying awake, studying, etc. It must contain 10 lines and 5 metaphors.
Write one scene of a play that shows personification for at least three characters.	Write a letter to a friend using at least five different kinds of figurative language in the text.	Write a song or a rap that includes onomatopoeia, personification, hyperbole and alliteration.

Appendix D

Tell Them From Me Survey Results

Intellectual Engagement

Appendix E

Universal Design for Learning Guidelines

I. Provide Multiple Means of **Representation**	II. Provide Multiple Means of **Action and Expression**	III. Provide Multiple Means of **Engagement**
1: Provide options for perception	**4: Provide options for physical action**	**7: Provide options for recruiting interest**
1.1 Offer ways of customizing the display of information	4.1 Vary the methods for response and navigation	7.1 Optimize individual choice and autonomy
1.2 Offer alternatives for auditory information	4.2 Optimize access to tools and assistive technologies	7.2 Optimize relevance, value, and authenticity
1.3 Offer alternatives for visual information		7.3 Minimize threats and distractions
2: Provide options for language, mathematical expressions, and symbols	**5: Provide options for expression and communication**	**8: Provide options for sustaining effort and persistence**
2.1 Clarify vocabulary and symbols	5.1 Use multiple media for communication	8.1 Heighten salience of goals and objectives
2.2 Clarify syntax and structure	5.2 Use multiple tools for construction and composition	8.2 Vary demands and resources to optimize challenge
2.3 Support decoding of text, mathematical notation, and symbols	5.3 Build fluencies with graduated levels of support for practice and performance	8.3 Foster collaboration and community
2.4 Promote understanding across languages		8.4 Increase mastery-oriented feedback
2.5 Illustrate through multiple media		
3: Provide options for comprehension	**6: Provide options for executive functions**	**9: Provide options for self-regulation**
3.1 Activate or supply background knowledge	6.1 Guide appropriate goal-setting	9.1 Promote expectations and beliefs that optimize motivation
3.2. Highlight patterns, critical features, big ideas, and relationships	6.2 Support planning and strategy development	9.2 Facilitate personal coping skills and strategies
3.3 Guide information processing, visualization, and manipulation	6.3 Facilitate managing information and resources	9.3 Develop self-assessment and reflection
3.4 Maximize transfer and generalization	6.4 Enhance capacity for monitoring progress	
Resourceful, knowledgeable learners	**Strategic, goal-directed learners**	**Purposeful, motivated learners**

Initial Student Survey Results

1. What is your gender?

Gender

Female	42%
Male	58%

2. Pick the choice closest to your overall average.

Student Overall Average

A (100-94)	71%
B (83-72)	25%
C (71-69)	2%
D (59-50)	1%
E (Below 50%)	0%

3. In general, how difficult do you find your classes? Please select one.

How Difficult are your Classes
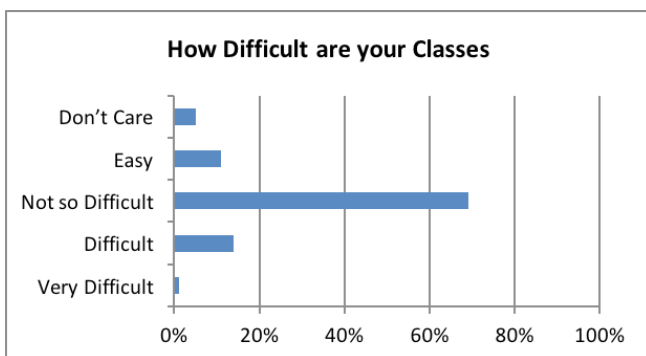
Very Difficult	1%
Difficult	14%
Not so Difficult	69%
Easy	11%
Don't Care	5%

4. How interesting are your classes?
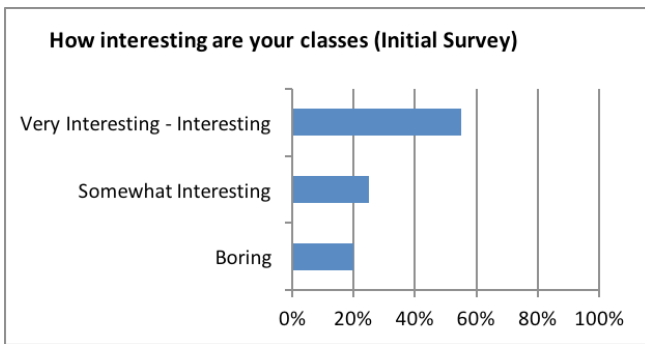
Very Interesting/Interesting	55%
Somewhat Interesting	25%
Boring	20%

5. To what extent are you being challenged in class?
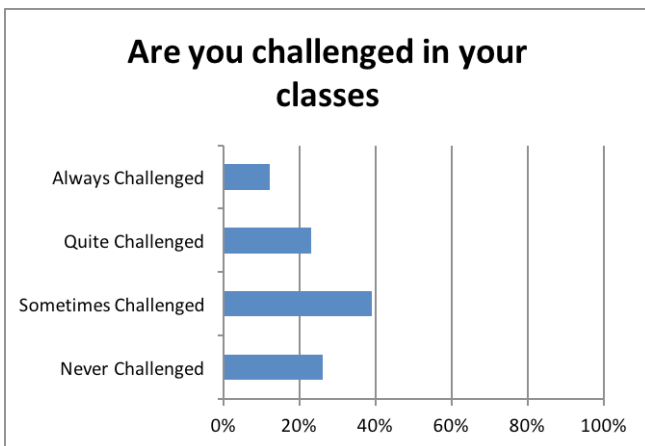
Never Challenged	26%
Sometimes Challenged	39%
Quite Challenged	23%
Always Challenged	12%

6. How often are you distracted from your work in class?
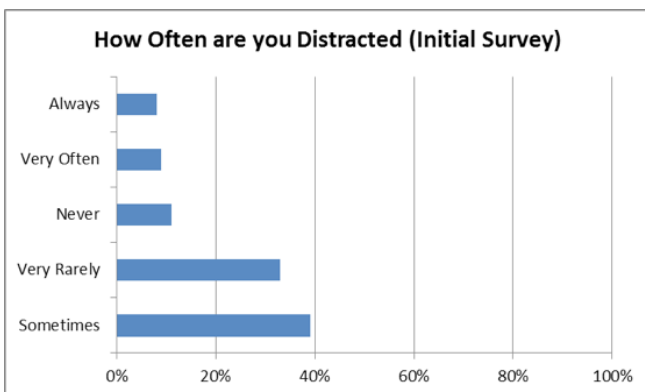
Always	8%
Very Often	9%
Never	11%
Very Rarely	33%
Sometimes	39%

7. How often are you unprepared for class?
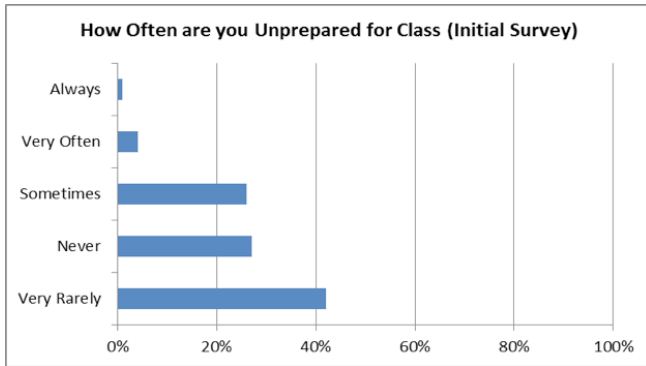
Always	1%
Very Often	4%
Sometimes	26%
Never	27%
Very Rarely	42%

8. When you are faced with a difficult task in the classroom, do you:
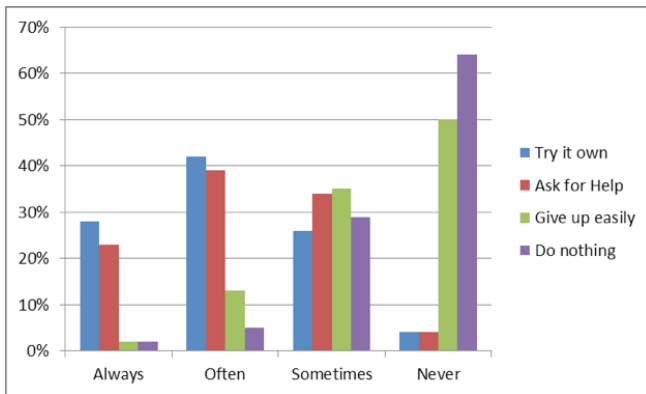
	Always	Often	Sometimes	Never
Try it own	28%	42%	26%	4%
Ask for Help	23%	39%	34%	4%
Give up easily	2%	13%	35%	50%
Do nothing	2%	5%	29%	64%

9. With assignments, would you rather…
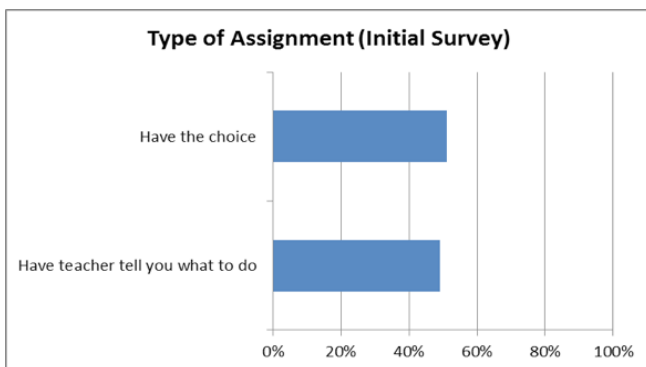
Have the choice	51%
Have teacher tell you what to do	49%

Observation Checklist

The observation checklist was used to informally observe students behavior while they were completing their menu options (by subject area) during class time in one grade 7 class and three grade 8 classes. The behaviours observed were:

- Were students working independently
- Were students disruptive to others
- Were students cooperating with each other
- Were students off-task and unable to complete the menu options in class
- Were students participating in the menu activities

