Making a Makerspace: The Tools, The Spaces and the Theories

A Holistic Approach Design Project
Zoe Branigan-Pipe (2017)

- Constructivism, Constructionism, and Beyond
- Inspired by Reggio Emilia, Montessori, and Waldorf Schools
- Deep Learning Pedagogies
- Connections to Indigenous Worldviews
- Health and Well-Being

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You can visit Zoe’s blog at http://pipedreams-education.ca, and can follow her on Twitter at @zbjpipe.
Introduction

The purpose of this project is to build capacity in others who wish to create a Makerspace in their classroom or school, and to understand the traditional pedagogies and approaches that have directly impacted the Makerspace Movement. This movement continues to gain momentum, as evidenced by the not only the increase in Makerspaces being developed in schools, libraries, and communities across the globe, but also by the fact that the ideas inspired by Jean Piaget’s theories of constructivism are being discussed and implemented as part of new pedagogies in the 21st century.

This resource is intended to:

(1) Inspire and support educators who wish to better understand, articulate, and reflect on the pedagogies and teaching approaches that connect to the design and implementation of Makerspaces in the classroom or school environment. While there are many methods and approaches identified in this resource, I hope that educators can take what they need – for instance, a lesson, a classroom design idea, or even a better understanding of the theories that are related to constructivism.

(2) Showcase The Makerspace Design Project (the creation of a Reggio-inspired Makerspace) through pictures and design examples to help educators collect ideas and connect practice with pedagogy.

(3) Bring transformative and progressive approaches to teaching in a mainstream education program by demonstrating how past practices are being embraced through the Makerspace Movement.

(4) Provide a conceptual framework that links to the development of a holistic Makerspace.

(5) Provide a template and lesson examples that connect Makerspaces to deep thinking pedagogies.

(6) Assist teachers in articulating and reflecting on their practices.

(7) Offer insight into how and why teachers are central to teaching and learning in the 21st century and what a holistic and constructivist inspired approach looks like in practice, specifically as it relates to a Makerspace learning environment.

This project was designed, researched and written as part of a Major Research Paper (MRP) for the Graduate Program at Brock University and was part of a qualitative conceptual study.
Can you imagine a learning space where nature, music, art, and literature are infused in the design of the STE-A-M (Science, Technology, Engineering, Art, and Math) focused room? A space that celebrates community through nutritious food prepared each day by students who gather at a cafe bar or surround a kitchen table, and are prompted by in-depth discussions of innovation and creativity? A space for people of all ages? A place where tea is served at the start and end of each day in beautiful porcelain cups – where there are no bells or distinct transitions and subjects are infused with big ideas or themes?

Image 1: Picture from a Blog Post: “The Third Teacher: From Classroom to Cafe - A Learning Space for All.”

After 15 years as a teacher-leader in education innovation and 21st century practices, in September 2014, I began the task of co-creating a Makerspace classroom for students participating in a Gifted Program who range in their abilities, interests, and ages. But what separates this Makerspace from others is its holistic approach to mind, spirit and body.

As a team, we implemented conditions to facilitate the characteristics of deep learning Pedagogies (Fullan & Langworthy, 2013). We drew from the research and philosophies of the Reggio approach (founded by Loris Malaguzzi, 1920-1994), The Waldorf School (founded by Rudolf Steiner, 1861-1925) and the Montessori approach (founded by Maria Montessori, 1870-1952). These philosophies are growing in influence in North America and have many points in common (Edwards, 2002). They all share in the idea that learning is constructed through (1) inquiry-based learning experiences which are authentic and connected to real world problems; (2) learning environments that facilitate deep thinking and are rich with resources, nature, and beauty; (3) hands-on, personalized, and varied learning opportunities; (4) a secure connection
to the outside world and social justice; and (5) a strong focus toward the social and emotional well-being of each individual.

Background Context
The Enrichment and Innovation Centre Makerspace was awarded the first place Canadian Education Association (CEA) Ken Spencer Award in June 2016 after being recognized as a top innovative classroom environment including the flexible, human-centric nature of the learning program.

The video submission showcasing this classroom is found here. https://www.youtube.com/watch?v=p7xVW7ojtbs.

After receiving additional funding, along with the success of this program, the school district opened a second Makerspace classroom. A team of educators, students, and parents worked in creating a unique learning space that is considered a Reggio-inspired Makerspace environment – because it used established theories and frameworks from Jean Piaget’s constructivism and with a strong focus on Indigenous principles and worldviews. This process took about six months from conception to completion with many meetings, discussions, and revisions; in January 2017, the new space was officially opened for students and teachers. With this initiative, there was also time to be given for research, ensuring that the project would align with current 21st century teaching methods, district initiatives, and teaching strategies that are universally designed and innovative and enriching for students and teachers.

The Makerspace classroom design project demonstrates examples of how some of the characteristics of constructionism, constructivism and learner centric teaching approaches based on the theories of Emilia Reggio, Montessori and Waldorf schools can be incorporated into a classroom Makerspace while also incorporating Aboriginal worldviews and perspectives, mindfulness and life skills that might translate into teaching and learning at the classroom level.

The Makerspace Design Project: Description and Goals
Makerspaces are very popular in the 21st century learning context because such approaches are so closely linked to constructivist theorists whose research – for many decades – has pointed to the fact that when students are active participants in their learning through play and making, they are engaged in their own learning process. This, then, enables deep and meaningful learning to take place. As this resource aims to demonstrate, and as pointed out by Resnick (2015), Professor of Learning Research at the MIT Media Lab, “just making things is not enough” (p. 164).
Lee Martin, of the University of California (2015), also points out in his detailed research on the Maker Movement in Education, that,

the history of the adoption of computers in schools suggests a lurking danger: The Maker Movement that assumes its power lies primarily in its revolutionary tool set, and that these tools hold the power to catalyze transformations in education. Given the growing enthusiasm for making, there is a distinct danger that its incorporation into school settings will be tool centric and thus incomplete. (p. 37)

There are many different approaches to making things, and some lead to richer learning experiences than others. Moreover, most involve the integration a variety of curriculum with many layers, real-world learning, and the use of a cross-curricular approaches using real-world problems and critical thinking.

Therefore, the following goals and ideas describe the foundation for this project:

1. **Draw on the following questions:**
   - Can a Makerspace classroom go beyond STEM (Science, Technology, Engineering and Math) and to have a more holistic perspective of the student, including the Humanities, Visual Arts and Music?
   - How does the physical environment in a Makerspace impact the role of the teacher or student and does the classroom environment impact our teaching methods? How are Teachers connecting the use of Makerspaces at the school level to past and present pedagogy?

2. **Create a Makerspace classroom that is holistic in nature:**
   - Use theoretical frameworks specifically which focus on the pedagogies and approaches that connect directly to the Makerspace culture including (but not limited to) theoretical conceptions from Dewey, Piaget, Montessori, Papert, and Malaguzzi, and inspired by Emilia Reggio methods, and Montessori and Waldorf schools

3. **Develop a series of inquiry-focused lessons and resources:**
   - Maker lessons encompass a wide variety of teaching methods and philosophies that are connected to design thinking, wicked problems, and critical literacy
   - Lessons allow room for flexibility, collaboration, and cross-curricular integration, including the Arts
Makerspace Classroom Design: Project Outcomes

Throughout the process of creating this learner-centered and multifaceted Makerspace, the teachers involved gained:

- Stronger understanding of the complexity in creating a learning environment that incorporates the Reggio Emilia and Montessori and Waldorf Methods in a public-school setting and how this connects to the student-centred approach and current pedagogies.

- Valuable collaboration and team building skills associated with design thinking, action research, teacher inquiry, problem solving and the creation of lessons that were cross-curricular and used a constructionist approach.

- A greater understanding of networking and professional development through social networking tools like Twitter, Blogging and Instagram as well as presentation skills at conferences and showcase events.

- A stronger understanding of Makerspace tools and projects and implementation in a meaningful way.

- A meaningful way to connect practice to pedagogy.

- Opportunity to practice creating classroom lessons that focused on a variety of conceptual frameworks and being able to articulate each framework depending on the context, the environment, the teacher and the learner.

- The opportunity to create teacher through the implementation of lessons and experimentation with the tools themselves.

- A developed (ongoing) framework to create a human centric makerspace.
Chapter One: Makerspaces in Education

If there is one thing alone to take from the research, it is that a Makerspace environment is collaborative in nature, and can occur at a school, a library, a classroom, a shared workspace, a community church, a garage, or a backyard – it is a space where individuals (who are interested in creating, making, fixing, talking, exploring, inventing, and discovering) get together, and it is usually done through self-motivation and direction, personal interest, and with a willingness to share, learn, and work with others regardless of age, gender, or ability.

“Learners make intentional use social interactions where they use one another as experts and mentors and that they make considered and deliberate choices throughout the ‘making’ of their final artifact or project.” (Robbins and Smith, 2016)

Historical Pedagogical Connections in Schools

It is hard to talk about pedagogy, the shift in teaching and what has prompted this project about Makerspaces and the Maker culture without briefly mentioning the significant changes that the school systems underwent at the end of the 20th century and into the 21st century. Here, it is perhaps important to make concrete connections back to how and why the Maker culture is an essential aspect to student learning today.

Education has shifted in and out of the constructivist learning approach and while the philosophies that inspire the Makerspace culture are not new, the term itself is new in education; it has roots in methods that span across many decades and have influence from Europe, the United States, and Europe, as well as from Indigenous Cultures.

People might remember attending elementary school when “Making and Tech” courses such as Home Economics, Cooking, Woodworking, Art, and Instrumental Music were a regulated part of the school day, and were included as part of the report card, thus giving these skills-based, trade-focused subjects a strong sense of purpose and meaning.

Is the curriculum and pedagogy heading back to a time in which hands-on learning approaches and the Arts were strong drivers to teaching and learning?
Ontario Education Trends

“This approach is somewhat out of favor in many of today’s education systems, with their strong emphasis on content delivery and quantitative assessment. But the enthusiasm surrounding the Maker Movement provides a new opportunity for reinvigorating and revalidating the progressive-constructionist tradition in education.”

(Resnick & Rosebaum, 2013, p. 163)

Stephen Anderson and Sonia Jaafar (2003) give a detailed overview of Ontario’s education trends in Policy Trends in Ontario Education and explain that during the time of these Maker classrooms, the curriculum was guided by what is called The Formative Years (1975) in which many of the philosophies were steeped in recommendations made by the Hall-Dennis Report in Living and Learning (1968), including adding to the curriculum areas such as, “the individual and society, decision-making, values, perception and expression, and Canadian Studies” (Ontario Ministry of Education, 1994).

The Formative Years curriculum was eventually replaced by the Common Curriculum in 1993, and then again replaced what by curriculum introduced in 1995 during what was referred to as The Common-Sense Revolution. As these education philosophies and requirements were changing and many task forces and committees were being deployed, the Ontario noted in the For the Love of Learning that,

there have been changing notions about child development, the nature of teaching and learning, as well as changes in political trends, fiscal priorities, student enrolments, teacher supply, and other issues. Thus, a core curriculum shifts to a system of streaming, with many options and, in time, goes back to de-streaming and what is now called a common curriculum. Over time, teaching strategies also change: as the benefits of individualized attention are better understood, the emphasis shifts from rigid lesson plans to co-operative, small-group learning and other flexible concepts. (Ontario Ministry of Education, 1994)

Individualized learning, small groups, and flexible concepts are rooted in the very nature of the Maker culture and Makerspaces in classrooms today.
A major shift how Ontario would approach teaching and learning happened in June 1995, when the Conservative government in Ontario replaced the New Democratic Party (NDP) as the elected government and made changes to the education system in *The Common Sense Revolution*, and recognized that these changes impacted how teachers would teach, how schools and classrooms would be organized, and even how educators would be trained and evaluated.