**8F & 8C Math
Participation During Menu Activity**

**8F - 8C - 8G Language Arts
Participation during Menu Activity**

**8G French Language Arts
Participation during Menu Activity**

**7N Social Studies
Participation during Menu Activity**
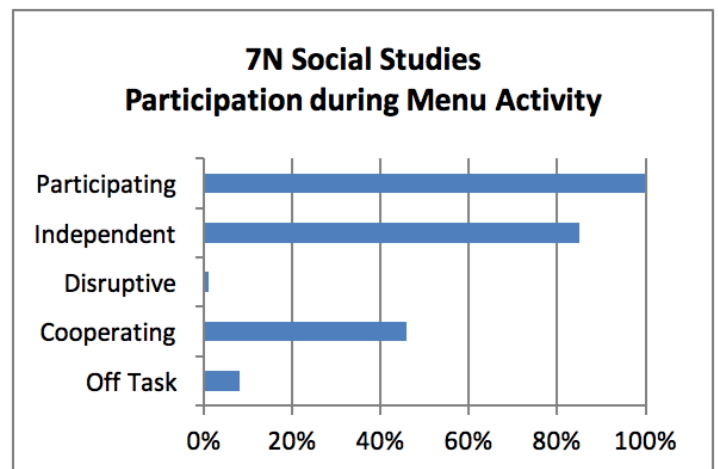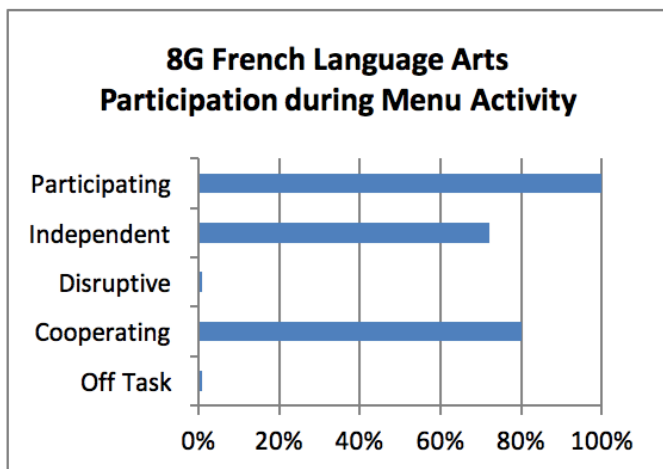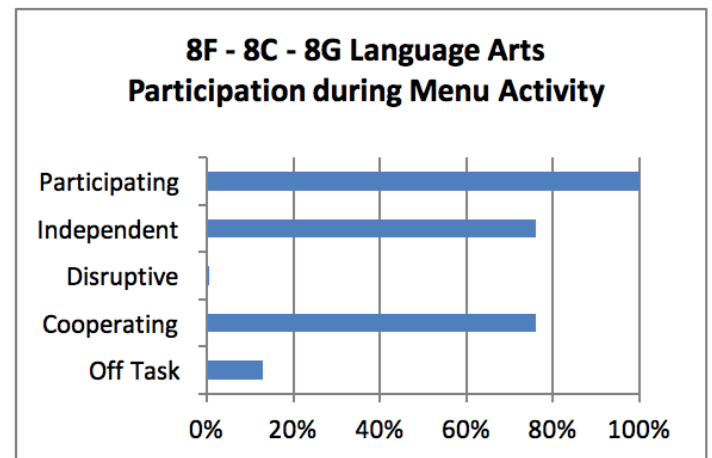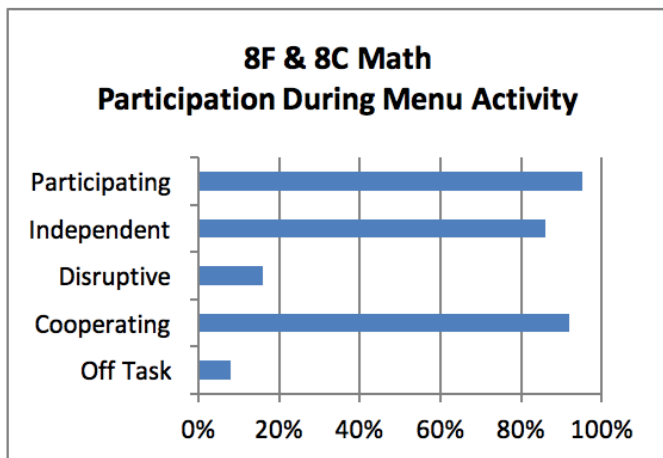
Post Menus/Choice Boards: Student Follow-up Survey
The Student Follow-up Survey, made up of seven questions, was designed to assess the students' overall perception of menu boards as a means of demonstrating their knowledge. The survey was administered to three grade 8 classes and one grade seven class.

1. **Within the learning menu/choice board activities you completed, what activity did you like the MOST?**

Favorite Menu Activity (Post Activity)
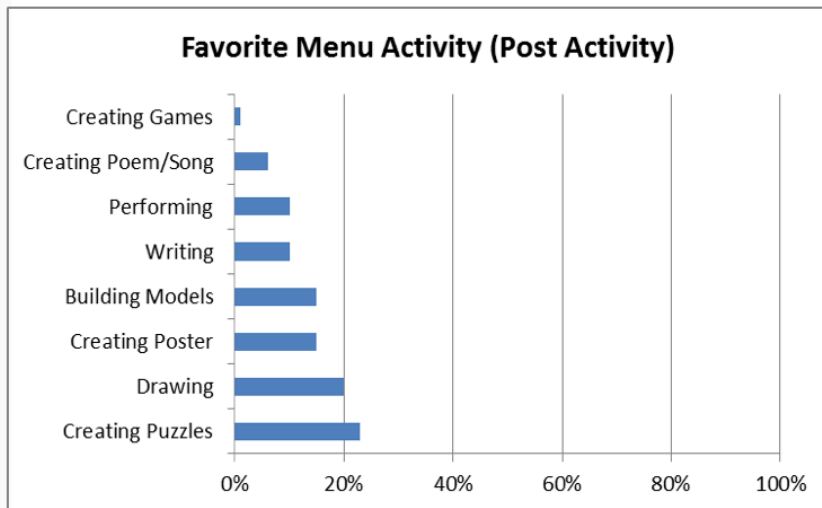
Creating Puzzles	23%
Drawing	20%
Creating Poster	15%
Building Models	15%
Writing	10%
Performing	10%
Creating Poem/Song	6%
Creating Games	1%

2. **Within the learning menu/choice board activities you completed what activity did you like the LEAST?**

Least Favorite Menu Activity (Post Survey)
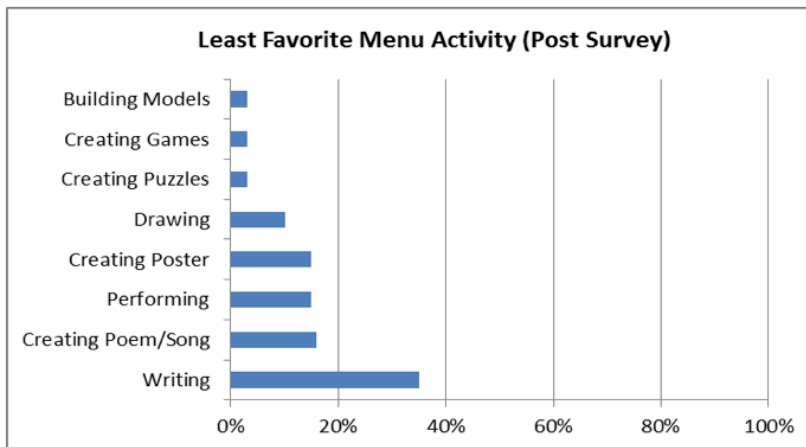
Writing	35%
Creating Poem/Song	16%
Performing	15%
Creating Poster	15%
Drawing	10%
Creating Puzzles	3%
Creating Games	3%
Building Models	3%

3. Were your learning menu/choice board selections mostly:

Why Did You Choose Each Menu Item (Post Survey)
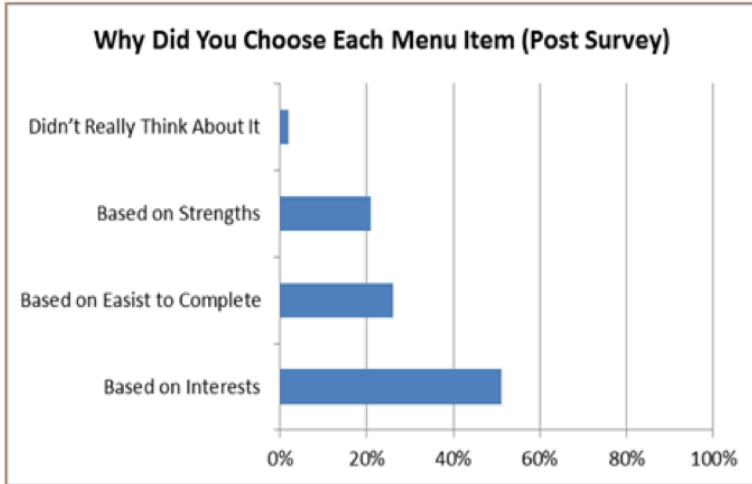
Based on Interests	51%
Based on Easist to Complete	26%
Based on Strengths	21%
Didn't Really Think About It	2%

4. If given the option between another menu board or writing a final test (as a summative assessment), which would you choose?

Menu Board or Test? (Post Survey)
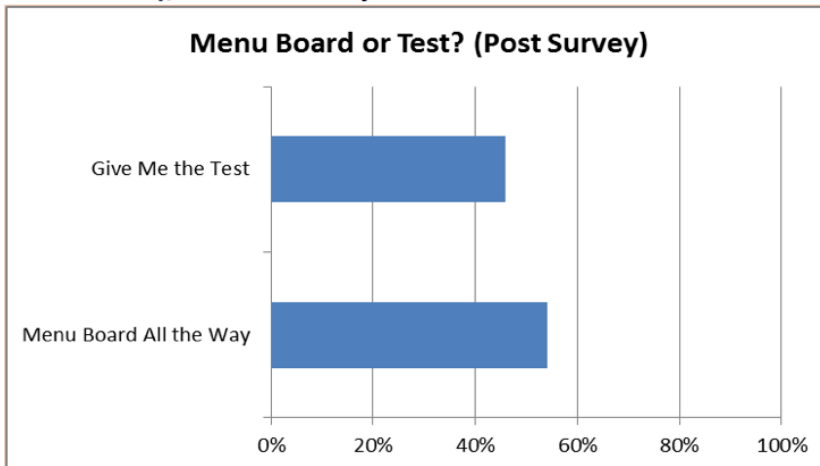
Menu Board All the Way	54%
Give Me the Test	46%

5. With assignments, would you rather:
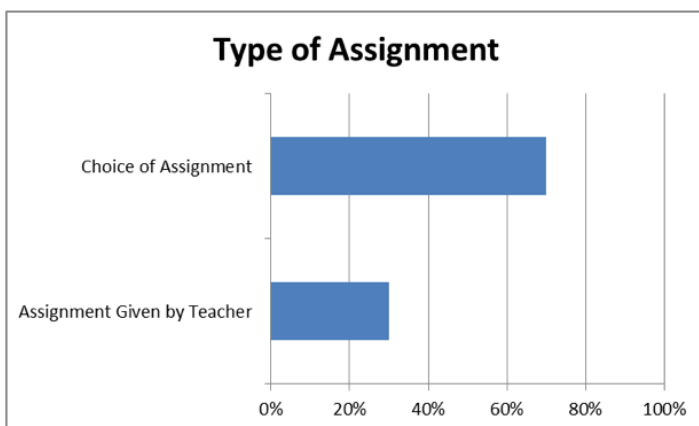
Type of Assignment

Assignment Given by Teacher	30%
Choice of Assignment	70%
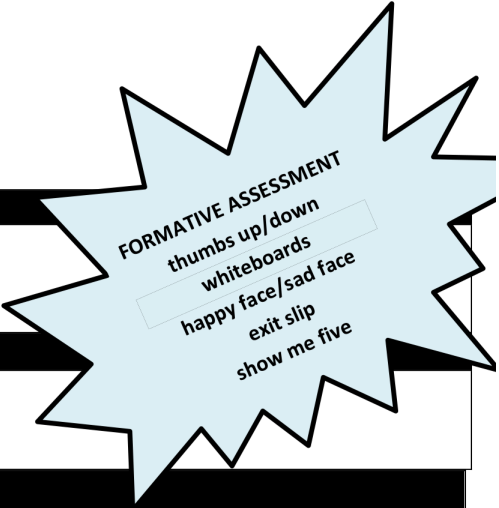
UDL Lesson Plan Template

Title:
Subject:
Grade Level:

Materials/Resources

Individualizations

FORMATIVE ASSESSMENT
thumbs up/down
whiteboards
happy face/sad face
exit slip
show me five

Curriculum Outcomes	
Lesson Goals	*Stated in a way that does limit what media or means students use to demonstrate their knowledge*
Pre-Assessment	*Data to inform instruction*
Anticipatory Set	*Provides support for students with limited background knowledge prior to activity*
Introduction/Modeling of New Knowledge	*Highlight key features through multiple means of representation (auditory, visual, kinesthetic)*
Providing Guided Practice	*Give multiple exemplars/models*

Independent Practice	*Different levels of challenge and representation of knowledge*
Wrap-up	*Small group/whole class/think-pair-share*
Assessment	*Summative assessment or Formative*
UDL Reflection	*Think about how to increase background knowledge prior to lesson and content*

Menu Board Rubric   **Total** _____

	Good (3)	Fair (2)	Poor (1)
Content Does the content of the product show the student's learning?	The content establishes solid understanding of the topic.	The content establishes a fair understanding of most of the topic	The content does not prove the student's understanding.
Completeness Is everything included in the final piece/collection?	All information/elements needed/required is included in the product .	Most of the important information/elements needed/required is present.	The product does not meet the task requirements, significant amount of information is missing.
Creativity Is the product original?	The product shows original thought, creativity and interest.	The product shows some original thought, some creativity and elements of interest.	The product lacks originality, creativity and interest.
Correctness Is all of the information included correct?	All information in the product is correct and accurate.	Most of the information in the product is correct and accurate.	More incorrect than correct. Needs to revisit information.
Communication Is the information in the product easy to understand.	All information is neat , easy to read and shows significant effort.	Most of the information is neat , easy to read and shows some effort.	This product is difficult to read and is not neat and lacks effort.

Hosting the Saxby Gale at Riverview High: Using Disaster Day to Teach Universal Design, Increase Student Engagement, and So Much More

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Abstract

We used Participatory Action Research to assist teachers in accessing a Universally Designed section in the course(s) of their choice. The staff was presented a scenario centered on Climate Change and a localized natural disaster. Staff were invited to participate in our study which described a severe weather event much like the Saxby Gale of 1869. This involved selecting specific course outcomes (essential skills and knowledge) and redesigned traditional lessons to incorporate more UDL strategies. Our intent was to promote opportunities for planning and providing a safety net for teachers to work together to use UDL strategies resulting in an improvement in student and teacher engagement.

Introduction and Background

In the fall of 2013 teachers from Riverview High School applied to participate in the New Brunswick Department of Education and Early Childhood Development's (DEECD) action research project. We chose a broad theme to allow teachers to incorporate Universal Design for Learning (UDL) in their curricular areas. In the second semester of 2014, our school hosted a disaster day (the Saxby Gale project). This topic gave us flexibility to connect with as many curricular areas as possible. We knew human resources we could access outside of the school that would provide expertise to our team and classroom teachers. Our interest was to determine if creating a school wide cross curricular case study would effectively encourage teachers to use UDL strategies subsequently increasing engagement, motivation, and performance for students. We invited all teachers to participate to the degree they felt able while supporting them with professional development on UDL practices. We were interested in determining if a project like this would also increase teacher engagement.

Riverview High School a high school of about 1100 students with 73 FTE and 22 support staff. Student families primarily reside in rural Albert County and urban Riverview representing extremes of the socio-economic spectrum. The school offers over 130 different courses, including a French immersion program, to students of all academic ability levels.

To support students, staff previously created a number of systems that address the diverse needs of learners. In reading Buffum, Mattos, and Weber (2009), staff created a pyramid of instruction and intervention combining Response to Intervention (RTI) and positive learning environment planning. This was in conjunction with dedicated weekly curriculum based Professional Learning Community (PLC) teacher time and an assessment system that clearly outlines content and skill expectations for students. It is within this context that teachers incorporated UDL in curricular teams and increase support for students using UDL strategies.

Literature Review

The overarching DEECD goal of having teachers increase their use of UDL and the RHS goal of increasing student engagement is the most significant portion of the project. We include in this literature review a discussion that has guided our school's creation of learning communities, UDL, and student engagement as they were understood in this project.

Universal Design for Learning

Bugstahler (2010) outlines the foundational concept describing how classes, interventions, and other interactions should be structured in a UDL framework. A UDL framework is designed by teachers for students with a broad range in ability, disability, age, reading level, learning style, native language, race, ethnicity, and other characteristics. A key concept through each teacher-student interaction is the students' ability to access multiple modes of representation, action, expression, and engagement.

At the classroom level, when designing classes with Universal Instructional Design, Burgstahler (2010) instructs teachers to used strength based approaches involving

students, applying instructional strategies, ensuring accessibility and accommodations, and evaluating students on a regular basis. Involving students necessitates that the teacher factors in the student's preferences when developing lessons, assessments, and programs to include multiple modalities and learning styles. These same principles hold true in an intervention setting and curriculum design. Burgstahler encourages regular and effective communication methods accessible to all participants by promoting effective communication, making interactions accessible to all students, utilizing student input, and being a student advocate.

In an attempt to deliver curriculum in a UDL model, Howard (2003), suggests teachers employ a number of techniques including using big curriculum ideas, employing explicit teaching and learning strategies, building appropriate scaffolding, integrating knowledge in meaningful ways, providing opportunities for students to recall previous knowledge, and connecting new information to previous information. This builds on McKenzie (2000) and Sutherland's (2002) shared definition that instructional scaffolding for curriculum and instruction contains six characteristics. These are 1) providing clear direction , 2) clarifying purpose by helping students understand why they are doing the work and why it is important, 3) keeping students on task by providing structure and clear pathways to learning, 4) clarifying expectations on assessment using models of exemplary work, 5) pointing students to worthy sources that reduce confusion, frustration, and time and 6) offers them choices, and reduces uncertainty, surprise, and disappointment by offering multiple routes to success.

Engagement

Research suggests there is a reciprocal effect of teacher and student engagement. Students who show higher initial engagement subsequently receive more teacher engagement. Skinner and Belmont (1993) suggest behaviorally disengaged students receive teacher responses that further undermine their motivation. Marzano, Pickering, and Heflebower (2011) suggest four daily strategies to encourage student engagement in the classroom: 1) using effective pacing, 2) demonstrating intensity and enthusiasm, 3) building positive teacher student and peer relationship, and 4) using effective verbal feedback. While we are interested in staff engagement we did not undertake an initial review of literature on this topic.

Professional Learning Communities

Lave and Wenger (1991) initially examined the social aspects of apprenticeship and peer groups of learners and this has evolved in the education literature, becoming known as learning communities or professional learning communities (PLC). Originally a community of practice was defined as a place where, "learners inevitably participate in communities of practitioners and that the mastery of knowledge and skill requires newcomers to move toward full participation in the sociocultural practices of a community" (Lave & Wenger, 1991, p. 29). This social process of professional educators learning from each other is integral to our PLC groupings.

We believe that this project could only have happened because the lead teacher team was able to create a functioning PLC outside of their normal curricular teams. There are a number of factors in the literature that contribute to the team's success in creating this project. The first set of variables to form genuine professional communities come from Louis, Kruse, and Bryk's (1994) as reflective dialogue, deprivatization of practice or feedback on instruction, collaborative activity, shared sense of purpose, and a collective focus on student learning. Lomos et. al (2011) add a culture of risk taking and collaboration, "…enhances living an inquiry stance toward teaching: a shift to uncertainty and a shift to community" (p. 243). We also resonate with Leithwood, Harris, and Hopkins (2008) as they identify the leadership practices of, "Building vision and setting directions, understanding and developing people, redesigning the organisation, and managing the teaching and learning programme" (p. 30) as vital to the development of an effective PLC team. It is within this established culture that our team was formed and able to create this action research project.

Methodology

Our Methodology for this project is action research and we use McNiff's (2016) work as our theoretical foundation. McNiff shows that, "Action research is open ended…[it] is the developmental process of following through the idea, seeing how it goes, and continually checking whether it is in line with what you wish to happen" (para. 11). McNiff suggests, "… action reflection [is] a cycle of identif[ing] an area of practice to be investigated, imagine a solution, implement the solution, evaluate the solution, change practice in light of the evaluation …" (para. 28). We chose to better

understand the link between student and staff engagement. To do this we collected a wide variety of qualitative and quantitative data.

Because of the cyclical nature of action research we initially collected as much data as possible and used it to inform our next steps in the process. Teacher and student surveys collected quantitative data. Interviews, surveys, examples of student work, student reflections, teacher reflections, and photo and video documentation formed the body of qualitative data. All types of data created as full a picture as possible to answer the question of UDL's influence on student and teacher engagement.

We conducted a baseline survey of teachers in January and February and a final survey at the beginning of May. Created based on the work of Burgstahler (2010), these surveys allowed us to gather comparable data on teachers' perceptions of engagement, use of UDL strategies, and student perceptions of UDL strategies. We examined this data for trends in UDL strategies and engagement between classes adopting the Saxby Gale project and those that have not. In order to help teachers implement UDL strategies we used school based professional learning time to inform teachers of UDL and increased the number of ESS teachers co-teaching in classes in line with the DEECD's yearlong roll out of UDL implementation.

Students completed a baseline survey about student perceptions on engagement, student interest in classes, UDL strategies, and instructional practices. A post survey was given to classes that participated in the project. The survey results were collected and examined to determine if students working with the project were more engaged and experienced more UDL strategies than before the Saxby project.

The qualitative observations include student work, student reflections of their learning, photo and video documentation, and teacher reflections. Data collected in surveys also contained qualitative results that provide further insight into the results of the disaster day scenario.

Our Project
The Saxby project had three phases. The first phase was the planning stage taken on by teachers in the form of making connections between staff and outside agencies to ensure an authentic experience for teachers and staff.

The second phase included providing professional development to staff on UDL strategies followed by teachers implementing those strategies in their classroom. This also included the creation of a student leadership team. The third phase was the disaster day activities engaging the whole school and outside agencies. Critical aspects of these phases are described below.

Phase One
A group of interested teachers met in June of 2013 to discuss how we could create a school wide interdisciplinary project. It was determined that we would need administrative support to create a PLC team across disciplines meeting during regular RHS team meeting time throughout the next academic year. From September to November we had weekly 50 minute planning sessions to set our agenda for the next semester and work through tasks. In this time we developed connections to various local agencies such as Canadian Red Cross, Town of Riverview, Riverview Fire Department, Emergency Measures Organization, and others. We were accepted to the DEECD action research group on UDL, which helped us clarify the direction we wanted to take the project in second semester. At this point we launched our project to the RHS staff, started planning UDL professional learning, hosted a round table to connect teachers with outside agencies, and established a need for a student team to aid in the project. With teachers engaged and a plan in place for Canadian Red Cross and Riverview Fire Department to set up a disaster shelter in our gymnasium and a command center in a classroom, it was time to tell students.