Educators were given a direction, and were even given more time to learn and map the curriculum, and photocopy, enlarge, and laminate the language and math curriculum documents; many would be expected to post lists of expectations, curriculum goals, and learning criteria each day. Oftentimes, teachers would cross expectations off the list as they covered expectation after expectation, for each strand in every subject of their grade.

This curriculum was more specific than the *Common Curriculum* and had more expectations per grade to cover. At the time, it seemed like everything was assessed and that everything had a rubric or checklist attached. Teachers were focused with teaching and grading every expectation including homework workbooks, worksheets, group work, quizzes, home reading log books, and journals – you name it, and we put a grade on it.

The “new” Ontario Curriculum documents; the new report cards; the constant discussion and planning for the standardized tests; the new leadership model – in which Bill 160 removed principals from the Ontario Teacher’s Union; new staff professional development mandates; new school districts – as many school districts were amalgamated; and new home and school interactions mandated by new rules regarding how parent councils would be regulated: these were all major drivers for how teachers would teach, what pedagogy would guide programming, and how classrooms were organized. These formed the very scripted, organized, scheduled, and planned methods teachers used in their practice. Worksheets, workbooks, and agendas were the norm; in fact, they were not only accepted, but encouraged.

It is ironic, however, that this was how Ontario education was changing at the start of the 21st century and, with all these changes, there was very little mention of how technology would impact teachers or learners.

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*Did anyone know that our pedagogies today would become similar to those that were implemented in The Formative Years or those recommendations inspired by the Hall-Dennis Report back in 1968?*
Interestingly, as noted by Anderson & Jaafar (2003), that prior to – and even during – the *Common Curriculum*, there were many examples in the elementary school curriculum that were steeped in philosophies of student-centred learning, active learning, and individualization according to student learning styles, developmental and academic progress, and interests (*The Formative Years*, 1975; *Education in the Primary and Junior Divisions*, 1975).

And now, 40 years later in 2017, in Ontario, these very approaches have been increased to now include Full-Day Senior and Junior Kindergarten and *play-based learning*, a substantial part of the Kindergarten and pre-school classroom pedagogies that connects strongly to the Reggio Emilia approach, Montessori education, and the Maker Movement. These concepts, in many ways, can closely be linked to what we considered the fundamental principles of Makerspaces today – those that encourage interested amateurs and creators to share their ideas with experienced experts and mentors who could help them to design, prototype, and iterate novel solutions to their real-world problems (Dougherty, 2013; Hatch, 2014).

While many examples of student centered philosophies can be cited in our past policy trends, evidently, our schooling systems were not yet ready to fully accept and implement these very teaching strategies that have been advocated for at least a century by Dewey, Piaget, Montessori, Vygotsky, and Papert (Fullan & Langworthy, 2014). As noted by Fullan & Langworthy (2014), perhaps at this time, the conditions for these ideas to take hold and flourish did not exist. Only now has new technology provided the stage for educators and leaders to embrace these very philosophies more meaningfully – which will be unpacked in the following pages.
“Being creative, the act of creating and making, is actually fundamental to what it means to be human.” (Hatch, 2014)

Emel Ultanir (2012) researched and wrote a detailed description of the constructivist learning theories entitled, “Constructivist Learning in Dewey, Piaget, And Montessori.” Ultanir (2012) emphasizes that there are many connections to John Dewey’s assertions that our experiences are vital to authentic learning; firstly, Jean Piaget asserted that the basis of learning is discovery, and secondly, Papert’s research recognized and declared that that knowledge is not transmitted, but constructed – literally, through the process of making. Papert referred to this as constructionism.

“Building and playing with castles of sand, families of dolls, houses of Lego, and collections of cards provide images of activities which are well rooted in contemporary cultures and which plausibly enter into learning processes that go beyond specific narrow skills. I do not believe that anyone fully understands what gives these activities their quality of ‘learning-richness.’ But this does not prevent one from taking them as models in benefiting from the presence of new technologies to expand the scope of activities with that quality.” (Papert, 1991)

Piaget’s theories of constructivism were inspired by the belief that children are not empty vessels to be filled with knowledge, but instead are active builders of knowledge (Igafo-Te’o, 2002). In Piaget’s theory of constructivism, knowledge is not about information to be delivered, memorized, retrieved; it is an experience that is acquired through interaction with the world, people and things (Ackermann, 2001).
One of the common threads of constructivism that runs across all these definitions is the idea that development of understanding requires the learner to actively engage in meaning-making. The real understanding is only constructed based on learners’ previous experience and background knowledge. It maintains that individuals create or construct their own new understandings or knowledge through the interaction of what they already believe and the ideas, events, and activities with which they come into contact. (Ultanir, 2012, p. 195)

**Constructionism**

Constructionism, Makerspaces and deep learning go hand-in-hand, as recognized by Papert (1980) of Massachusetts Institute of Technologies (MIT), who developed a theory of learning based upon Piaget’s constructivism. Papert (1980) asserts that, “children build their own intellectual structures with materials drawn from the world around them”.

What is different from Piaget’s theories, however, is that Papert (1980) maintains that learning occurs through making rather than overall cognitive potentials and thus, his approach – *constructionism* – helps to understand how ideas get formed (Ackermann, 2001).

Noss and Clayson (2015) describe the concepts behind constructionism beautifully in their article *Reconstructing Constructionism* in saying, “when we build, we build with things – not just ideas … if we design properly, the things we build with have an epistemic foundation – of ‘powerful ideas’” (p. 285). Papert (1980) also asserts that, “children build their own intellectual structures with materials drawn from the world around them”.

**Key Influencers of Makerspaces**

The ideas and practices of the Maker Movement resonate with a long tradition in the field of education as emphasized by Resnick and Rosenbaum (2013) in their article, *Designing for Tinkerability* when they state:

> This approach is somewhat out of favor in many of today’s education systems, with their strong emphasis on content delivery and quantitative assessment. But the enthusiasm surrounding the Maker Movement provides a new opportunity for reinvigorating and revalidating the progressive-constructionist tradition in education. (p. 163)

Mark Hatch, author of *Maker Movement Manifesto* (2014), notes that creativity is fundamental to what it means to be human and describes secular philosophers like Georg Wilhelm Friedrich Hegel, Carl Jung, and Abraham Maslow, who all concluded that creative acts are, “fundamental to being human”.

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In their article, *The Maker Movement: Implications of New Digital Gadgets, Fabrication Tools, And Spaces For Creative Learning And Teaching*, Schön, Kumar, & Ebner (2014) also recognize that reformist and progressive educators from the first half of the 20th century like Montessori and Dewey promoted the usage of physical artefacts and tools in education to promote the creative process and hands-on learning.

These approaches are supported by research from psychologists such as John Dewey (1859-1952), an academic, philosopher, and educator; Jean Piaget (1896-1980), a psychologist and pioneer of child development; Lev Vygotsky (1896-1934), a social development theorist recognized for supporting research of benefits of play in learning; and Seymour Papert (1928-2016), a mathematician, computer scientist, and educator whose pioneered a constructionist – learning through making – approach to teaching children (Gandini, 1998, 2003).

*Each of these pioneers in constructivism encourages an inquiry-focused, student-driven, project-based, experiential approach to learning.*

In her detailed paper, *Three Approaches from Europe: Waldorf, Montessori, and Reggio Emilia* (2002), Carolyn Pope Edwards recognizes a commonalities of progressive education frameworks from three different approaches: Reggio Emilia, Montessori, and Waldorf. She writes,

> All three approaches represent an explicit idealism and turn away from violence toward peace and reconstruction. They are built on coherent visions of how to improve human society by helping children realize their full potential as intelligent, creative, whole persons. School communities struggle continually to keep their guiding principles alive in current, meaningful ways and not to let them degrade into slogans.

- Carolyn Pope Edwards, 2002
Emilia Reggio Approach to Makerspaces

“What children learn does not follow as an automatic result from what is taught, rather, it is in large part due to the children’s own doing, as a consequence of their activities and resources.

– Loris Malaguzzi, *The Hundred Languages of Children*

Initial questions that guided in this resource project focused on how the Reggio Emilia methods might resonate within the Maker culture. Is it because of its strong emphasis on exploration, self-direction, problem-solving and deep thinking? This is an approach to teaching that was developed by Loris Malaguzzi between 1920 and 1994, and reflects Piaget’s theories of constructivism.

Reggio Emilia is a city in northern Italy where educators, parents, and children began working together after World War II to reconstruct society and build an exemplary system of municipal preschools and infant-toddler centers (Edwards, 2002).

“Reggio Classrooms focus on listening and respecting children and their potential by witnessing their actions towards reformulating everyday practices, ideas and projects. The approach proposes a participatory and democratic educational system, that emphasizes research and experimentation and which is one of the many educational approaches to arts education in childhood.” (Santín & Torruella, 2017, p. 51)

The Reggio Emilia approach is not a formal teaching method, but more of a philosophy of instruction. As per Kate Cribble (2016), in her extensive blog notes, there are no international training colleges to train to be a Reggio Emilia teacher. In fact, according to Gandini (2003), Reggio educators, “formulate new interpretations and new hypothesis about learning and teaching along the side of their students”. Schools and preschools (and home schools, as well) which are Reggio-inspired use an adaptation of the approach specific to the needs of their community (Cribble, 2016). This can be also connected to further understanding a Makerspace environment, since there might be so much variance in the tools and artifacts available.

**Inspired by Emilia Reggio approach, the Makerspaces can all look, feel, and run differently.**
Lella Gandini (1993), author and educator, is recognized as a world leader and advocate on the Reggio Emilia method. In an interview entitled, *Play and the Hundred Languages of Children*, Gandini describes the key influences of the Reggio Methods:

In Europe after the Second World War, there were many innovative ideas being floated and experiments going on. In France, for example, there was the work of Celestin Freinet; in Switzerland, there was Jean Piaget; and in Russia, the influence of Lev Vygotsky, who had been interested also in the psychology of play. Malaguzzi was an avid reader of all these thinkers, but the one who probably influenced him most was the American John Dewey, whose work dated from much earlier but was translated for the first time in the 1950s. A decade later, Malaguzzi was very attentive to the work of two other influential Americans, David Hawkins and his wife Frances Hawkins, who were active in developing experiences and reflecting on them in line with progressive education” (Gandini, 1993)

In their article, “*Reggio Emilia: An Essential Tool to Develop Critical Thinking in Early Childhood,*” Mercè Fernández Santín and Maria Feliu Torruella (2017) emphasize that Reggio Emilia is a philosophical approach to be considered in the arts program, referred to as the *many languages of children* (Gandin, 2003). Their study points out that sometimes, there is a lack of innovation in Arts programming because teachers are missing key theoretical and philosophical elements; they also assert that the Reggio Emilia method can inspire creativity and imagination. In this approach, the teacher, who works in a special workshop or studio known as an atelier, is called *Atelierista.* The Atelier contains many resources, books, kits, examples, and tools. Through time, and ongoing learning with specialized Art teachers, the Reggio room is eventually set up with mini Ateliers, and teachers learn to address Art in a more connected and thoughtful way (Gandini, 2003).

“We understand arts education as the one of the types of educational models that allows the awakening of critical thinking from artistic works as critical thinking is achieved when attitudes, emotion and expression of feelings are developed and when reflection and interpretation are stimulated. Thus, arts education contributes to the children’s critical thinking.” (Santín & Torruella, 2017, p. 51)
The Montessori Approach and Constructivism

In his article, *The Promise of the Maker Movement for Education*, Lee Martin (2015) recognizes that it has long been argued that children and youth can learn by playing and building with interesting tools, materials and attributes; this links to the work and research of Montessori and further emphasizes Piaget’s ideas that, “testing ideas out in the world allows one to check expectations against reality, a process that can create conceptual disequilibrium, and can in turn lead to conceptual adaptation” (Piaget, 1950).