Phase Two
At an assembly of the whole student body in February (early second semester) we presented the project to students. Interested teachers informed their classes how the Saxby project would fit in their content area. Some teachers spent as little as one day linking content to a local history lesson. Others spend a week discussing emergency preparedness (Outdoor Pursuits) or marshal law (Law). Some took a few weeks taking on challenges such as building a scale model of the river and 3D printing a dam (Physics), creating a plan to clean up a local dump in the flood plain (Chemistry), and writing about current and historical events (Journalism). A few others wove it into the entire course such as Social Studies 9 whose theme is Canadian identity. Most of these students and teachers reported an increase in student engagement linked to the Saxby project and use of UDL

strategies.

To gather baseline data we surveyed both teachers and students on the use of UDL strategies and engagement levels in their courses. We then provided provincially mandated professional development to staff both as a whole group and on an individual basis. This professional development was helpful for teachers being able to implement UDL practices in the Saxby project and across curricular areas. The common task of learning about UDL, meeting with outside agencies, and planning for the disaster day created an atmosphere in the school and among staff that we were moving towards a common goal.

Some of the most engaged students through the entire project were five students we recruited to act as our student leadership team. These students were instrumental in working through the logistics of disaster day as well as coordinating and collating data on student engagement. They earned a credit for their work in helping host the event, market the project, collect data, and doing other assigned tasks.

Phase Three
At the end of May 2014 we guided students in our building through our disaster center over the course of one morning. Canadian Red Cross used our gymnasium to set up a disaster center to train their volunteers and familiarize students with disaster preparedness. The Riverview Fire Chief led groups of students through various disaster scenarios in a mock command center. Students work was set up in a science fair style to illicit student conversations about a potential disaster event. A social studies class paired with the Red Cross volunteers to help in the center while theater arts classes took on the role of disaster victims creating an authentic environment for the volunteers. While this represented the hard work of a number individuals we were interested in measuring the engagement level of students.

Picture 1: Students and members of the Canadian Red Cross interacting in the mock emergency response center.

Picture 2: Students showing their scale model of the Petitcodiac River and the flood plain.

We conducted end of project surveys with students and staff to try and measure any effects of UDL, interdisciplinary projects on engagement. These surveys allowed us to collect quantitative and qualitative results in order to capture the full scope of the project. We feel that it is important to include samples of both types of data as different classes participated differently.

Chart one and two summarize our Qualitative data on student engagement and teacher perceptions of engagement. This data from Chart 1 shows that increasing the frequency of UDL strategies increases the self-reported level of student engagement. The data from Chart 2 shows that teachers also perceived an increase in student and teacher engagement through the project. It is with this in mind that we state that UDL practices embedded in a broad interdisciplinary setting can have a positive impact on the level of student engagement.
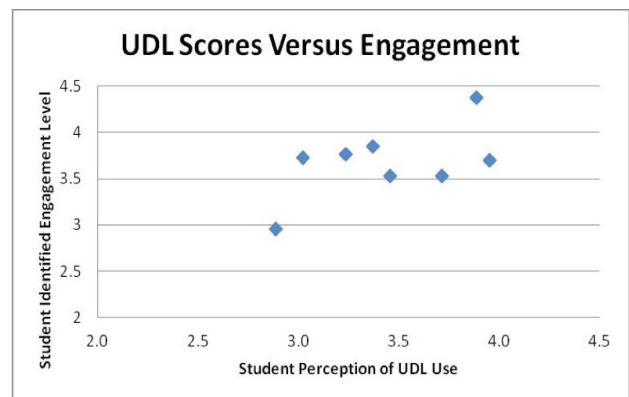

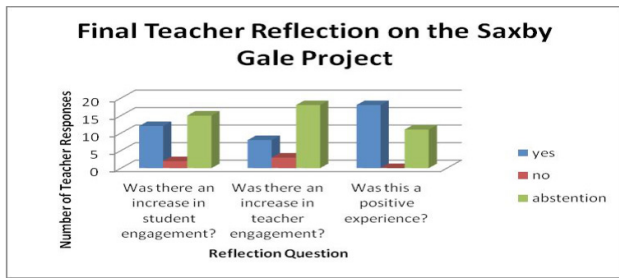*Chart 1*: Student perception of UDL and Engagement

Chart 2: Final teacher reflection

Our qualitative data comes from the final surveys and conversations with students. While this data did not point as conclusively to a correlation between UDL practices and student engagement, it did highlight the need for authentic learning. Teachers and students commented through the project that they learned about themselves as a member of a community and about their community. Students indicated that they were able to find and pursue a passion within the structure of the project that they would not have otherwise been able to take on. Teachers also commented on the impressive quality of the disaster day showcases as well as the increased awareness of emergency preparedness among students. This data reinforces the fact that deep learning about self happens when learning is authentic.

One teacher embraced the project to such an extent that she was able to track student academic progress both anecdotally and through assessment data comparing student success when UDL was being used in the class and when it was not. Students and teacher felt that the use of the project to frame UDL implementation significantly positively impacted student success. Across four classes with students of varying abilities, the teacher relayed that not one student failed an assessment tied to the project compared to 32 students failing the previous assessment. The teacher also relayed that external assessors from community agencies came to help evaluate oral presentations related to the Saxby project and could not determine which students were on a Personalized Learning Plan or had learning disabilities. Results on increased academic achievement coupled with increased confidence and understanding leads us to stress the need for UDL use attached to meaningful context for student learning. In this context teaching becomes a combination of coaching, resource collecting, questioning, interviewing, and guiding. The use of formative assessments through conferencing, driving questions and problem solving, become common ways to evaluate each student's individual learning and a true understanding to how students are actively producing their own learning.

Summary and Recommendations

While we feel that the use of an interdisciplinary case study was an effective method to scaffold UDL learning for teachers and increase student engagement, it is important to highlight some other positive aspects of the project as well as limitations we encountered. We discuss here some of the teacher reflections on what we did that contributed to the success of the project and things that we would improve on if we took on a large project again.

The three factors that we felt were the most influential to our success were the time we had to collaborate as professionals, the use of a student team, and the fact that the topic was broad enough to tie into any curricular area. We were given release time by the department and were able to secure weekly meeting time through our school based PLC structure. These times allowed us to plan, meet with outside agencies, and reflect on our conversations in order to refine our direction. The amount of planning that we were able to accomplish before launching to staff was key. Our student team was a hand-pick group of grade 12 students that expressed interest in taking on a challenge. They were able to perform administrative and logistics tasks that freed us up to focus on coaching teachers on UDL and making connections with outside agencies (as well as still teaching a full course load). The broad topic of a disaster that would affect everyone in our community allowed students and staff to understand that this was an authentic topic. Students truly embraced the fact that they should be thinking about their community and their neighbors. They were interested in not only Science and Law but in helping the town of Riverview. Without these factors our Saxby Gale project would have not been as successful.

In any project of this scope there are limitations that hinder progress. We were no exception to this and had a number of limitations that reduced our ability to connect with staff, challenged teachers who took on the project, and made it difficult for students to achieve at the highest possible level. Some of the broad categories of these limitations are summarized as:

- Cultural undertones in pockets of the school that did not embrace the project as it was seen as a disruption to student learning.
- Staff meetings were the only time we could administer surveys to the entire staff and this was not always a conducive environment to disseminate

information or engage in a study.

- Some teachers had difficulty with the idea that students would progress through the project in a non-linear fashion requiring the teacher to navigate multiple learning targets in the same room and subject.
- Teachers felt overwhelmed with not knowing how their curriculum fit with the project.
- There are policy limits on how students are to interact with outside agencies. While these policies exist for the protection of the pupil, they were found to hinder individual curiosity and the immediacy of inquiry.
- The computing policy stalled a few projects. The fact that students cannot use their own device or need to rely on restrictive, antiquated technology is disheartening.
- Our biggest inhibiter was the weather of New Brunswick. Many snow days forced teachers to retract on the time they devoted to the project.

In the name of action research there are a number of things we would change to address some of these issues. We recognize that any changes are not solutions but ways of mitigating these limitations. We would like to engage in a similar large project in subsequent years to provide more data in answering our questions. We would have monthly UDL planning and coaching sessions leading up to the project so teachers could work with colleagues to address challenges. We would like to establish a list of local agencies and experts that students could connect with. Finally, we would brainstorm concrete examples of content connections so teachers and students could connect more readily to the project.

As we moved through the project we also realized that we needed more research on teacher engagement. This was an aspect of the project that we expected to happen organically through the course of the project. We realize now that more literature would need to be reviewed in order to properly create pre and post surveys that would accurately assess teacher engagement.

We have taken some of what we learned through this project and applied it to other large projects. Because of the success of the Saxby Gale project and the connections made with community, we were invited by the Town of Riverview to participate in both of the Town of Riverview Sustaina-Palooza conferences. We have also continued to make connections between staff in think-

ing about how we can reframe some teaching in order to allow students the flexibility to take on large, real-world problems. We strive to push the system limits that often restrict teachers' creativity in truly engaging students.

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Math Exchanges Through Universal Design for Learning: An Action Research Project

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Abstract

The grade one team at Salem Elementary School in Sackville implemented Math Exchanges by Wedekind (2011) for mixed ability groups of students and a teacher facilitator to use an inquiry approach to solve word problems. Using Diller's (2011) Math Work Stations, the teachers wanted to include an awareness of multiple intelligences. After an inventory of math stations, items were purchased to address gaps. We conducted pre and post testing of numeracy and problem solving skills using questions from our district math screener (Appendix A). Post interviews with students and teachers assessed the effectiveness of the new approach. Results indicated that a combination of math exchanges and math stations following UDL guidelines were effective for problem solving and numeracy skills.

Introduction

The team of three grade one teachers and one ESS-Resource teacher implemented an Action Research Project to improve the experience and effectiveness of math learning. We implemented strategies from two resources by Diller (2011), and Wedekind (2011). Recognizing that our new system aligned well with Universal Design for Learning (UDL) principles, we incorporated multiple intelligence principles for an active approach to learning and explored the effect on student learning.

Thesis

We wanted to know how the implementation of UDL principles using math work stations and math exchanges affected students' ability to learn. Our research question was: "How can the Grade 1 team promote mathematical thinking through the implementation of facilitated math exchanges so that all students have the opportunity to learn in a variety of ways that compliment individual learning profiles?"

We collected data in pre and post questions, videotaped ourselves and our students during math, collected data during exchanges, studied the videos to learn and make any needed changes to program delivery, and studied student work.

Context

The action research project was completed with grade one classrooms at Salem Elementary School, located in the small town of Sackville, New Brunswick. The school's catchment area includes a large rural component. The school's population of just over 300 students is varied in educational background and income level.

Fifty-nine students participated in the study (33 boys and 26 girls). The students are a diverse group including children with Asperger's Syndrome, English Language Learners, apraxia, and ADHD. Two classrooms were supported by an Educational Assistant, and one had a student intern and a School Intervention Worker. Students were supported by the school's resource teacher. Classroom teachers led math exchanges; the resource teacher supported students in their math work stations. Rationale

Our team researched effective ways to deliver math curriculum. Math Work Stations by Diller (2011) provided a structure for students to learn independently or with a partner. We then incorporated Wedekind's (2011) Math Exchanges,

> The teacher's focus is on guiding student talk and mediating thinking as students share problem-solving strategies, discuss how math works, and move toward more effective and efficient strategies and greater mathematical understanding. (p. 4)

Math exchanges support key principles of UDL in exchange of ideas among students, activating prior knowledge and valuing students' ideas, interests and engage-

ment. Similarly, math work stations support the UDL model by providing opportunities to apply math concepts in various ways. Once both were in place, the team explored and investigated the effectiveness of these combined approaches.

What does current research on this new practice or intervention suggest?

Fosnot and Dolk (2001) suggest that math has traditionally been taught in a way that needed to be "learned, practiced, and applied" (p. 13). They describe mathematics using the verb, mathematize, which is to see and understand the world using math models. In this way, students struggle with mathematical ideas, learn and revise math strategies and create their own schema to understand math in their world. It is the activities, strategies, and big ideas that students develop with experience, time, and modelling that are important. Wedekind (2011) has developed her approach based on these premises.

Wedekind's lessons include an opening, a focus lesson, independent practice and one or more math exchanges (pp. 3-4). Lesson components that directly applied to our research were independent practice and math exchanges. Wedekind (2011) specifies independent practice can take the form of individual, small group or pairs working together on math games, tasks and/or problems. To run an effective math exchange, other students must be engaged in activities that are "truly independent and mathematically meaningful" (p. 4). Our classrooms were already versed in math work stations, best described as a system or structure for managing small independent group work (Diller, 2011). She based her ideas on the thinking of Eric Jensen (1998, as cited in Diller, 2011 p. 7), who suggested students' intrinsic motivation is increased when they are provided choice, learning is relevant and personal, and activities are more engaging when they provide opportunities for physical movement.

Math work stations are comprised of up to 10 "stations" or boxes that contain instructions and manipulatives for the required task, game or exploration. These stations reinforce and extend prior learning. Diller uses the term, "work station" to signify a time for work, not play. Pearson and Gallagher's (1983) gradual release model of instruction, as cited in Diller's (2011) work, is used to prepare students for station routines. Each station is introduced and modeled to the class one station at a time.

Every routine from getting the station, organizing materials, playing the game, to using talking cards is modeled and practiced until the students demonstrate independence.

Fundamental principles behind math work stations complement guidelines to UDL (CAST, 2008). Students become responsible for their learning, choices, activities, and work with partners based on flexible mixed ability groupings. These principles meet guidelines for providing multiple means of representation, action and expression, and engagement (CAST).

Math work stations allow for representation of visual and auditory information. They activate prior knowledge, introduce and practice vocabulary and math symbols, guide information processing, and support memory and transfer (CAST). This model incorporates multiple means of action and expression by providing activities designed to include all multiple intelligences. Opportunities are provided for physical response, use of manipulatives, problem solving, and self-monitoring (CAST).

Students are more engaged in classrooms that use math work stations than traditional classrooms using worksheets (Diller, 2011 p. 16). Key components of the math work station philosophy improve engagement through choice and autonomy, relevance and authenticity, varying levels of challenge and support, collaboration and communication, and self-assessment and reflection.

Well-designed math work stations and routines allow for math exchanges to occur within the math workshop. In the forward to Wedekind's (2011) book, Chapin states "Math Exchanges offers teachers a grounded approach, supported by research and professional knowledge, to designing and implementing math workshops that help develop young mathematicians" (p. vii). Math exchanges allow the learner to hear about math concepts and processes from peers using child friendly language. The Math Exchanges approach is based on the theory that choice is a critical part of learning, peers are a mathematical resource so collaboration and sharing are important, and students learn to self-manage and self-monitor their learning.

Wedekind bases Math Exchanges on the work of those who developed Cognitively Guided Instruction. She quotes Carpenter (1999), who shares that "children enter school with a great deal of informal or intuitive knowledge of mathematics that can serve as the basis for

developing understanding" (as cited in Wedekind, 2011, p. 29).

A typical math exchange is a small group meeting of children with their teacher facilitator, guiding children in connecting ideas to solve a problem together. Problems are based on the students' experiences, taking into consideration background knowledge. Students in the mixed ability groups are given the same problem, however, differentiation occurs by changing the numbers in the problem to suit each student's learning needs. Katz (2012) defines academic inclusion to encompass the philosophy that "all students are a part of the learning activities of their classrooms and school – not parallel, but interactively with their peers and the general curriculum" (p. 2). She further emphasizes all students should have the same task, and differentiation occurs through development of different goals for each student.

Finally, students are engaged in math exchanges because the exchanges are designed to be relevant and authentic, with flexible mixed-ability groupings, which promote collaboration among students and teachers (CAST, 2008).

Methodology and Data Collection Process
This project was designed as an action research project, in which we followed the model of McNiff (2002) which suggests a cycle of identifying an issue, imagining a solution, implementing a solution, and reflecting on the process and impact. Our research question identified our issue, and through extensive reading we implemented the math work stations and math exchanges as our solution. This paper is the result of our reflection on the process.

After determining the research question and the potential solution, we began the process by administering math screeners to create a set of baseline data. In the Anglophone East School District, teachers are expected to administer math screeners (See Appendix A) three times per year. Winter screener data was collected in early February, just before the research study. Pre and post data were extracted from math screeners. Specific questions pertaining to number sense and problem solving were analyzed in winter and spring screeners. Pre-testing was completed on February 6 with follow-up testing on April 24.

Math exchanges were video and audio recorded throughout the study. Student responses were recorded and analyzed pre and post using a rubric (see Appendix B) modified from Wedekind (2011, p. 190). As well, classroom videos were used to provide teachers with feedback on implementation of new strategies. Videos were shared among the team and comparison of vocabulary, questioning, groupings and materials were the focus of professional dialogue.

Several team meetings were entirely devoted to the Math Exchanges project including two meetings in Fredericton at beginning stages, one meeting with Dr. Ann Sherman, Dean of Education, University of New Brunswick, and several school based meetings on December 9, February 6, and February 27, April 4 and May 5. Teaching processes, student development and planning were topics of discussion.

Part of the action research project was to examine and expand upon math work stations to include UDL. Math manipulatives were ordered to supplement the workstations and fill gaps. Digital cameras and audio recorders were purchased to document teaching practices and student progress. Budget information can be found in Appendix C.

Findings
Results of the study indicate that a combination of UDL principles, math exchanges and math work stations have a positive impact on the development of concepts and problem solving skills. Pre and post results can be analyzed by examining overall data from key questions posed from math screeners. Students improved from 53% to 73% correct answers as indicated in Chart A.
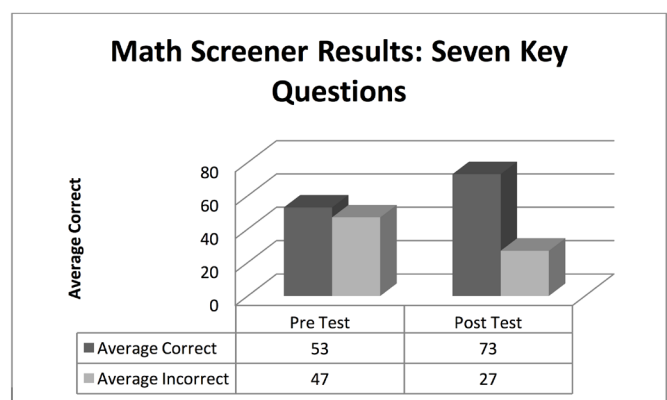

Math Screener Results: Seven Key Questions

	Pre Test	Post Test
Average Correct	53	73
Average Incorrect	47	27

Chart A: Math Screener Results

Results of each question can be analyzed to see where the greatest gains were made (See Chart B). The first 3 questions selected on the screener focussed on numeracy. Pretest results were already fairly high on these questions (ranging from 31-51 out of 60 correct responses). Post results improved to a range of 52-60 out of 60 correct responses.

The key numeracy questions from the math screeners were:

> Question#7: Show student task card with the numbers 8 and 13.
> Ask: Which number is closest to 10?
> If the student answers 8, ask: How many more to 10?
>
> Question #11: Say: I have 7 counters in my hand.
> I am going to add 2 more.
> Ask: How many counters are now in my hand?
>
> Question #17: Place a ten train next to the student's 8 train.
> Ask: What is the difference between the number you made and the number I made?

Problem solving questions were more difficult as indicated in pretest data ranging from 17-27 correct responses out of 60. Significant improvement was noted with questions 21 and 23, where results tripled and doubled.

The key problem solving questions from the math screeners were:

> Question #20: Say: I have 3 buttons.
> Ask: How many more do I need to have ten?
>
> Question #21: Show student 6 counters.
> Ask: How many counters would you have if you added ten more to these?
>
> Question #22: Say: I have 9 blocks, and I lose 6.
> Ask: How many blocks do I have left?
>
> Question #23: Show student a task card with a balance question. One side has 2 dice with numbers 5 and 2. The other has a die with a box and a die with the number 3.
> Ask: What number goes in the box?

Results of Key Questions: Numeracy and Literacy

	Numeracy #7	Numeracy #11	Numeracy #17	Problem Solving #20	Problem Solving #21	Problem Solving #22	Problem Solving #23
Pre Test	48	51	39	27	13	17	19
Post Test	55	59	51	39	38	24	36
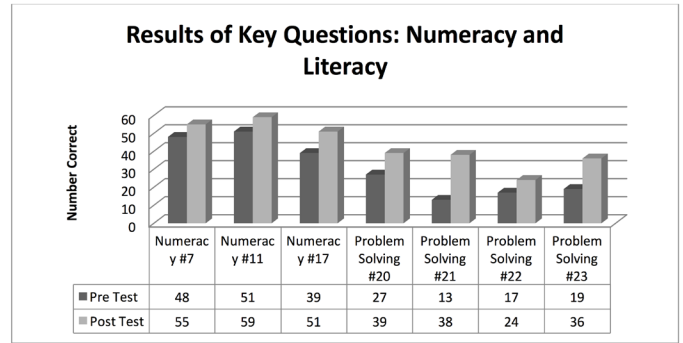
Chart B: Results of Key Questions

Screener results can also be compared at district level (Chart C). In October Salem grade one students scored 0.33 points on average above district. In February this increased to 0.88. June results were released following the study. Salem grade one students continued to be above the district average; however the gap decreased slightly. The district does not collect question by question data and so it is impossible to compare the key numeracy and problem solving question results to the district.

Comparison of Math Screener Data

Screener Results: Comparison to District

	October	February	June
Salem Average	8.06	15.37	18.59
District Average	7.7	14.49	18.28

Chart C: Screener Results Comparison to District

As part of the study, a gap analysis was conducted in order to determine how existing math work stations fit into the multiple intelligences model. An inventory of math stations was taken and organized by intelligences and math strand (see Appendix D). Results of analysis indicate gaps in physical, music, self and nature domains.