“The Maker Movement is a new phenomenon, but it is built from familiar pieces, and its relevance to education has deep roots. It has long been argued that children and youth can learn by playing and building with interesting tools and materials (Montessori, 1912). Making and building can foster learning in a variety of ways that mesh with long-established theories of how learning unfolds.” (Lee Martin, 2015)

Maria Montessori was the first woman admitted to practice medicine in Italy and today, she is most known more for her approach to learning and the many Montessori schools that span across the North America and Europe. The Montessori approach has been extremely successful in the implementation of Makerspaces. As a constructivist who was influenced by Jean Piaget and John Dewey, Montessori’s approach recognizes that children best learn through a strong facilitation of self-direction, and through play, experiential learning, problem-solving, and by having a strong understanding of the world around them.

Gerard Leonard, a Montessori educator and explorer wrote an excellent article and delivered a presentation called, *The Montessori Classroom: A Foundation for Global Citizenship* shared his own experiences about teaching and learning through global citizenship and connections to social justice. He recognized that the Montessori classroom helped pioneer the idea that children need strong and meaningful experiences to learn.
“Maria Montessori understood this, well over a half century ago. Having traveled widely and developed a global perspective, she believed that the essential quality needed in the emerging world was adaptability. Being adaptable to one’s own society was in fact no longer enough; one had to be prepared through education to adapt to the whole world. Young people would find a world of rapid change. How correct and prescient she was.”

-Leonard, 2015

Jennifer Turliuk, the Co-Executive Director of MakerKids indicates that highly successful and creative innovators, makers, and entrepreneurs such as Edison, Wozniak, Ericsson, and Alexander Graham Bell are all supporters of the Montessori style of learning, and she recognizes the "Montessori" approaches are linked closely to how we are implementing Makerspaces for children. In a blog post that describes the success of the Montessori approach, she shares, “when the founders of Google were asked if having parents who are college professors influenced their success, they instead credited Montessori. Larry Page said it was part of the training of not following rules and orders, being self-motivated, questioning what’s going on in the world, and doing things differently. And Sergey Brin credited his willingness to go out on his own to Montessori. Will Wright, the inventor of The Sims, said it taught him the joy of discovery and that it’s all about learning on your own terms rather than the teacher explaining stuff to you. And Jeff Bezos, the CEO at Amazon, used to get so engrossed in his activities at Montessori that the teachers would literally have to pick him up and move him on to the next activity. So it’s no wonder that by age 5, Montessori students test better in areas such as reading, math, and executive function (the ability to solve problems in a constantly changing world like the one we live in today).

- Turlik, 2014
In her article, *Montessori and Nature Study* (2013), Kelly Johnson, a Montessori teacher and consultant, emphasizes the strong need for students to be immersed in an abundance of nature and garden experiences. As a teacher, she scheduled a great deal of outdoors time with her students where they would observe, journal, and explore. Johnson (2013) recognizes Montessori for her philosophy and method, as she advocates that, “establishing lasting peace is the work of education” (Montessori, 1972, p. viii) and emphasizes the importance of the child’s evolving connections to the physical and social worlds to achieve this. Johnson (2013) notes that, “I was thankful for the Montessori curriculum’s emphasis on discovery and research in the areas of natural history, economic geography, botany and zoology for connecting the outdoor environment with the indoor.”

### The Waldorf Approach and Constructivism

Waldorf education is also called *Steiner Schools*, which are based upon the educational philosophy of Rudolf Steiner. This is another approach and framework to be linked with the Makerspace model because it emphasizes creativity, problem-solving, and has a strong tendency toward student-centered learning, creativity, and imagination above all.

Linked to the Makerspace environment that is inspired by Reggio Emilia or the Montessori approach – again, a hands-on approach to learning – and Papert’s theories of constructionism, Waldorf classrooms are very active and strongly based on experiential learning and creativity. Waldorf education values and promotes personal achievement, while at the same time espousing a non-competitive approach to learning and individual effort regardless of the actual outcome (Rawson, 2015).

> “Learning involves respectful and careful watching (in Waldorf we would say, “with wonder”) in a mood of gratitude for being able to share this experience, combined with the assumption that there is always more than we can perceive or understand at any one moment. It is a descriptive process and its purpose is to enable us to become more richly experienced and thus to transform ourselves.”
> - Rawson, 2015

“Many Maker environments have drawn Waldorf-inspired pedagogies have shifted teacher-pupil relationships by offering greater freedom and by being less prescriptive.”

-Shank, 2016

In her research on Waldorf education, Carrie Norland (2015) notes that Waldorf schools and educators often devote more time in the curriculum for students to wonder and then discover, which is paramount to inquiry-based learning. Norland (2015) inquires,

“I wondered if Waldorf especially with its seamlessly arts-infused curriculum and focus on children’s imagination, could provide public school educators alternate ideas and structures for supporting thinking in and through the arts”.

Our Words, Our Ways: Teaching First Nations, Metis and Inuit, a publication from the Alberta Ministry of Education (2017) recognizes five strong threads common to Aboriginal worldviews that can be brought to life in the classroom and share many common threads asserted by Dewey, Piaget, and Papert. These principles have been widely accepted in Montessori education and the Reggio Emilia and Waldorf approaches; it recognizes that learning is achieved through self-direction and that the teacher’s task is to facilitate the child’s learning and act as a guide or mentor (Gandini, 1998; Oberman, 2007).

“Traditional education allowed children to begin the process of observing from the time they are in their takinaakan and learn by participating as soon as they are able; traditional life was ruled by the principle of production from each according to his ability and distribution to each according to his need.” (Red Lake Heritage Centre)

Aboriginal education is based upon these worldviews:
It is a holistic process where learning takes place across different spheres of human experience including spiritual, physical, emotional and mental dimensions and may also consider relationships and experiences of the past, present and future as interconnected. (Alberta Ministry of Education, 2005, p. 14)

These worldviews are closely connected to the constructivist approach because they emphasize:

(1) A holistic perspective to learning;
(2) The interconnectedness of all living things;
(3) Connection to the land and community;
(4) Mentorship and collaboration;
(5) The dynamic nature of the world’s strength in “power with”

The following excerpt of a blog post by Branigan-Pipe (2016) entitled, “How Indigenous Worldviews Inspired a Makerspace Classroom” describes how theses Indigenous practices relate to the Makerspace classroom:

* Inquiry approaches (and Makerspaces) are about wondering, discovering and experiencing the world. This approach is being adapted instead of what is ‘traditional’ teaching.

* Learning can happen at HOME with the family (Blended learning, online learning, Family Involvement, Travel, Discovery, Experiential). This isn’t about homework, but instead about learning through mentorship and self-direction.

* Education programs include explicit teaching of environmental education and we emphasize human impact on the earth. Schools are connecting learning to outside environments using natural playgrounds, green walls/roofs and gardens, celebration of the earth. There is more emphasis on primary sources and storytelling (using digital media and internet for worldwide connections, learning from elders, learning from each other, accessing networks to connect to remote areas)

* Mindfulness is a practice seen as good for students’ mental health and overall well-being and is being adopted as part of the school program. According to Tobin Hart (2014), in an articled called, Opening the Contemplative Mind in the Classroom, “Long dormant in education, the natural capacity for contemplation balances and enriches the analytic. It has the potential to enhance performance, character, and depth of the student’s experience. Perhaps most important, the contemplative helps to return the transformative power of wonder, intimacy, and presence in daily learning and daily living”.

* More and more, Teachers are incorporating lessons about life balance and mental health, nutrition and physical health as part of our daily curriculum which includes looking at non-traditional ways of healing and medicine. Here is one example of how we are incorporating Food and Nutrition into the classroom, not as a separate curriculum topic, but in a holistic way, as part of the learning process.

* The term “Maker” is being expanded to include approaches to learning that enhance and develop hands-on skills, inquiry and learning through play or through doing, problem solving and creating

Like the Reggio approach, for example, Indigenous principles also recognize that welcoming and caring learning environment that give, “Aboriginal students the sense that they belong can make an important contribution to student engagement and participation” (British Columbia Ministry of Education, 2016, p. 66).

The depth of Indigenous knowledge rooted in the long inhabitation of a place offers lessons that can benefit everyone, from educator to scientist, as we search for a more satisfying and sustainable way to live on this planet (Kawagley & Barnhardt, 2007); this connects these foundational principles to design thinking because there is not always a specific solution and this approach requires a great deal of critical thinking, contemplation, and reflection.
Design thinking is a way of problem solving (Craig, 2017) that has evolved to be considered a purposeful, human-centred approach to innovation and change-making for individual, community, and societal benefit, which can be applied to any number of contexts (Howard & Davis, 2011) including those lessons of interconnectedness, experiential learning, inquiry, the power of storytelling, and experience from Elders – all universal principles of the Indigenous cultures.

“Kitchen Philosophy” and Indigenous Principles

“Each day, prior to the start of the lesson, students gather for a “meeting” to talk about the Indigenous principles and reflect on which would guide them on any given day or project. Some lessons inquiries and projects require a strong focus toward mentorship, while others require a need for silence and listening and others, a need for collaboration” – Zoe Branigan-Pipe, Gifted Program, HWDSB.

This allows students to recognize that each person in the room has differing needs depending on any given task. Aboriginal education is based upon these worldviews, which, as emphasized in a constructivist learning approach, is a holistic process where learning takes place across different spheres of human experience including spiritual, physical, emotional and mental dimensions and may also consider relationships and experiences of the past, present and future as interconnected. (British Columbia Ministry of Education, 2005, p. 14)
Principles of First Nations, Metis and Indigenous in the Classroom

This classroom would like to recognize the enduring presence of Aboriginal Peoples on this land. The City of Hamilton is located on traditional Haudenosaunee (Iroquois) Territory. Our city is also just 10 km from Six Nations of the Grand River which is Canada’s largest Reserve.

**Oral Traditions**
- Significance of Balance
- Interaction with Community
  - Significance of Elders
  - Importance of Silence & Listening
  - Respect for the Group Process
  - Role of Family & Community
- Experiential Learning
- Respect for Traditional Knowledge

**Importance of Values**
- Connection to the Land

**Mentorship**

This classroom will endeavour to incorporate Indigenous Worldviews & Principles into our lessons & practices. This classroom will aim to highlight Aboriginal contributions to our way of living, learning and being. *We will never forget those that suffered at Residential Schools & those that continue to suffer because of past practices.*

*Image 4: Indigenous artifacts posted in room.*
How Indigenous Worldviews can Inspire a Makerspace classroom

The following blog post by Branigan-Pipe (2016) reflects how and why a Makerspace classroom uses the Indigenous worldviews as a foundation. This exercise created an opportunity to recognize how these principles connected to the philosophies and methods of a Makerspace.

<table>
<thead>
<tr>
<th>What Do You See?</th>
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<tbody>
<tr>
<td><strong>Espousing a holistic perspective and that knowledge is comprehensive</strong></td>
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<tr>
<td>Cross-Curricular and integrated disciplines are more prevalent, as demonstrated by the structures of classroom schedules (less rotary, more time spent in one classroom with one teacher, combining topics into projects). Further, an inquiry approach to teaching is the best way to engage students in real world issues, social justice, and global issues. Most recently, classrooms are adopting “Mindful” practices and are emphasizing that when knowledge and learning are approached holistically, students gain a better sense of self and a stronger self-esteem.</td>
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| **Recognizing the interconnectedness of all living things** |
| There is a strong emphasis on critical literacy, inquiry (Branigan-Pipe, 2016) and using the world (local and global) issues and big ideas in the classroom. In fact, the new Ontario Social Studies/Geography and History documents emphasize a connection to real world matters that leads to studies about how land, animals, and food are interconnected, the impact of global warming on our health, how oil extraction is impacting the earth, how the use of pesticides are impacting Bee populations. There is an emphasis on teaching students to relate curriculum topics and subject matter associated with History, Geography, Social Studies, Sciences and the ARTS to present day issues. |

| **Having a strong connection to the land and community** |
| We are interconnected more than ever before not just due to the internet, but because collaboration and communication are vital components of learning and living in the 21st Century. This allows us to communicate and share with our communities whether urban or rural. There is more emphasis on eating throughout the school day, on health, and on making different food choices. Schools are using the United Nations Goals to guide teaching and learning. |

| **Inclusion of Environment and dynamic nature of the world in lessons and learning** |
| Environmental Education is now weaved through all areas of the curriculum. Some schools are participating in community gardening initiatives; community food organizations and local markets are partnering with classrooms to help students to see their connection to the land. |

| **Strength in “power with.”** |
| As noted in the Our Words, Our Ways Document, In Aboriginal cultures, worldviews reflect “power with,” rather than “power over.” The image for this concept is a circle, and all living things are viewed as equal within the circle. “Power with” is a dialogue, where everyone stands on the ground, face to face – leadership and learning are “distributed.” |
Chapter Two: Classroom Design and Learning Spaces

Image 5: Makerspace vision statement.
The concept of environment as the *third teacher* is built upon several theories (Danko-McGhee, 2009). The Ontario Literacy Secretariat suggests that it is the *third teacher* that can enhance the kind of learning that optimizes our students’ potential to respond creatively and meaningfully to future challenges.

Gandini (1998) recognizes that the environment acts as a *third teacher*. The learning space is where the children are interacting, growing, developing, exploring – it is essential to the learning process as the teacher and curriculum.

Through the classroom environment, the teacher can carefully facilitate the learning process and allow the space to be cared for by both the children and the adults (Cribble, 2017). In this type of classroom, learning environments are led by teachers who listen to children’s ideas, who provide them with choices in the classroom and access to materials daily that give them a level of autonomy, and the opportunity to explore independently (Gardner & Jones, 2016).

The school is considered a *unitary living organism*, a place of coexistence to exchange relationships between adults and children (Santín & Torruella, 2017, p. 53) and there is a strong emphasis on the aesthetic and the beauty of the classroom atmosphere which are pampered and cared for in detail.

“This is a place where adults have thought about the quality and the instructive power of space. The layout of physical space fosters encounters, communication and relationships.” (Gandini, 2003)

*Like the Reggio classroom, Makerspace is more than a workbench and the tool, but about how educators put specific value on the physical space.*

A learning space and arrangement of the Reggio-inspired classroom focuses on the principles of relationships, manipulation of light and exploration of materials, and seek to bring the natural world into the classroom (Smith-Gilman, 2016); these are strongly linked to the to the tenets of the constructivist philosophy of learning and environment because of the hands-on nature, the opportunity for collaboration, and the availability of a variety of real-world materials and opportunity to use them.
Makerspaces are rarely, if ever, defined by having one single teacher teaching a large group of students as in a traditional setting. Instead, as inspired by the Reggio Emilia approach, a Makerspace can use the Environment as a teacher allowing for multiple entry points, small group interaction, multiple learning areas, more individualized instruction, purpose and interest based learning as well as a focus on life problems or artifacts and of course, a variety of assessment methods.

Essential to a Makerspace classroom is the organization of the space because it allows students to explore, to investigate, and to direct their learning by feeling safe and by knowing that their needs and learning styles are being addressed. Another interesting and explicit strategy used in the Reggio classroom is the idea that nature can be used as a teacher and the use of natural objects and artifacts can inspire student learning through natural investigation and making.

Fostering appreciation of the beauty of nature is consistent with the attention to beauty and design of environments evident in Reggio schools (Gandini, 1998). Examples could be growing or having students bring plants or other living organisms into the classroom, using plants and vegetables as part of the learning process. Listening to and learning from nature has been the purview of poets and philosophers throughout human history, and the Nature Study movement of the late 19th and early 20th century incorporated nature into formal schooling (Torquati & Ernst, 2013).

There are many ways to incorporate pieces of the Reggio method into the Maker classroom and research provides many practical ideas of how can schools and teachers use the ideas of the third teacher when creating Makerspace:

(1) Always have teacher, mentor or facilitator to listen, guide and explore with the students;
(2) Ensure there is a strong level of autonomy and independence;
(3) Place a strong emphasis on the aesthetic and the beauty of the classroom atmosphere;
(4) Organize the space in a variety of ways, allowing for flexible seating, and movement which gives students “permission” to explore and play;
(5) Use natural objects to provoke inquiries (sea shells, objects taken from nature);
(6) Inspire all the senses using food, or a variety smells and tastes.
This Makerspace classroom is separated into many spaces and at the time of the design, the space was inspired the Montessori approach of teaching that recognizes that space is an

Image 6: Enrichment Centre Makerspace.
important part of the learning process and that learners need the opportunity to explore, experiment and have access to a variety of tools and resources. The following describes the initial spaces that were implemented:

- **MakerSpace:** A large part of the room is dedicated to a MakerSpace where students can build, engineer robots, take apart machines and co-create their own computers or devices.
- **Laptops:** One side of the room is reserved for group laptops, iPads and an Apple TV for sharing.
- **Design and Engineering:** There is a 3D Makerbot printer along with tablets and computers allocated specifically for design and engineering.
- **Math and Science:** There are two hubs – one for Science and one for Math exploration – with a shared Interactive Smartboard for small group activities.
- **Health and Fitness:** Here you will find a small herb garden and literature dedicated to healthy living, as well as a worm composter.
- **Social Justice and Critical Literacy:** There is a strong emphasis on Critical Literacy. Inquiry questions and Big Ideas provide the focus for exploration of Millennium Goals/United Nations Sustainable Goals and for both guided and self-directed learning.
- **Literacy:** A writing centre provides resources such as Livescribe Pens, Journals (for co-written topics) and a variety of choices for students to write and share at their level and interest.
- **Arts:** There is a ceiling-to-floor Green Screen for filming, along with a puppet display for drama. The piano and guitar are rarely quiet. Even during group inquiry time, students use self-directed breaks to paint or draw or listen to music. *(Branigan-Pipe, 2016)*
Enter this room and be **absorbed** by a **Maker Culture** that encompasses a larger purpose than only for **constructing**, **programming**, building, and **making**. This **learning space** represents an opportunity to make a **social contribution** and solve complex problems. We are focused on **community and mentorship** with the purpose of **exploring**, tinkering, **building**, drafting, designing **and** playing and where we “makers” work independently or collaboratively to **construct** our learning in a multidisciplinary approach to learning that is **hands-on** and has deep connections to **Science**, **Technology**, **Engineering** and **Math** (STEM) as well as the **Arts**. We are **kitchen tinkerers**, household gardeners, **textile workers**, basement fixers, **thinkers of problems** and **problem solvers**, designers and budding **engineers**, inventors **AND** creators and best of all, **community members** that show **care** and **respect** for each individual above everything else. In this **Makerspace**, there are opportunities to look at problems facing the world and to challenge and support one another to produce **ideas**, products, services or activities which are valued by others and instill a sense of community, empathy **and civic engagement**, locally and globally.

**Image 7**: Inspiring message and vision posted at the entrance of Makerspace.

The spaces are designed to give the child the experience of being at home in the natural world, a sense of place appropriate to his developmental stage, and a sense of belonging to a community within the greater community of life (Leonard, 2015).
In the Reggio Emilia approach, learning environments are led by teachers who listen to children’s ideas, who provide them with choices in the classroom and access to materials daily that give them a level of autonomy and the opportunity to explore independently (Gardner & Jones, 2016). In this classroom, therefore, there is a mix of exploration, hands-on learning and inquiry, but with a ‘bistro’ or ‘coffee shop’ feeling. This is an older school and the windows are small, but still allows some space for many plants, natural materials and a herb garden in the room.
There are many stimulating materials that children can choose from, which connects strongly to the literature that the teachers are seen mainly as observers rather than what we would typically think of as a teacher (Gandini, 1998; Turliuk, 2014). Often, students who attend this classroom, for example, are grouped in multi-grade and age groups, as well as adult-student learning situations, which, as noted by Edwards, 2002, promotes adult-child continuity and close peer relationships.

Like the Montessori school environment, which is often arranged based on subject area such as cooking, cleaning, gardening, art, caring for animals, and library corner, this classroom is set up in spaces that encourage children to freely to move around the room instead of staying at desks. The entrance of the room, for instance, demonstrates that the arts define the space, not technology, even if the classroom is technological rich in resources.
Image 12: Art Centre.

Image 13: Art Centre.

Image 14: Whole-class learning; Skype with @Thecleversheep (podcasting lesson).

Image 15: Science learning space.
In this classroom, one side of the room is used for laptops, tablets, and a projector for sharing, videos, and ongoing interactions including connections to classrooms globally. We combined our Science and Math spaces which allowed for personalized exploration. Image 14 demonstrates an example of students learning to Podcast through an expert off-site. In this area, there is also a 3D Makerbot printer along with tablets and computers allocated specifically for writing, research, design and engineering and game-based learning. We use creative game-based programs like Minecraft, Tinkercad (and other 3D design software), Lego Mindstorms, Vex, and Portal2 – to name a few – to engage students in design concepts, as well as provide opportunity for them to co-create.

Our physical space is also blended with an online space. Students would have access to online learning (E-Learning) and blended learning (face-to-face combined with online) where we post information, offer feedback, and provide opportunity for rich discussions, even when students are not present. We use collaborative tools like Office 365, OneNote, Google Documents, Mindomo, and Voice-Thread – to name a few – to share work and allow for natural and engaging extensions. This use of social networking and the Web 2.0 also allows students and teachers to use connectivity to reach out to leaders, learners, and experts around the world to network, share and make connections.

As part of the universally designed classroom – the idea that all resources, tools, and methods are available for anyone who needs it – we also recognize the need for clarity in voice and listening and would use a classroom amplification system. Students and teachers use share, speak, and be heard effortlessly. Teachers do not raise their voice or use clapping or whistling – the environment stays calm and yet student voice is emphasized.
We created a space for our students to tinker, take things apart, and build. If space allowed, we would dedicate an area for Lego and whatever building materials we could get our hands on. Maria Montessori called the type of education we offer an *education for vastness*. She also called it an *expansive education*. Such a formation does not limit the child; rather, it opens broad vistas for exploration and contemplation. It expands the child’s horizons (Leonard, 2015).
Elementary Classroom Design #2: A New Approach – Research-Focused and Intentionally Designed

Did you know...

- That the Reggio Emilia Approach values that every student brings with them a deep curiosity and potential and this innate curiosity drives their interest to understand their world and their place within it.

- It values that when students are driven by their interests that they are capable of constructing their own learning.

- It values that the teacher is not the giver of knowledge and that knowledge is built together.

- It values that the adults in the room are mentors and guides.

- It recognizes that the environment is a third teacher that inspires students.

- The environment should be: An environment filled with natural light, order and beauty.
Creating this Reggio-inspired centre was nearly a year long process. Several factors contributed to the creation of the space. First, it was the team of people who initiated the idea working together to develop the concept through regular meetings, ongoing review, discussion of the literature, and developing the curriculum. The team of teachers worked closely with a consultant who helped to better understand and comply with bureaucratic intricacies of the district school board. The success of the space depended on the team’s willingness to develop and integrate curriculum and share the responsibility to ensure that not only was there buy-in from the students and parents but from other educators, the district Superintendents, and the Director of Education.

Half of the room is set up using a variety of seating options such as couches, low chairs, rocking chairs and bar stools (Image 25). In this arrangement, students can easily move around, sit or lay on the floor, and find both individual and collaborative spaces which also respect the need for varied learning styles and needs. There is an attempt to use mostly natural material – for instance, the coffee table top, wooden chairs, organic wicker rug, plants, wooden signs, and textiles.
When reflecting on the type of spaces that encouraged conversation, deep thinking and collaboration, with all joking aside, our team agreed that a bar area (Image 27), with standing or sitting options, was convenient and versatile. It allowed two-way conversations, small group instruction, and an individual learning space. It also promoted leadership and community by encouraging students to “serve” one another: be it information, games, or food and tea.