Number of Stations Per Multiple Intelligence
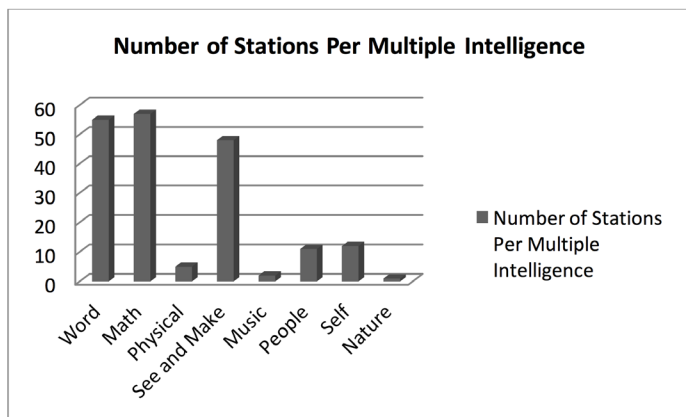
Chart D: Stations per Multiple Intelligence

Limitations

As with any action research project and implementation of new strategies within the classroom environment, limitations occurred. Life sometimes gets in the way of the timeline for classroom planning. This past winter, an above normal number of snow days played an enormous factor in the project. Specifically the 5 snow days following March break.

Scheduling math exchanges proved to be difficult as some classes were scheduled on consecutive days. Often, there was not enough time between math exchanges to fully teach and model new math work stations. District math mapping expectations for March focussed on measurement, so the teaching team incorporated measurement activities and problems into math exchanges and math work stations. This resulted in fewer periods devoted to numeracy.

Technology also proved to be a limitation as the team devised a way to share an enormous amount of audio and visual documentation among members. Eventually, a restricted Youtube account was created for all team members to have access to the videos.

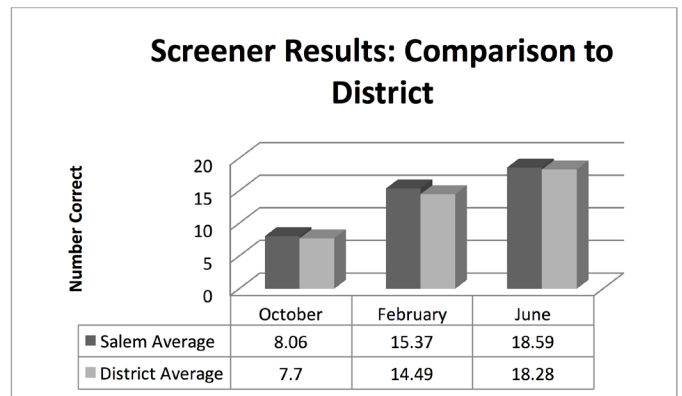Part way through the research project, the team discovered Wedekind's (2013) video entitled, "How Did You Solve That?" The video was purchased with grant funds, but the team was not able to explore its contents until late in the study. We recommend that future teams watch the video in advance of implementing math exchanges.

The most time consuming aspect for planning was in the completion of the math work stations inventory and

organizing stations by strand. The new organization system will assist in future planning.

More time should have been allotted at the beginning of the study with math work stations, to ensure that stations used during math exchanges were well modelled and practiced and students had stamina and independence beforehand.

Despite these limitations, the action research project was well worth the time and effort. Professional learning occurred among all teachers involved in the project and positive impacts on student learning were obvious.

Implications to our Teaching Practices

The findings of this action research project have made a significant impact on the participants' teaching practice. As previously mentioned, teachers became facilitators and coaches of math exchanges. This allowed teachers to gain different perspectives on student learning in a typical classroom. Teachers saw greater evidence of children's understanding of mathematical concepts as compared to traditional classroom discussion and independent seatwork. Metacognition was evident as students verbally and visually shared their thoughts and processes. Strategies utilized by students were demonstrated and explained in student friendly language. It was evident students did benefit from hearing the ideas of others.

Math exchanges, in particular, allowed teachers to reach students at individual levels using student knowledge and interest to further engage them. The language of math was explored deeply by introducing the problem as a "story" without numbers. All students could then discuss the problem, make suggestions, and formulate an approach or strategy. This "story" approach to problems allowed for vocabulary to be introduced and background knowledge to be activated.

Progress with both numeracy and problem solving skills was tangible. Evidence was collected in a rubric format through classroom reflections following exchanges. Formative assessment was a key component to the math exchanges.

Recommendations for Instructional Practices and Future Research

The research team intends to continue with math exchanges and math work stations. The approach is highly recommended to others in similar situations. We recommend implementing these activities at the beginning of the year to establish routine. Many early years teachers in the province are already using approaches like guided reading and/or Daily Five as structures to establish routines. The Daily Five, Second Edition (Boushey & Moser, 2014) was designed to provide a "structure that would ensure all children were working at their level of challenge while taking responsibility for their learning and behavior, and that would provide meaningful instruction blocks" (back cover). These same approaches could be easily applied to math classrooms through math exchanges and math work stations.

In addition to using Wedekind's (2011) and Diller's (2011) books, it would be beneficial to view Wedekind's (2013) video. It would also be beneficial to examine what additional math work stations could be added to further complement multiple intelligences. The team wishes to continue developing an organizational system for math work stations with labels for math strands, outcomes and multiple intelligences. The team has been collaborating with the school district's Physical Education mentor who has provided numerous suggestions for incorporating physical activity into the math classroom.

Some practical recommendations relate to the way our classes are timetabled. Longer periods of time in the morning within the classroom would allow students to become more engaged in these activities. At times, specialty classes occurred during blocks of time that could have been better used for in depth math explorations. Another practical consideration is with regard to documentation sharing. It is recommended that a restricted YouTube account be created in order for all team members to have access to videos.

Much of the research surrounding UDL centers on providing students with choice. Further investigation is warranted to develop ways of incorporating more student choices within the current structure. Discussions were initiated on how to provide differentiation within work station boxes and how to incorporate student choice of stations.

Finally, the teaching team plans to share the results of this study with the teaching staff at Salem Elementary School. Additional opportunities may be available within Anglophone East School District and at the provincial level.

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Grade 1 Math Screener

Student Name: _____   Date: _____

#	Task	Materials	Teacher Observations	Coding Criteria	1	0
1	Ask: "How high can you count?"			Code 1 if the student is able to count to 100 with fluency.		
2	Show Task Card A. (numeral 9) Ask: "What is this number?" Ask: "What number comes after?" Ask: "What number comes before?"	Task Card A		Code 1 if student can tell you all three correct answers; 9, 10 and 8.		
3	Show Task Card B. (numeral 19) Ask: "What is this number?" Ask: "What number comes after?" Ask: "What number comes before?"	Task Card B		Code 1 if student can tell you all three correct answers; 19, 20, and 18.		
4	Flash Task Card C (8 dots) Ask: "How many dots do you see?"	Task Card C		Code 1 if they say 8, or count on from 5 Code 0 if they count all the dots or if they need to touch the paper.		
5	Give student Numeral Cards 46-52 Make sure the cards are not in order as you pass them out. Say: "Put these in order."	Numeral Cards 46-52		Code 1 if the student correctly sequences the numbers in either ascending or descending order		
6	Show the Numeral Card 14 Say: "Show me this amount on a double ten frame."	Numeral card 14 Double ten frame Marker		Code 1 if they can show 14 without evidence of counting from 1-14, (Benchmark the 10) Code 0 if they draw dots, ask for counters, or show evidence that they counted.		
7	Show Task Card D(8 and 13) Ask: "Which number is closest to 10?" If student answers 8, Ask: How many more to 10? If student answers 13, code a 0.	Task card D		Code 1 if the student says 8 **AND** is able to explain that it is 2 away. Code 0 if the student says 13.		

1 for Achieved   0 for Not Yet Achieved

Grade 1 Math Screener

Student Name: _____ Date: _____

	Task	Materials	Teacher Observations	Coding Criteria	1	0
8	Show Task Card E (4 on a ten frame) Ask:"How many more to make 10?"	Task Card E		Code 1 if they say 6. Code 0 if they need to count the empty squares to get 6.		
9	Say: "Begin at 67 and count to 80."			Code 1, if the student counts successfully with fluency, even if they count past 80.		
10	Show Task Card F (14 stars) Ask: "How many stars are there?"	Task Card F		Code 1 if student answers 14 with or without touching the stars.		
11	Say: "I have 7 counters in my hand. I am going to add 2 more." Ask: "How many counters are now in my hand?"	9 counters		Code 1 if the student answers 9.		
12	Say: "Count backwards from 23 and stop at 11."			Code 1, if the student counts backwards successfully with fluency, even if they count past 11.		
13	Show Task Card G (4 dots and 3 dots) Ask: "How many in total?"	Task card G		Code 1 if the student answers 7 with automaticity. Code 0 if the student shows evidence of counting.		
14	Show Task Card H (3 4 7) Say: "Point to the 2 numbers that make 10 when you add them together."	Task card H		Code 1 if the student points to 3 and 7 without hesitation.		

1 for Achieved   0 for Not Yet Achieved

2

Grade 1 Math Screener

Student Name: _____ Date: _____

#	Task	Materials	Teacher Observations	Coding Criteria	1	0
15	Show Task Card I (10+9) Ask: "What is the answer to this question?"	Task card I		Code 1 if the student answers 19 with automaticity. Code 0 if the student shows evidence of counting.		
16	Show linking cube train (10 cubes) Say: "Here are linking cubes. Show me 8."	10 linking cubes 5 of one color, 5 of another color		Code 1 if they take the linking cubes and break off 2. Code 0 if they count cubes up to 8 or count on from 5.		
17	Teacher places a ten train next to the students 8 train and asks.... Ask: "What is the difference between the number you made and the number I made?"	10 linking cubes 5 of one color, 5 of another color		Code 1 if the student answers 2 with automaticity. Code 0 if the student shows evidence of counting.		
18	Show Task Card J (4+5) Ask: "What is the answer to this question?"	Task card J		Code 1 if the student answers 9 with automaticity. Code 0 if the student shows evidence of counting.		
19	Show task Card K Ask: "Which arrow is pointing to the number 4?"	Task card K		Code 1 if the student points to the correct arrow.		
20	Say: "I have 3 buttons." Ask:" How many more do I need to have ten?"			Code 1 if the student says 7 without counting. Code 0 if the student has to count.		
21	Show student 6 counters Ask: "How many counters would you have if you added ten more to these?"	6 counters		Code 1 if the student answers 16 without evidence of counting on.		

1 for Achieved   0 for Not Yet Achieved

3

Grade 1 Math Screener

Student Name: _____   Date: _____

	Task	Materials	Teacher Observations	Coding Criteria	1	0
22	Say: "I have 9 blocks, and I lose 6." Ask: "How many do I have left?"			Code 1 if the student says 3.		
23	Show Task Card L (equality) Ask: "What number goes in the box?"	Task card L		Code 1 if the student answers 4. Code 0 if the student shows evidence of counting.		