Waldorf, Montessori, and Reggio Emilia approaches emphasize the use of natural sunlight, which inspired the small workspace under the window, surrounded by plants (Image 28). The benefit to large windows (as shown in Image 27) is that a work space can be created without a lot of supplies. Here, a ledge was installed at a counter height, allowing students to use the natural light and landscape as a tool for inspiration, to calm oneself, or to immerse oneself in a different environment. While physically the learner is still in the classroom in all respects, the window and landscape gives a feel and illusion of being in a different
Image 27: Natural Light; a counter was installed as a workspace for art, writing, and thinking.

Image 28: Herb garden and sitting area.

Image 29: Music area and flexible space.

Image 30: Collaboration areas with natural light.
In this learning environment, as depicted in Image 32, students have access to sewing machines. Lessons and tasks vary from learning to repurpose materials, to creating their own, original patterns. This Maker activity uses many math concepts and aligns with the Sustainable United Nations goals in that students use the task to highlight ways to reduce the massive textile landfills. Through the process of Making, students gain a deeper understanding of measurement, geometry, and calculations, and they use analytical and problem-solving skills when developing their own patterns and eventually feel confident enough to delve into more complicated and complex patterns that use a variety of technologies.
Chapter Three: Program and Lessons

Connections to Physical and Mental Health and Mindfulness

Image 34: Once a teacher work space, now a kitchen.

Image 35: Using food and nutrition as provocation for health inquiry.

Image 36: Bread-making and Science provokes questions. Why didn't it rise?
In the classroom, our space always speaks to our strong belief that health (both physical and mental) and fitness are what matter most. With this as a key facet of the program, we planted a small herb garden, healing plants, and showcased literature dedicated to healthy living, including fitness, balance, and mental health. This would allow us to practice and model an environmentalist approach to living and the interconnectivity of all things.

The Kitchen Table
Creating a space natural space for gathering is intended to help nurture the relationship between the teacher, student, and community and connects to the Reggio Emilia approach which recognizes the importance of this relationship in the learning experiences of the child. Further, the relationship between students, teachers, and parents help to make co-constructive learning as they create opportunities to generate ideas emerging from the cognitive conflict (Gandini, 2003; Santín & Torruella, 2017).

This reflective blog post below asks:

- What is one artifact or symbol that can literally make students feel “at home” in the classroom?
- What is one artifact that can ease stress, encourage conversations, build relationships, have no limitations of age or ability, and be completed diverse in nature?

“In our home, The Kitchen Table is not just where we gather for meals but where we gather to talk about our day. It is the first stop when getting up in the morning, returning from a walk or coming home from work. Where we throw down our keys, where we pile up our books and add to the weeks’ worth of newspapers. It is where we charge our phones and open our computers and play our music. It is our card table, our game table, an art centre and a sewing station. It is where the mail gets read and sorted and where the bills get paid. The table is a space for food preparation, for sorting groceries and for sharing surprise snacks. Sometimes, the table is our refuge after a long day- a safe place to sit and gather, where we talk and plan and discuss and cry. Our best arguments happen around the table and our best apologies follow. Sometimes, it is a place to sit together in silence reading or writing”

The following two minute video gives an excellent description of why we start and end our day at the Kitchen Table.
https://www.youtube.com/watch?v=K2k9kipP7h
By developing a kitchen space in the classroom, we created a natural context for relationship building. What was once a teacher workspace and a storage area was transformed into a small kitchen, allowing students, teachers, and parents to gather in a natural, comfortable area which emphasizes a connection to home and family.

This space would be where students or adults could sit around and table talk, listen, and create ideas together – to be active learners and leaders. In this space, students wouldn’t be judged and wouldn’t place judgement on others, but instead, would welcome differences and offer support, skills, and talent whenever needed. This space, in some way, would speak to every single student and would welcome all abilities.

“Whatever it is and whatever time of day – it is always a safe place to be ourselves, to take risks, to be honest, to be vulnerable and to love one another. And so, in effort to create an environment of trust, we brought the Kitchen table (literally) into the classroom and built a kitchen around it. We created a situation – a small space, a ‘feeling’ where students could be vulnerable, tell stories, laugh, cry and be themselves.”

(Branigan-Pipe, "The Kitchen Table," 2017)
Social Justice, the United Nations, and World Issues Connections

Image 41: Students identifying needs and wants; prior to the inventions inquiry.

Image 42: Students create a collaborative city, based on the United Nations Goals.

In using the learning space as the *third teacher*, teachers can introduce *provocations* meant to surprise children and spark discussion, “like a pizza box in the kitchen corner, paper and pencil in the blocks center, or aromatic scents to tantalize the children’s noses when they first enter the classroom” (Strong-Wilson & Ellis, 2007, p. 40). When students arrive each day, provocations are spread across the room. They may be invited to start making bread for lunch, or decide on the flavor of tea, or choose ingredients to make a smoothie (based on specific health attributes).
Another interesting and explicit strategy used in the Reggio classroom is the idea that nature can be used as a teacher, and the use of natural objects and artifacts can inspire student learning through natural investigation and making. There is a strong emphasis on critical literacy. Inquiry questions and big ideas would provide focus for exploration of millennium goals (United Nations, 2017) and for both guided and self-directed learning.
CONSTRUCTING THINKING through POETRY and Design

“The Road Not Taken”

~Constructing in Minecraft~

A Holistic Makerspace Approach
Created by: Zoe Branigan-Pipe

LITERACY AND POETRY - MINECRAFT AND ROBERT FROST
**Minecraft and Poetry - The Road Not Taken**

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<th>Maker Tool/Resource</th>
<th>Type of Lesson/Learning</th>
<th>Thinking Skills</th>
<th>Learning Skills</th>
</tr>
</thead>
<tbody>
<tr>
<td>*Minecraft / MinecraftEDU</td>
<td>*Full Lesson</td>
<td>*Creative Thinking</td>
<td>*Collaboration</td>
</tr>
<tr>
<td>*Lego</td>
<td>*Unit depending on depth and interconnections</td>
<td>*Abstract Thinking</td>
<td>*Reflection</td>
</tr>
<tr>
<td>*Art Materials and Supplies</td>
<td></td>
<td>*Divergent Thinking</td>
<td>*Organization</td>
</tr>
</tbody>
</table>

The Road Not Taken - Overview:

**Big Idea: What are our Needs and Wants as Learners? How do our choices impact our learning?**

In this Design lesson, students collaboratively design the poem, *The Road Not Taken* (Robert Frost). This is an open-ended, creativity focused lesson allowing learners at many levels and starting points to contribute. Students reflect on their own personal and physiological needs as children, by first connecting to the [UN Goals](https://www.un.org/unsd/sdgs/) and examining the needs of all humans and finding common connections to themselves. Prior to the lesson, time is given for students to gather and write quotes, poems and songs that focused on learning, choices, human needs/wants and self-regulation. Teacher can use a variety of online sites, books and collaborative tools to share examples. As a class (depending on age and needs) students deconstruct the poem and contribute to a reflective discussion about the metaphors and vocabulary used in the poem.

Using a collaborative Minecraft (Education Edition) server and starting with a [flat world](https://www.minecraft.net/en-us/education-center), students self-organize and design their version of the poem using blocks and materials in Minecraft. Individually, students may add their own poems or quotes to sections of the design (they can find a place on “the path”).

For consolidation and assessment of learning, students screenshot and then add their work to a pre-created collaborative book (online link such as a google document, Microsoft OneNote or blog) where they discuss their contribution, poem and reflection and ultimately making links back to their understanding of the Global Goals.

What the Research says:


Curriculum Connections / Focus: Lesson is a literacy lesson that is cross-curricular and meets learning expectations in the Arts and Maths at a variety of grades

Grade 4: read and demonstrate an understanding of a variety of literary using a range of strategies to construct meaning;

Grade 5: generate, gather, and organize ideas and information to write for an intended purpose and audience; produce pieces of published work to meet identified criteria.

Grade 6: produce a variety of media texts for specific purposes and audiences, using appropriate forms, conventions, and techniques.

Assessment

*Teacher observation of students understanding of the poem during group activity allows for formative assessment and provides data.

*Students share and reflect using a collaborative document.

*Students may use an exit card or audio exit to share what they know about the vocabulary used.

*Based on the level of understanding, students may extend thinking.

Extensions

*Painting or drawing the poem.

*Blogging about the different choices people have or don’t have depending on their home or life environment.

*Memorizing and reciting the poem in different ways, including musically.

*Write a reflective poem using metaphors.

*Creating a song that connects to choices, pathways and uses metaphors.

*Researching literature with a similar theme.

*List of different choices or pathways that are available to people from different areas in the world and connect this to the UN Global goals.

Instructional Pedagogy

**Design Thinking**
Students use their own creativity and design to make connections to a problem, an idea and a solution. As a group, they are deconstructing and constructing the poem based on new ideas.

**Inquiry**
"Create a Question activity" will encourage students to use their curiosity to dive deeply into the topic, compare strong and weak questions and use questions to guide learning.

**Play Based Learning**
Students will engage in play and exploring in Minecraft with guidance and will be given perimeters to help them stay on task and to scaffold their own learning.

**Project Based Learning**
The Project is to create a collaborative design using the meaning from a poem. Individually, students set a goal to write their own poem and share somewhere in the collaborative area using Minecraft.

**Constructionism**
Students use tools to assist in thinking process including LEGO or other construction mediums to help them visualize and make sense of their own thinking by taking apart, putting together and problem solving.

**Classroom Set-up, Mindfulness and FNMI:**
The classroom set up has individual spaces, quiet areas, and gathering spots. Students are free to use mindful tools like music, sensory tools, food, or sit amongst plants and nature areas.

<table>
<thead>
<tr>
<th>Key Strategies Teaching Strategies</th>
<th>UDL, Modifications and Accommodations</th>
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<tbody>
<tr>
<td>*Whole Group Discussion</td>
<td>Students work in groups and/or independently. Lesson can be done online or any variety of art mediums. Build complexity can vary depending on student. Activity can be modified depending on the tools available. This lesson allows for the use of many entry points and skill levels, from novice to expert and promotes creativity and design allowing many solutions or outcomes</td>
</tr>
<tr>
<td>*Game Based Learning</td>
<td></td>
</tr>
<tr>
<td>*Online, Blended and Collaboration tools</td>
<td></td>
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<tr>
<td>*Consideration of Classroom Space</td>
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<tr>
<td>*Audience and Authenticity</td>
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<tr>
<td>*Consideration of Needs of all Learners, including Gifted Learners</td>
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</table>
Fractals, Math and Nature

~Constructing in Art, Minecraft and Math ~

How have patterns in nature impacted innovation of today?

A Holistic Makerspace Approach
Created by: Zoe Branigan-Pipe
<table>
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<tr>
<td>*Minecraft MinecraftEDU</td>
<td>*Full Lesson/Unit (can span over a series of days)</td>
<td>*Creative Thinking</td>
<td>*Collaboration</td>
</tr>
<tr>
<td>*Art Materials and Supplies</td>
<td>*Small Groups in a variety of stations</td>
<td>*Math - Computational</td>
<td>*Reflection</td>
</tr>
<tr>
<td>*Variety of Robotics</td>
<td></td>
<td>*Thinking, Patterning</td>
<td>*Organization</td>
</tr>
<tr>
<td>*Collaborative/shared software</td>
<td></td>
<td>*Geometric Thinking</td>
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</tbody>
</table>

**Big Idea:** Why should we pay attention to changing patterns in nature? How was Mandelbrot Impacted by Nature in his designs? How have patterns in nature impacted innovation of today? How did he create a Mathematical Equation?

**What the Research says:**

*This lesson is an inquiry that is connected to the study of Mandelbrot, Fractals and his use of Nature to inspire art, invention and problem solving. In this lesson, students explore a variety of Maker stations to represent Fractals. Stations and topics can be altered depending on student interests or needs. The room is set-up with areas that promote integrative thinking, exploration, minds-on and hands-on learning. The inquiry question is posted in a central area and revisited throughout each station around the room.*

*To introduce the concepts, students are invited to play an online game Game (Kahoot, for example) and watch a short video about Mandelbrot. This is an excellent opportunity for formative assessment and to track learning and provide a space to share and reflect (assessment of learning), a collaborative document (classroom Book) is created (OneNote, Google Presentation) so each student can contribute. Students rotate through a variety of stations (below) until they find one that resonates strongly with them.*

*To consolidate learning, students are shown how to screenshot or use a camera/tablet to upload a picture of their creations so they can add their image/creation to the collaborative class book (created at the start of the lesson).*

*Students explain their thinking and inspiration behind the Fractal that they have created, connecting back to Mandelbrot. Finally, students use Minecraft to apply their learning in a shared World via MinecraftEDU (this can be an empty world).*


Mathematics Education in Fiber Arts: (Visuals) [http://www.toroidalsnar k.net/mkss3-pix/mkss3-exh.html](http://www.toroidalsnark.net/mkss3-pix/mkss3-exh.html)


As a whole group, students can play, create and share different types of Fractal Patterns.

**Classroom Centres:**

1) **Online Activity:** Using an online bulletin board, students post a collaborative Fractal Image that they have found - can add, colour in, adapt and edit. They may also use a drawing program where they can start with the “Paisley image’ or Koch Snowflake that can be built upon as they explore;

2) **Sensory:** Use of Sand, Magnets, Rocks are displayed on a table. Students create and recreate patterns through sand, texture and colour variations;

3) **Art:** Students have access to Fractal colouring pages and a variety of art materials to aid them in creating their fractal image, using a variety of mediums;

4) **Knitting or Sewing:** kits are available for students to explore. Providing a copy of fractal knitting patterns is helpful for students to visualize the math patterns;

5) **Coding Area:** There are many online coding activities that use the Fractal Patterns. Scratch/MIT, advanced level projects, is an excellent place to start. Tinker Pattern Play is another great resource: https://www.tynker.com/hour-of-code/play;

6) **Robotics:** Students investigate the applications of Fractal Robots by reviewing this paper: http://www.irdindia.in/journal_ijtarme/pdf/vol2_iss4/20.pdf; Students can use a variety of Robotics (and coding languages) around the room to create a prototype of a Fractal Robot. Students can also code the Robot to colour Fractal Images by designing a “code” that repeats using the fractal pattern;

7) **Explore and Play; Wolfram demonstration project:** Download the following LINK to interact with Iterations and Fractals: http://demonstrations.wolfram.com/download-cdf-player.html; Food Station, Photography Students, contribute a Salad Bar item to class (a letter is provided prior to the lesson). Using food items, students create a beautiful Fractal pattern. Once complete, take a picture of the student’s work and have them use a photo editing app to alter or edit their creation. Email the picture to the student and have them post it on their blog along with a reflection.
<table>
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<tr>
<th>Curriculum Connections / Focus:</th>
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<tr>
<td><strong>Art:</strong> <em>create two and three-dimensional work that express feelings and ideas inspired by their own and others' points of view</em></td>
<td><strong>Small Group Instruction and Discussion about Fractals followed by an exit card to demonstrate understanding of “Iteration”</strong>.</td>
<td><em>Painting or drawing a Fractal Pattern</em></td>
</tr>
<tr>
<td><strong>Math/Number Sense:</strong> <em>demonstrate understanding of proportional reasoning</em></td>
<td><strong>Students share and reflect using a collaborative document</strong></td>
<td><em>Blogging about Fractals and how Mandelbrot created an equation to represent the iterating pattern.</em></td>
</tr>
<tr>
<td><strong>Math/Geometry:</strong> <em>identify and classify two-dimensional shapes by side and angle properties</em></td>
<td><strong>Students may use an exit card or audio exit to share what they know about the vocabulary used</strong></td>
<td><em>Continue to practice Coding as a way to create Fractal images. Share the code on a blog.</em></td>
</tr>
<tr>
<td><em>identify and describe translations, using a variety of tools</em></td>
<td><strong>Based on the level of understanding, students may extend thinking</strong></td>
<td><em>Write a Fractal Poem using creative word iterations (Be creative!)</em></td>
</tr>
<tr>
<td><strong>Math/Patterning &amp; Algebra:</strong> <em>create, identify, and extend numeric and geometric patterns, using a variety of tools</em></td>
<td></td>
<td><em>Researching Fractals in a more in-depth way and creating a Presentation for your family or class.</em></td>
</tr>
<tr>
<td><strong>Language Arts:</strong> <em>read and demonstrate an understanding of a variety of literary, graphic, and informational texts, using a range of strategies to construct meaning;</em></td>
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<tr>
<td><em>recognize a variety of text forms, text features, and stylistic elements and demonstrate understanding of how they help communicate meaning</em></td>
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<td><strong>Critical Literacy/Social Studies:</strong> <em>B2. use the social studies inquiry process to investigate Canadian social and/or environmental issues from various perspectives, including the perspective of the level (or levels) of government responsible for addressing the issues</em></td>
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**Instructional Pedagogy**

**Design Thinking:** Students will dive into the math concepts and design of Fractals and use an algebraic expression to discover the design nature of the pattern and relate this ‘discovery’ to the big idea. Students will access a variety of ways to represent and Design the Fractal pattern, from food art, using Pulses (beans, seeds), drawing and using Minecraft.

**Problem Based Learning:** Students will make connections to how patterns in nature and data play an important role in how we solve problems. They will find Fractals themselves and draw conclusions about how the data of the particular Fractal can tell them something/inform them.
Inquiry
"Create a Question activity" will encourage students to use their curiosity to dive deeply into the topic, compare strong and weak questions and use questions to guide learning students will have an opportunity to narrow down a specific choice relating to the Big Idea.

Play Based Learning
Students will engage in play and exploring in Minecraft with guidance and will be given perimeters to help them stay on task and to scaffold their own learning

Constructionism
Students use tools to assist in thinking process including LEGO or other construction mediums to help them visualize and make sense of their own thinking by taking apart, putting together and problem solving Fractal Patterns,

Classroom Set-up, Mindfulness and First Nations, Metis and Inuit Recognition:
The classroom set up has individual spaces, quiet areas, and gathering spots. Students are free to use mindful tools like music, sensory tools, food, or sit amongst plants and nature areas. Kitchen and Gathering spaces use Indigenous Principals as a guide.

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<td>*Consideration of Classroom Space, small groups</td>
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<tr>
<td>*Audience and Authenticity (blogging)</td>
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<td>*Consideration of Needs of all Learners</td>
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UN Global Goals and Social Justice

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<tr>
<th>UN Global Goals and Social Justice</th>
<th>ISTE Standards 2016 (Student)</th>
</tr>
</thead>
<tbody>
<tr>
<td>* A strong understanding of Mathematical concepts will be needed to assist in achieving the UN Sustainable Development goals. *Goal #13 - Climate Action, Goal #14 - Life Below Water and Goal #15 - Life on Land because the concept itself is in helping students recognize that changing patterns in nature can provide valuable data about climate change and life on earth.</td>
<td>*Students leverage technology to take an active role in choosing, achieving and demonstrating competency in their learning goals, informed by the learning sciences. *Use of a variety of technologies within a design process to identify and solve problems by creating new, useful or imaginative solutions. *Students use digital tools to broaden their perspectives and enrich their learning by collaborating with others and working effectively in teams locally and globally.</td>
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Additional Links

REPURPOSING and UPSCALING

A hands-on Inquiry Approach to learning - Sewing and Textiles

What it does it mean to be a consumer?
What does it mean to be a maker?

~Constructing with TEXTILES~

A Holistic Makerspace Approach
Created by: Zoe Branigan-Pipe
The Doing: Maker Tool/Resource  The Learning (Style)  The Thinking (Skills, Process)  The Social Emotional

Sewing Machine Material  Re-Used Materials  Sewing supplies  *Full Lesson/Unit (can span over a series of days)  *Small Groups in a variety of stations  *Individual - design clothing and choice based (type of material, pattern)  Computational Thinking  Creative Thinking  Analyzing  Problem Solving  Design Thinking  Understanding Textiles from a historical perspective  *Working in teams and through collaboration  *Self-Directed Learning

Big Idea: Can we redefine what it means to be a consumer? What is the social impact of mass textile production?

In this lesson, students are introduced to the concept of repurposing as it relates to the Maker or Do-it-Yourself Culture. Students are drawn to the UN Sustainable Development Goals and begin making connections to how repurposing can aid in decreasing poverty (Goal 1), can contribute to a healthy environment (Goal 13) and start thinking more responsibly about consumption and production (Goal 12).

Students learn about the textile industry and participate in their inquiry about Textiles in the past and present as well as why the Textile industry has an impact toward developing countries. Students are confronted with a design problem - to create a different garment using an old piece of clothing.

Through the process of Making, students will experience the skills used by textile labourers and understand the many complexities of the industry (leading to further inquiry). Students will create basic stitches using a sewing machine as well through hand-sewing. They will have first to make a design, cut and pin material and learn how to sew together the pieces so that it matches their design.

What the Research says:


### Curriculum Connections / Focus:

<table>
<thead>
<tr>
<th>Science, Technology, Engineering, and Math (STEM):</th>
<th>Assessment</th>
<th>Extensions</th>
</tr>
</thead>
</table>
| *Exploring the process of manufacturing cotton fabric to produce apparel, home, or industrial products requires students to analyze concepts related to physical, life, and engineering application of science.* (Shirley & Kohler, 2012, pp. 46-56) | *Students are assessed on their ability to transform one product into another product (a shirt to a skirt) by using math concepts*  
  *How complex is the final product? Is it something different?*  
  *Students can identify reasons why repurposing benefits locally and globally*  
  *Students understand how the textile industry has led to inequity in certain countries and how they can make better consumer choices.* | *Can students use a more complex product and using a variety of sewing skills (sewing a pocket, adding an elastic waistband)?*  
  *Can students further investigate and create a report focusing on sweatshops and the impact this has on poverty in developing countries?*  
  *Can students combine other technologies in their design (use of conductive thread, LED lights, other textile products)?* |

**In Math** - basic geometric constructions, describing and justifying the procedures used “algebraic, spatial and logical reasoning to solve measurement problems” Items are are constructed to fit the 3-D forms and measurements are investigated in algebraic patterns. (National Governors Association Center for Best Practices, & Council of Chief State School Officers, 2010).

### Instructional Pedagogy Focus

**Design Thinking:** Students are approaching this activity from a variety of perspectives and are encouraged to look beyond current solutions through an innovation mindset. Can an old product become something better? What skillset is needed to transform an idea? How can students innovative to make something new?

**Inquiry:** This hands-on approach to Inquiry allows students experience Textiles with a Problem-Based lens. How can I create something new from something old? Why is this necessary? How can my consumer choices impact the inequities associated with the Textile Industries in developing worlds?

**Project Based Learning:** Students are given a project along with flexible and open-ended criteria. Each project will use the skills of sewing and making, but the finished product will look different, based on individual student choice and decision throughout the design process.

**Constructionism:** The act of sewing and doing evokes a strong understanding of how things are made - the complexity of design and how/why certain industries have created inequities among vulnerable people.

**Classroom Set-up, Mindfulness and FNMI:** Students participate in a repurposing “Maker” activity by contributing to a shared meal. Each student contributes one food item and discusses transformation. Respect for the earth and community is addressed by paying respect to Indigenous groups.
**Key Strategies Teaching Strategies**

- Setting the stage through provocation using historical thinking and creating a meal to share at the end of day
- Whole Group Discussion
- Online, Blended and Collaboration tools for pre-learning and post teaching
- Consideration of Classroom Space - lights, music, quiet areas and areas for collaboration
- Audience and Authenticity
- Consideration of needs of all learners

**UDL, Modifications and Accommodations**

- Students work in groups and/or independently.
- Complexity of lesson can vary depending on student.
- Activity can be modified depending on the tools available.