1 for Achieved   0 for Not Yet Achieved

4

Appendix B

Appendix B: Math Exchange Rubric

Analyzing Student Work, Thinking, and Understanding			
Name and Date: _____			
Evidence of Student Thinking	What Can the Student Do?	What Can the Student Almost Do/Not Yet Do?	Next Steps
Noticing →	*Interpreting* →		*Responding*

Appendix C

Provincial UDL Grant

Items Purchased	Cost	Store
3 x Sony Recorders	118.00	Staples
1 x Ready Set Move	50.09	School Specialty
3 x Step by Step Numberline	194.88	Flaghouse
3 x Math Balances, 3 x Magnetic Ten Frames, 1 Math Dog House, 3 x Shaker sets, 3 x Jingle sets	246.33	Louise, Kool, & Galt
DVD – How Did You Solve That?	140.00	McIntyre Media
Camera	239.88	SportChek
TOTAL:	989.18	

University of New Brunswick Grant

Items Purchased	Cost	Store
Memory cards	94.96	The Source
3 x 0.5 Supply Teachers	300.00	UNB Grant
3 x Cameras	479.97	Amazon.ca
TOTAL:	874.93	

Appendix D

Outcome	Station	Word	Math	Physical	See and Make	Music	People	Self	Nature
N1 Say the Number Sequence, 0-100, by: 1's forward and backward, 2's to 20, forward, starting at 0, 5's and 10's to 100, forward	Dominoes Games	1	1		1		1		
	Bump	1	1		1		1		
	Race Back to One	1	1		1		1		
	Race to 25	1	1		1		1		
	Match the Die Pattern	1	1		1		1		
	Blue Sequencing Game	1	1		1		1		
	Let's Count to 100	1	1		1		1		
	Counting Books	1	1		1		1	1	
	Caterpillar Game	1	1		1		1		
	The Great Penny Drop	1	1			1	1		
	Exer-Counting	1	1	1					
	Incey Wincey Spider	1	1	1					
	We Want Action	1	1	1		1			
N2 Recognize at a glance and name familiar arrangements of 1 to 10 objects or dots	Snap	1	1				1		
	Concentration	1	1		1				
	Clean Sweep	1	1		1				
	Dots Fingers	1	1		1				
	Terrific 10 Snake	1	1	1	1				
N3 Demonstrate an understanding of counting by: indicating that the last number says how many; showing any set has one count; using the counting on strategy; using parts or equal groups to count sets	Four Kings	1	1		1				
	Penny Shuffle	1	1						
	Die Plus One	1	1						
	Die Plus Two	1	1						
N4 Represent and describe numbers to 20, concretely, pictorally, and symbolically	Match words, #, 10 Frames		1		1				
	Mind Reader / Hat	1	1		1				
	Mystery Number	1	1		1				
	10 Frame Riddle	1	1		1				
	Number Representing		1		1				
N5 Compare sets up to 20	10 Frame Compare	1	1		1				
N6 Estimate quantities to 20	Closer to 5 or closer to 10	1	1	1					
N8 Identify the number up to 20 that is one more, two more, one less, and two less than a given number	What number is?	1	1		1				
	Snakes and Ladders	1	1		1				
	One More Two More Bingo	1	1		1				

Outcome	Station	Word	Math	Physical	See and Make	Music	People	Self	Nature
N9 Demonstrate an understanding of addition of numbers with answers to 20 and their corresponding subtraction facts	Dominoe Addition	1	1		1				
	Number Sentence Match	1	1		1				
	Addition Dominoe Train	1	1		1				
	Find the Missing Number	1	1		1				
	True or False	1	1		1				
	Cover Up	1	1		1				
	Egg Head	1	1		1				
	Three in a Row Add/Subt	1	1		1				
	Addition Crossout	1	1		1				
	Race for a Flat	1	1		1				
	Tug of War	1	1		1				
	Shake and Share	1	1		1				
	Subtraction Snap	1	1		1				
	3 in a Row Addition Game	1	1		1				
	Snake Dice	1	1		1				
	Addition Rectangle	1	1		1				
	Race Money	1	1		1				
N10 Describe and use mental math strategies (count on and back, make ten, doubles, addition to subtract to 18)	Angry Doubles	1	1		1				
	Double Facts	1	1		1				
	Double Dice Game	1	1		1				
	Ten Alone	1	1		1				
	Egg Carton 10-Frame	1	1		1				
	Totally 10 Snake	1	1		1				

NO MATH STATIONS

N7 Demonstrate concretely and pictorally how a given number can be represented by a variety of equal groups with and without singles

Changing the Picture

Crystal Bourgoin (Nashwaak Valley Elementary School), Joe Crossland
(New Maryland Elementary School), Tayne Moore (Barkers Point
Elementary School) and Alex Yaychuk (Nashwaaksis Middle School)

Abstract

Our project involved four K-8 schools and their physical
education environments. We used formative assessment
strategies paired with a program called 'Coach's Eye'
to enhance learning. Our overall finding was that when
looking at skill development, video analysis offered
students the ability to learn more quickly and pursue
the skill acquisition more efficiently. This allowed us to
meet the needs of various learning styles because the
auditory, visual, kinesthetic, interpersonal learning styles
of students were engaged with more meaning. Students'
overall understanding showed that they were able to re-
member cues better as a result of having video analysis
because they had a visual image to connect to the verbal
feedback. The visual image is slowed so the student has
time to elaborate on what they have learned in an other-
wise fast paced learning environment.

Introduction

This action research project allowed four physical edu-
cation teachers to enhance their formative assessment
strategies by using technology paired with various ped-
agogical techniques. In keeping with Universal Design
for Learning (UDL) principles and meeting the needs of
every student, a variety of assessment strategies such as
co-construction of criteria, student portfolios, peer and
self-assessment, video analysis and information graphs
were explored. To ensure that the assessment strate-
gies were successful, a greater emphasis was placed on
individual, group and whole class goal setting in order to
increase student engagement and ownership. To support
the physical education curriculum in multiple ways and
to enhance assessment practices, IPADs, apple TV and
other applications were used as pedagogical tools in the
assessment strategies explored.

When looking at self-correction by increasing formative
assessment when using iPads, students increased per-
sonal awareness of what they needed to correct. Student
involvement was increased by allowing choice, perspec-
tive, exploration and self-initiation. Students paid more

attention to detail within the movement cue by looking
at iPad technology. This allowed students more owner-
ship and higher achievement.

Rationale and Research Question

How does the use of multiple of formative assessment
strategies in physical education impact skill development,
understanding and self-correction?

Over the years, formative assessment strategies in phys-
ical education have evolved with the use of technology
support, enhancing the quality of teaching and learning
due to multiple means of feedback. As practitioners, we
wanted to explore the use of technology mediated for-
mative assessment to assist students in increasing their
self-regulation to promote a more autonomous environ-
ment of learning and better understanding of outcomes
and expectations, with the end goal of increasing stu-
dents' ability to monitor their own learning progress.
In order to do this, we investigated several formative
assessment strategies best suited for the gymnasium. We
explored information and samples of assessment strat-
egies aligned with curriculuar content in physical educa-
tion to enhance practice with the use of a visual analysis
app called 'Coach's Eye'. The opportunity to explore
multiple assessment strategies with the use of technolo-
gy forms the basis of this action research project.

Context

In keeping with the formative assessment strategies
mentioned above, each school used video analysis as a
tool to enhance student learning. Each school adopted
formative assessment practices that worked well for
independent teaching styles and environments.

Alex teaches at Nashwaaksis Middle School, an urban
school with a population of 600 students. Students
receive physical education twice per week (50 minute
classes) and teaches both French immersion and English
classes. The participants in this research section were
a grade 7 English class comprised of 22 students. Two
students require an educational assistant and several

more are on individualized learning plans. Although some students in this class are strong athletes, the majority of the class would be average ability in terms of skill level. All lessons were taught on one basketball court with two large volleyball nets used. Using the dividing curtains, Alex projected the image from the iPad allowing students to view the footage at any given point during the lessons.

Image 1: Alex projecting footage from the iPad to studnets

Tayne teaches at Barkers Point School, an urban elementary school consisting of approximately 350 students. Most classes were doubled with 120 minutes of physical education weekly. Every student from K-5 participated in co-constructing assessment criteria with use of video analysis. The gymnasium required several small adaptations to prepare for the project. These included a mobile tech cart with speakers, projector, and a portable screen positioned on the stage.

Image 2: Students co-constructing assessment criteria

Joe teaches at New Maryland Elementary School, an urban K-5 School of approximately 475 students. There are 23 classes, and two full time physical education specialists. The Kindergarten to Grade 2 classes receive 120 minutes of physical education weekly and grades 3-5 receive 90 minutes each week. One class through the week is team taught with 40-55 students in the gym at any one time. A sample of the new report card for physical education assessment was sent out to provide K-2 parents and students with more feedback on their progress.

Crystal teaches at Nashwaak Valley Elementary School, a rural school, with approximately 127 students. There is one grade level class at the school from K-5 and a 1-2 split. The largest class is grade 3 with 26 students and the smallest class is 14 students as a 1-2 split. Most classes receive physical education four times per week in 30 minute blocks. The stage set up in the gymnasium makes technology use very efficient and effective. The parameters of the gymnasium reflect a multipurpose room size. Every student participated in co-construction of assessment criteria. Students with exceptionalities were given a progressive portfolio to follow their individual successes. Student led conferences were held to discuss learning.

Image 3: Student and educational assistant participating in skill development activity

Literature Review
Formative assessment suggests that, "teachers do not create learning, learners create learning, teachers create the conditions in which students learn" (Wiliam, 2006 (page?)). Visual analysis allows students to follow through on a part of their skill acquisition and game play strategies that are established as required through a summative assessment protocol (Wiliam, 2006). Teachers that support students in the process of problem solving allow for greater independent growth. Students have a greater desire to learn rather than feeling they have to learn because of a given mark through an approach that focusses only on assessment of learning.

These points bring strong support to our initial intention to use iPads and 'Coach's Eye' to increase student engagement and overall growth of learning. Expectations were raised for all students in the four schools in the project. Short cycled formative assessment was used throughout the duration of this project. William (2006) suggests that short cycled formative assessment, assessment used within a day or two of a learning activitiy, has

the greatest impact on student learning and achievement.

An Alberta Education report (2012), also advocates the use of iPads as an effective way of increasing the level of engagement in learners. The report also supports multiple ways of using iPads to access the curriculum and enhance assessment practices with teachers. Careful use of iPads allow for opportunities to create multiple ways for students to access information while simultaneously providing learning hooks for teachers to draw their students in. Educational apps allow for richer multimedia and interaction enhancing curricular content (Alberta Education Report). We fully believe that iPads can be used as an effective assessment tool when paired with other teaching strategies such as short cycled formative assessment, peer assessment and co-constructing criteria.

Our project examined the work of Davies, Herbst, and Reynolds (2008). We found, through the use of regular descriptive feedback (formative assessment) and community of learning, students became more comfortable receiving feedback on their learning progress which lead to greater levels of skill acquisition (learning?). Using an approach that develops communities of learning allows students to self-reference (regulate) and plan their next steps in their learning process (Davies, 2008?). Due to the nature of our positions, where we teach every student in the school in some cases, it is not feasible to give feedback to every single student each day through student-teacher conferencing. However, when we use co-construction to set up criteria-expectations, and students come up with their own cues to assess their work, they become more accountable for their own learning. When this is combined with peer assessment and self-assessment, the feedback loop is increased yet again across our student base (Davies, 2008).