This lesson allows for the use of many entry points, age groups and skill levels, from novice to expert and promotes creativity and design allowing many solutions or outcomes.

### UN Global Goals and Social Justice

**GOAL #1: Eradicating poverty** - students learn that more than 800 million people are still living on less than US$1.25 a day, many lacking access to adequate food, clean drinking water and sanitation (United Nations Development Program, 2016). This activity serves as a catalyst for students to discuss the role of Sweatshops in developing countries and its role in contributing to poverty. Further, students will gain skills and knowledge that will impact their decisions when consuming or buying.

**Goal #9: Build resilient infrastructure, promote sustainable industrialization and foster innovation**

“Least developed countries have immense potential for industrialization in food and beverages (agro-industry), and textiles and garments, with good prospects for sustained employment generation and higher productivity (United Nations Development Program, 2016)

### ISTE Standards 2016 (Student)

To produce a textile product, such as the denim jean, it is necessary for students to use technology concepts, systems and operations (ISTE, 2007).

- Students leverage technology to take an active role in choosing, achieving and demonstrating competency in their learning goals, informed by the learning sciences.
- Students use a variety of technologies within a design process to identify and solve problems by creating new, useful or imaginative solutions.
- Students use digital tools to broaden their perspectives and enrich their learning by collaborating with others and working effectively in teams locally and globally.

### Additional Links

- **DIY and Maker Classroom:**
  https://prezi.com/hmxejj2gmfvrdiymaker-culture-in-the-textiles-classroom/

- **Mindspark with E-Textiles**
  http://makered.org/mindspark-tinkering-with-e-textiles/

- **How kids learn math through Sewing:**
  http://leftbraincraftbrain.com/2016/02/22/fashion-math-how-to-learn-math-by-sewing/
Art – The Reggio Approach
A hands-on Inquiry Approach to learning

What does it mean to be a consumer?
What does it mean to be a maker?

A Holistic Makerspace Approach
Created by: Zoe Branigan-Pipe
## The Altier and Art – A Reggio Approach

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<tr>
<td>*Variety of ART SUPPLIES</td>
<td>*Full Lesson/Unit</td>
<td>*Linear thinking</td>
<td>*Self-Regulation</td>
</tr>
<tr>
<td>*Link to ART instructional</td>
<td>*Can span over a series of days</td>
<td>*Focus on specific skills</td>
<td>*Independence</td>
</tr>
<tr>
<td>*Computers, iPad, earphones</td>
<td>*Cross-curricular</td>
<td>*Convergent thinking</td>
<td>*Initiative</td>
</tr>
</tbody>
</table>

### Big Idea:
How did Leonardo practice his art and what drawing exercises did he use to "stretch" his abilities. Can this be connected to other areas of learning?

### What the Research says:
The origins of self-directed learning can be traced to John Dewey (1916, 1938). As Wilcox (1992) states, Dewey asserted that all people are born with an unlimited potential for growth and development.

### Personal Inquiry:
How do I scaffold my learning so that I am always improving and how do I use feedback to improve when art is so subjective?

### Lesson Overview:
This lesson has many facets. Students will learn to use tools, products, and skills that are unfamiliar and uncomfortable. Students construct their learning by going through a process of decision making, perseverance, and self-directed activities that lead up to a specific piece of art. They will also be asked to follow clear instructions and work independently. Students will use instructional videos (they will choose from a set) and will be challenged to complete at least one project. They are given at least 1-2 hours and will have regular check-ins. They will use examples of Leonardo da Vinci to talk about what motivated him to learn new skills and will connect this style of learning to other areas of learning and what it means to be self-directed, self-regulated responsible for their learning.

### Practice and Make:
Students will be given a variety of options to choose from that focus on a particular artistic skill. They will use a video instructor to follow step-by-step instructions and make connections to mentor and apprentice (like DaVinci). In this lesson, they are the “apprentice.” Once they have completed the design following the instructor, they will be challenged to use these skills to create their art and will use a blog to post their work and reflect on the process. Link to self-directed lessons - https://goo.gl/LP6cyv

### Key Learning:
What is Medium and why/how should it change depending on audience or message? How can Art create a message? How can

---

**References:**
we make connections between ART and ourselves? Our Learning? What is the value of copying a model or example as a way to learn? How is ART a combination of Math, Science, and Language?

**Whole Class “Thinking” about learning activity:**
Using this website/blog “Nine Exercises to achieve artistic mastery” as a model, have students make connections to other areas of learning. Have students use metaphors and symbols of art to connect with themselves and their lives.

**Review:** How did DaVinci change the medium used in painting and introduced oil as the medium and how this impacted art in the Renaissance period? What motivated daVinci to begin to take his learning to the next level?

Share and discuss example http://comfortpit.com/drawing-exercises-leonardo-da-vinci/

**Ask:** Does the medium used changed the message? Modify the way the art is viewed? What were other mediums used in his time? What mediums are used today and how does the way we use tools change depending on the context?

Minds-On “Linoit” → Shared ‘Sticky Note” to develop thoughtful questions about ART and its relation to learning. Where is art in design in my life?

doi:10.15390/EB.2014.3621

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<td><strong>Learning Skills -&gt;</strong></td>
<td></td>
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</tr>
<tr>
<td><strong>Responsibility</strong> - Student fulfills commitments in learning environments</td>
<td><em>Can students commit and follow through with a chosen task? Did they complete the task from start to finish? What support did they need during the process?</em></td>
<td><em>Students are given the art links and may continue to practice at home or school.</em></td>
</tr>
<tr>
<td><strong>Self-Regulation</strong> - Student identifies learning opportunities, choices, and strategies to meet personal needs and achieve goals; and perseveres when facing challenges.</td>
<td><em>Was the product completed in a way that demonstrated a commitment to the job? Did the students take their time to watch, listen and follow instructions?</em></td>
<td><em>Blogging about ART and showcasing their work</em></td>
</tr>
<tr>
<td><strong>Grade 5 Visual Arts:</strong> Students will create two- and three-dimensional art works that express feelings and ideas inspired by their own and others' points of view; Students use a variety of materials, tools, and techniques to determine solutions to design challenges; Students will develop understanding of all principles of design</td>
<td><em>Students may use an exit card or audio exit</em></td>
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<tr>
<td></td>
<td><em>How have their attitudes or beliefs about ART and Self-Directed learning changed after they participated in the activity</em></td>
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</table>
Design Thinking
In this lesson, students approach classroom learning differently by applying concepts of self-directed learning to a specific experience. The design challenge is about learning itself as they use different perspectives, views, and ideas to a model of learning that is most effective.

Inquiry
Lesson focuses on a big idea to encourage students to ask questions about their learning, about how their attitudes of specific content or subject matter can impact the learning outcome. Students investigate ways to apply different ways of learning.

Play Based Learning
Students will engage in play and exploring in Minecraft with guidance and will be given perimeters to help them stay on task and to scaffold their learning

Project Based Learning
Students are engaged in a project of choice - to choose a specific art lesson and complete it by following specific instructions - step-by-step.

Constructionism
Students are not told to be self-directed, nor are they taught the concepts of self-directed learning. Instead, they learn how to make choices, decisions, and reflections by participating in a making challenge that forces them to be completely self-directed and independent.

Classroom Set-up, Mindfulness, and FNMI:
The classroom set up has personal spaces, quiet areas, and gathering spots. Students are free to use mindful tools like music, sensory tools, food, or sit amongst plants and natural areas.

<table>
<thead>
<tr>
<th>Key Strategies Teaching Strategies</th>
<th>UDL, Modifications and Accommodations</th>
</tr>
</thead>
<tbody>
<tr>
<td>*Whole Group Lecture Discussion (15 min)</td>
<td>Students work in groups and/or independently. Lesson can be done online or any variety of art mediums. Build complexity can vary depending on student. Activity can be modified depending on the tools available. This lesson allows for the use of many entry points and skill levels, from novice to expert and promotes creativity and design allowing many solutions or outcomes</td>
</tr>
<tr>
<td>*Game Based Learning (use of Minecraft)</td>
<td></td>
</tr>
<tr>
<td>*Online, Blended and Collaboration tools</td>
<td></td>
</tr>
<tr>
<td>*Consideration of Classroom Space</td>
<td></td>
</tr>
<tr>
<td>*Audience and Authenticity (use of blog to showcase their work)</td>
<td></td>
</tr>
<tr>
<td>*Consideration of Needs of all Learners,</td>
<td></td>
</tr>
<tr>
<td>UN Global Goals and Social Justice</td>
<td>ISTE Standards 2016 (Student)</td>
</tr>
<tr>
<td>-----------------------------------</td>
<td>-------------------------------</td>
</tr>
</tbody>
</table>
| **GOAL #3 - Good Health and Well-Being**  
This lesson focuses on the physiological and Mental Health needs of people through self-reflection and discussion. Students are encouraged to connect their personal needs to broader issues as a way to find commonalities and begin to think about design solutions that have a broad impact. | *Students leverage technology to take an active role in choosing, achieving and demonstrating competency in their learning goals, informed by the learning sciences.*  
*Students use a variety of technologies within a design process to identify and solve problems by creating new, useful or imaginative solutions.*  
*Students use digital tools to broaden their perspectives and enrich their learning by collaborating with others and working effectively in teams locally and globally.* |

**Additional Links**

Financial Literacy through a Constructionist Approach

What is a Living Wage?
A Holistic Makerspace Approach
Created by: Zoe Branigan-Pipe
<table>
<thead>
<tr>
<th>The Doing: Maker Tool/Resource</th>
<th>The Learning (Style)</th>
<th>The Thinking (Skills, Process)</th>
<th>The Social Emotional</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Google Spreadsheets <a href="https://goo.gl/N7tOfd">https://goo.gl/N7tOfd</a></em></td>
<td><em>Lesson can span over a series of days depending on complexity and level of students</em></td>
<td><em>Computational Thinking</em>&lt;br&gt;<em>Problem Solving</em>&lt;br&gt;<em>Historical Thinking</em>&lt;br&gt;<em>Analyzing Data</em>&lt;br&gt;<em>Sorting and Organizing</em>&lt;br&gt;<em>Evaluating needs/wants</em></td>
<td><em>Empathy</em>&lt;br&gt;<em>Problem Solving</em>&lt;br&gt;<em>Decision Making</em>&lt;br&gt;<em>Compromise</em></td>
</tr>
<tr>
<td><em>Students are using codes and formulas in a spreadsheet in a design thinking lesson</em></td>
<td><em>Game-Based Learning</em></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Big Idea:** What is a LIVING WAGE? Whose responsibility is it to ensure that all citizens have their basic needs met? Can we change habits to better reflect our financial needs individually and socially? How does the Maker-Culture and DIY impact our Financial Decisions?

Do financial decisions impact our social or individual well-being? How do financial choices affect the world around us? Financial literacy is a skill that affects individual and family health and wellness and is fundamental to understanding sustainability on a national and global scale. Students will explore how money works in the world, and how a person earns and manages money. Students will create monthly budget sheets for a range of scenarios by investigating fixed and variable expenditures. Students will discuss and debate needs and wants, and inquire into perspectives on government responsibilities. This lesson is designed to be a catalyst for their own lifelong of becoming understanding finances and making informed money management decisions.