Methodology and Data Collection Processes
Our group participated in action research with the intention of improving our formative assessment practices in physical education. Action research is defined as, "a form of self-reflective enquiry that enables practitioners to take control of their practice by asking questions about how they can improve it. They then make their ideas public for critical evaluation" (McNiff, 2010, p.3).

Our team collected data from grades K-8 using various data collection methods. We did this for skill and self-correction by taking side-by-side analysis of individual students performing a skill in isolation, as well as from students involved in direct game play using the iPad's video recording capabilities. What we found when analyzing the data was that students, more often than not, were able to go back and correct the skill because slow-motion video analysis and break-down allowed them to see what needed to be corrected. Furthermore, students were able to come up with their own terminology to better understand what it was that they needed to improve. The data collection did not take away from the natural learning environment because the students could go directly back into game play and execute the learning point, allowing them to perform the skill correctly in an authentic learning situation.

Parental consent was obtained through the New Brunswick Department of Education video release form before students were recorded. An additional release form was completed for any videos used in presentations of this project for educational purposes done by the department. We ensured that the information on the iPad was locked with security keys so information did not get out to the general public. We secured student permission prior to sharing a student's video with the class.

It is important to note that when using technology as a tool, we need to be very aware of our students' comfort levels. Ensuring that students were comfortable with the process was important when recording was used. The research team was aware of students' perceptions of themselves and examined possible situations that could be harmful. In most cases, students were comfortable with some form of assessment using the iPad. The key was to be flexible with the way we used the technology and to be aware that some students may prefer one-on-one conferences over group conferences.

Consistency was attained by using identical interview questions in each school. Each teacher on our team interviewed between 3-10 students within their school. This sample provided researchers with student perceptions about using visual analysis to help them with their learning in a physical education setting.

One student, who is on the Autism Spectrum, was followed via a progressive portfolio. Given our desire to be as fully inclusive in our practices as possible, we wanted to see how he responded to the visual feedback. What was found by way of video response was that he responded more independently to directional cues by

having his instructional tasks and focus explained by way of video. This has assisted him and supported his ABA program to increase his word use as well. He is now saying more words in the gymnasium and understands what he has to do with those words. Written consent was given on three levels as this student is included in the presentation that was created. (See appendix A for the Educational Assistance response to this inclusion).

Barkers Point School put a large emphasis on co-constructing criteria. This allowed the students to set up criteria using the iPad and 'Coach's Eye'. The students' analyzed a sample of a model on the projector screen and produced learning cues using their terminology labels. For example, the traditional cues teachers used for the overhand throw cues could be 'the bow and arrow', 'squish the bug' and 'step follow through'. When we used co-construction with the students they came up instead with labels such: 'Ball near ear', 'reach high', and 'hug'. Although both sets of cues refer to similar actions, the students' cues became more powerful and meaningful to them as they were created by the students using their own terms. This provided a more powerful learning experience for the learners.

Nashwaaksis Middle School followed a sample class during a volleyball unit and documented the process of the formative assessment practice on video. Students were put in working groups and the teacher recorded baseline assessment as a form of pre-test. Thereafter, the students viewed themselves in the next lesson performing one of the three skills (focus of the day) and were given a baseline assessment and then were given time to go back into their working groups to try to improve. This process was repeated so they could complete all three skills. The data collections were student centered and peer reflected.

New Maryland Elementary distributed a sample of what the new physical education report card would look like to K-2 and sent it home to a sample parent base. The focus of this part of the project was to strengthen the communication between home and school with respect to summative assessment. The school went from having parents not engaged in parent/teacher interviews to more parents asking specific questions about their child. A questionnaire was administered that was specific to what parents thought of the report card and this has guided its implementation.

Findings

From our action research, we have concluded that using iPads as a tool for immediate feedback increases teacher's ability to assess formatively in ways that are effective and efficient. This pedagogical approach increased our ability to provide effective and timely formative assessment that enhanced student learning.

Every student surveyed made a point to say that they could better see what they were supposed to do because they were able to observe themselves performing the skill. Furthermore, our side by side analysis using 'Coach's Eye', displayed the improvement of the specific skill in as little as three minutes. This was clear on the saved videos as the app saves the initial attempt of the student versus the second attempt. We estimate that by sharing our videos with one another, that 80% of the time students were self-correcting the skill and able to understand why changes were needed. Some probing questions were used in the beginning to prompt students but quickly were less needed as the students' metacognitive awareness increased.

Over half the students surveyed mentioned goal setting and new learning techniques which were a reflection of their own learning and ability to apply the new learning situations. Parents who came into our gymnasium for student-led conferences (or parent-teacher conferences) to discuss progress were appreciative of the visual display allowing them to see the development of skills. By setting up student-led conferences, there was an increase in parents showing up during conferencing time. One school went from one parent conference to 15 from one term to the next. Another larger school went from four conferences to 30. One parent said, "times have changed and I am glad that you are using this for my child." (Personal conversation, March, 2015).

Our findings were conclusive with a few unique responses. With respect to self-correction and skill development, we found that students understood what was expected of them during self-correction. Student responses confirmed they became increasingly comfortable taking ownership of their learning and that it was okay to break learning steps down. In most instances, students felt comfortable as a community of learners in tackling learning outcomes. Some responses from students regarding the project included:

I like to see one version and then see another one for your improvement (side-by-side).

I like the slow mo because you can see the steps you are going through.

I can see what I am supposed to do clearer.

We can see what we are doing.

It is easier to understand because you can see how you are doing rather than hearing it.

I can say how I can improve myself.

Reviewing and learning strategies from it and learning from mistakes.

Sometimes I set a goal and learn new techniques.

Limitations
Reviewing the short video clips does not take a lot of time but uploading videos from iPad to a computer desktop does. We ran into time issues as the iPad has limited storage space. However, videos often did not have to be saved as they could be deleted after the students have made self-corrections and have gained the necessary knowledge from conferencing or having the video played back to them.

There were some limitations to the project. Access to media storage did present issues and having access to a larger iCloud and/or Dropbox account would be beneficial. An external hard drive for saving videos is also important to have. Some of the programs used to support the use of the IPad and formative assessment would crash often eating up valuable time. Programs, such as 'Airserver' and 'Coach's Eye', require regular updates to maintain functionality. Preparation for teaching with technology required some work in the beginning. The setup included a projector, laptop, iPad and its connector are required.

Discussion and Implications for Physical Education Teaching Practice
We now approach our lessons using co-construction, short cycled formative assessment, and feedback using video analysis by way of students, teacher and individual. Less emphasis is placed on summative assessment and

more on formative assessment. More feedback is given to parents about what areas their child can improve on. Focus on personal growth through formative assessment rather than summative assessment has increased.

Our aim is now to promote the increased autonomy of support by allowing our students to self-regulate their learning (Livingston, 1997). We are accomplishing this by working to provide the necessary learning environment with student options as required within each lesson to grow a community of learners (student-centred learning) rather than teacher-directed learning. In keeping with proper pedagogical practices, effective questions also help develop skill break down.

We have always been open to student-centred learning but we now have a framework and the tools to implement this form of learning in our lessons and assessment strategies. The assessment is used to give more timely feedback to students so that the feedback can have an immediate effect on their understanding.

Reflection
The beginning of this action research project was an exciting one for our group. We all jumped at the opportunity to be able to work toward a common goal with the end result being to change the frequency and efficiency of our assessment. We all had access to an iPad before entering the project and were aware of 'Coach's Eye'. We wanted to establish some common shared assessment practices that would improve our students' skill, understanding and ability to self-correct.

We learned to put more emphasis on formative assessment practices. The iPad was used as a tool to establish a stronger relationship with our students as it impacted how our students learned and quickly drew them into conversations with us about their learning. Formative assessment practices, paired with the use of an iPad, changed the way our students received and interpreted feedback. It provided our students with the opportunity to 'change the picture', reflect, and adjust their performance based on feedback.

Leadership implications of doing action research have been substantial. We did not know that we would be presenting provincially, nationally, and internationally tophysical educators across Canada and the United States. As a result of these presentations, other physical educators have adopted formative assessment practices

with technology. Many principals are purchasing iPads for their physical education programs.

Our research group was different than other New Brunswick schools participating in action research projects as we were located in four different schools, in four different environments and working on different pieces of a formative assessment process. We did not have daily face-to-face interactions with our research colleagues. However, when we did meet we were able to learn and grow our own assessment practices as we discussed them with our colleagues.

This action research project is now evolving as we create user friendly tools for physical education teachers and data that supports our findings. The feedback from parents, other educators using the tool, Educational Assistants and student comments has helped us to further our research. The general feedback to date has been positive. The project has evolved and it was challenging to keep up with on top of our full-time teaching positions and extracurricular responsibilities.

Conclusion

As technology advances, better learning devices (tools) will become available and should be used in our information age. However, the research combining co-construction, formative assessment, feedback variety, the promotion of community learning with a physical education specialist at this point, seems ideal. However, we can challenge ourselves as educators to increase and strengthen formative assessment practices by creating effective tools using technology. This increases time on task and confidence of our learners. One example of this would be the common probing techniques developed when using the iPad in one-on-one conferencing or larger group work. This should make formative assessment practice using technology more cohesive.

Teachers are well known for sharing and adopting techniques and resources. This is the same for our student base when given the opportunity. We see video responses of students and testimonials daily. Other teachers are excited about the process of using visual feedback as a tool. We now have many new schools on board with the process at all levels (elementary, middle, and high). We have been visiting others schools to provide workshops and are now presenting in other provinces with respect to our UDL project. How great would it be if our students could share their personal success stories with oth-

er students from other schools? This could easily be set up with video collections from 'Coach's Eye' to promote physically literate environments.

Video feedback as part of the assessment process is not new, but how we combined it with teaching strategies is. If other teachers become familiar with the use of these strategies through teacher training workshops then they would be more inclined to adopt these strategies. This would allow students to benefit through their personal goals (physical progressions) within physical education.

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http://www.education.alberta.ca/admin/technology/research.aspx

www.pegeek.com

www.phecanada.com

Appendix A

Interviews: Educational Support Worker Interview and response to visual technology in the gymnasium:

EA Support: Recognizes the significance of using this app because research proves and from knowing Mitchel directly. Gestalt Learning: Students with Autism are more supported in their learning with pictures and visual aids of any kind. The 'Coach's Eye' slows the full movement and it eliminates any distractors as it focus in on what we want him to see specific movement. This allows him to learn language and regulate body nervous system because the movements is segregated and there for allows him to decompress pent up energy. It eliminates barriers and breaks down steps to simple movement. Which in turn increases comprehension and focus and long term and short success. The app is very quick to use within 2 mins he is individual with this approach but is also mimicking the movement other students are doing inclusively. There Is no interruption to the other students as the IPAD is used by all for assessment.

Barb (EA) I like it because he knows an IPad as entertainment and learning tool and he is pulled into focus to it. The whole class is continuing with their learning in the lesson while Mitchel has a brief elaboration of what is expected with the Visualization. It is positive when he sees himself in a new way.