2. Learning the Tool - Spreadsheet Lesson (using formulas in cells) and introduction to Spreadsheet through a paired and individual activity (calculate your worth in a day through estimation).
3. Game of Life Introduction - Participate in Design Thinking activity through a Project Scenario (Problem Based Learning). Students create a monthly budget based on a given scenario. The facilitator provides a series of “Game of Life” pieces [https://goo.gl/fpsMZC](https://goo.gl/fpsMZC) and students adjust budgets accordingly. The game continues in a month by month process where decisions and resources change depending on different contexts. Scenarios: [https://goo.gl/XcIlqQ](https://goo.gl/XcIlqQ)

**Kids learn about cash and credit:**

**Math and Financial Literacy:**
can provide aid/support.

<table>
<thead>
<tr>
<th>Curriculum Connections</th>
<th>Assessment</th>
<th>Extensions</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Math Concepts:</strong></td>
<td><em>Can students make connections between their daily lives and the cost of living? (Oral discussion or blog post)</em></td>
<td>Continue exercise by factoring in additional costs and facts such as variable interest rates of credit cards, mortgages or loans</td>
</tr>
<tr>
<td>Solve problems that arise from real-life situations and that relate to the magnitude of whole numbers up to 100 000 …</td>
<td><strong>What level of complexity and detail is their budget chart (as well as realist factors). Has this demonstrated Critical Thinking and questioning?</strong></td>
<td>Propose a budget to a parent or other family member, factoring personal events, situations that impact finances.</td>
</tr>
<tr>
<td>Solve problems involving the multiplication and division of multi-digit whole numbers, and involving the addition and subtraction of decimal numbers using a variety of strategies</td>
<td><strong>Can students balance their budget by also using government resources (if needed?)</strong></td>
<td>Investigate costs and benefits of housing developments and consider their impacts from social, environmental, and economic perspectives.</td>
</tr>
<tr>
<td>Demonstrate an understanding of proportional reasoning by investigating rates and percents</td>
<td><strong>Can students make draw a conclusion based on their budget (focusing on equity and providing solutions that may be available through Government?</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Social Studies:</strong></td>
<td><em>identify and describe Canada’s economic, political, social, and physical links with the United States and other regions of the world</em></td>
<td></td>
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<tr>
<td>*</td>
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</tbody>
</table>

### Instructional Pedagogy

**Design Thinking**
How do we engage our students to generate new creative possibilities financial decisions and choices? This lesson will use concepts of Design Thinking to help students imagine NEW possibilities in achieving the conditions for financial equity?

**Inquiry**
Students are guided through a personal and social inquiry focusing on individual, family and world finances. Students will develop their own questions based on problems - What is a fair Living Wage? How can I better prepare for the future when I struggle to buy groceries? What is my social responsibility to others?

**Play Based Learning**
In this “Game of Life”, students are engaged in a “Role Play” game. They are given a variety of sceneries, all with different financial variables which lead to different decisions, choices and outcomes. Students take a stand on one social aspect of living (child care, care for elderly, housing, education, health).

**Project Based Learning**
This is a project where students design a budget, using a spreadsheet and editing the budget as needed in the game. Students have choice and the power to make their own decisions in this
**Constructionism**  
Students are learning through DOING. There isn’t a worksheet or instructional tutorial to follow. Instead they are learning by Making, as identified in this approach. Students create their own learning experiences by engaging in creativity, problem solving and design.

**Classroom Set-up, Mindfulness and FNMI:**  
Students are invited to participate in a class meeting in the classroom where Financial Literacy is connected to the history of our Indigenous people, immigration and community/world matters.

<table>
<thead>
<tr>
<th>Key Strategies Teaching Strategies</th>
<th>UDL, Modifications and Accommodations</th>
</tr>
</thead>
</table>
| *Use of food and historical concepts to set-stage*  
*Whole Group Discussion of current news to incite Critical thinking*  
*Online, Blended and Collaboration tools (In consolidation, students create a shared book)*  
*Consideration of Needs of all Learners, including Gifted Learners* | *Students work in groups and/or independently.*  
*Build in complexity can vary depending on student.*  
*Activity can be modified depending on the tools available*  
*This lesson allows for the use of many entry points and skill levels, from novice to expert and promotes creativity and design allowing many solutions or outcomes* |

<table>
<thead>
<tr>
<th>UN Global Goals and Social Justice</th>
<th>ISTE Standards 2016 (Student)</th>
</tr>
</thead>
</table>
| **GOAL #1 - Eradicating poverty in all its forms**  
This lesson focuses on the causes and prevention of Poverty at a local level. Students have a chance to experiment with financial gains and constraints using a variety of scenarios and make connections to government responsibilities. | *Students use digital tools to broaden their perspectives and enrich their learning by collaborating with others and working effectively in teams locally and globally.* |

<table>
<thead>
<tr>
<th>Additional Links</th>
</tr>
</thead>
</table>
### United Nations Global Goals:

* How can programming and robotics help further innovation with sustainable management of water?
* Can the use of coding empower individuals to further invent ways to solve world issues?

### Tool: Dash & Dot

<table>
<thead>
<tr>
<th>Learning/Curriculum Connections:</th>
<th>Website / Instruction Videos:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Language Arts</td>
<td><a href="https://play.makewonder.com">https://play.makewonder.com</a></td>
</tr>
<tr>
<td>STEM</td>
<td></td>
</tr>
<tr>
<td>History and Geography</td>
<td></td>
</tr>
</tbody>
</table>

### Activity

1. Try “Hello World” Challenge: [https://goo.gl/Mk68c8](https://goo.gl/Mk68c8)
2. Campfire Story Challenge: [https://goo.gl/ME2tIh](https://goo.gl/ME2tIh)
3. DJ Dot Challenge: [https://goo.gl/ynBZMF](https://goo.gl/ynBZMF)
7. APP Play: Check out the various apps! Race around with Go! Drive through a maze with Path! [https://www.makewonder.com/apps](https://www.makewonder.com/apps) Make Music with Xylo!
8. Use the BLOCKLY app to work through coding challenges and to code your own projects.

### Next steps:

- Use the same Blockly coding language with Sphero, OzoBot or on [Scratch](https://scratch.mit.edu).
- Tackle Challenges issued by the Wonder League.
- Design your own challenges to be shared with others.

### How to show and share your learning:

- Write about the tool and activity on your blog by capturing a picture, link and a reflection about they type of math
- Send a letter or audio podcast (soundcloud) to the developers (Be Active in the world of Engineers!)
- Write a proposal or Infographic to share with principal or parent to PURCHASE your own Dash & Dot
- Write a review of the tool or robot and compare it to other programming devices that you are familiar with
- Create a presentation with your favourite presentation software

### Resources:

- [Dash & Dot Lesson Library](https://www.makewonder.com)

### Troubleshooting:

* Dash & Dot work through bluetooth. Once you have logged onto an app it will ask to connect to a Robot.*

### Safety

- Make sure when Dash is put down on an elevated surface that it is turned off.
# Knitting & Crocheting

[https://goo.gl/EUi4bd](https://goo.gl/EUi4bd)

Created by: Zoe Branigan-Pipe @zbpipe and Kristy Luker @lukerkristy

## United Nations Global Goals:

How does learning hands-on skills like knitting & crocheting help us achieve **Goal 8** - to promote sustained, inclusive and sustainable growth or promote **Goal 3** - Ensuring healthy lives and promote well being

## Knitting & Crocheting Learning Connections:

<table>
<thead>
<tr>
<th>Language</th>
<th>Math</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Instruction Videos:</strong></td>
<td></td>
</tr>
<tr>
<td>Bella Crochet Patterns &amp; Tips</td>
<td></td>
</tr>
<tr>
<td>Finger Knitting</td>
<td></td>
</tr>
<tr>
<td>How to Crochet a Chain</td>
<td></td>
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<tr>
<td>Casting On</td>
<td></td>
</tr>
<tr>
<td>How to Make a Single Crochet</td>
<td></td>
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<tr>
<td>The Knit Stitch</td>
<td></td>
</tr>
<tr>
<td>How to Make A Double Crochet</td>
<td></td>
</tr>
<tr>
<td>The Purl Stitch</td>
<td></td>
</tr>
<tr>
<td>Making A Granny Square</td>
<td></td>
</tr>
</tbody>
</table>

## Skills:

- Patterning
- Creative Thinking
- Design Problems

## Activity:

**Beginner:** Use the Instructional Videos above to learn beginner Crochet & Knitting Skills. Finger Knitting is another fun way to try knitting without knitting needles.

**Intermediate:** Use your knowledge of Basic stitches to begin making a square or rectangle that can be connected with those made by others to make a blanket or quilt for the classroom. If you are comfortable Finger Knitting, arm knitting is a fun way to make a scarf!

**Advance:** Try creating a design based on a pattern. Many patterns are available online. Review the abbreviations used for each stitch (sc = single crochet)

*Take a look at these many images that connect Mathematics with Textiles [http://www.toroidalsnark.net/mkss3-pw/mkss3-exh.html](http://www.toroidalsnark.net/mkss3-pw/mkss3-exh.html)*

## Next Steps

- Consider making projects (such as hats and scarves) that could be donated to local charitable groups
- Search out and try simple patterns
- Try designing your own pattern that another person could follow

## Show and share your learning:

- Take pictures of the project and explain what worked or what didn't
- Donate your creation to the class to be weaved into the Class Blanket

## Troubleshooting and Safety

Patience! Fine motor skills with your hands are needed to complete projects. Practice is required to get the repetitive motions needed. Learn how to use the hooks and needles to grab the wool and DO NOT rely on your fingers to do the work. Keep stitches loose. When they become tight you cannot get the hooks and needles in very easily. Watch out for tangled wool!

## Resources:

- Recommended Bloggers: [http://bellacrochet.blogspot.ca/](http://bellacrochet.blogspot.ca/)
- [http://www.fiberfluxblog.com/](http://www.fiberfluxblog.com/)
- [http://www.toroidalsnark.net/mathknit.html](http://www.toroidalsnark.net/mathknit.html)
**United Nations Global Goals:**

*How can coding contribute to the sustainable development of the seas, oceans and marine resources?*

<table>
<thead>
<tr>
<th>Tool: Arduino</th>
<th>Connections:</th>
<th>Website / Instruction Videos:</th>
</tr>
</thead>
</table>

**Activity**

- Starter Activity: [https://goo.gl/6XhJFd](https://goo.gl/6XhJFd)
- Arduino Knight Rider: [https://goo.gl/iwQ2nj](https://goo.gl/iwQ2nj)
- Project ideas: [http://playground.arduino.cc/Projects/Ideas#Easy](http://playground.arduino.cc/Projects/Ideas#Easy)

**Further Explore:**

Go to Maker Block and program a robot using Arduino coding.

**How to show and share your learning:**

- Write about the tool and activity on your blog.
- Describe the connection between Arduino coding and writing in the English language.
- Write a proposal or Infographic to share with principal or parent to PURCHASE your own Arduino kit, or to purchase more if you already have one.
- Create an instructional video explaining both the circuit and the coding for one of the projects in the Arduino kit.
- Build one of the projects and then expand the circuit and code to do more of what it already does.
- Find two projects that you can combine. Build the circuit and write the code.

**Resources:**

[http://playground.arduino.cc/Projects/Ideas](http://playground.arduino.cc/Projects/Ideas)

**Troubleshooting: tips!**

Coding is very precise. Check for errors with things like spaces where there should be none, and capital letters. Also watch for loops where you don’t have both brackets.

**Safety:**

*Regular AA batteries will get hot if shorted (enough to cause burns/fires after a while). Use power supply with an adjustable current limit which helps avoid damaging equipment or people.* Some components like capacitors can explode if run over their voltage rating or with polarity reversed.
United Nations Global Goals:
*How can coding help ensure our cities become more sustainable, inclusive, safe, and resilient?*
*How understanding of “how things work” help to empower those who are disenfranchised?*

<table>
<thead>
<tr>
<th>Breadboard</th>
<th>Learning Connections:</th>
<th>Website / Instruction Videos:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Language; Math; Science; Engineering; Music</td>
<td>Starting Electronics for Beginners &amp; Beyond <a href="https://startingelectronics.org">https://startingelectronics.org</a></td>
</tr>
</tbody>
</table>

**Activity:** Review the basics of a breadboard: [https://goo.gl/LGbPUW](https://goo.gl/LGbPUW)
Beginner: Basic Push Button tutorial [https://goo.gl/1pT9qH](https://goo.gl/1pT9qH)
Basic LED Circuit: [https://goo.gl/WLxbUw](https://goo.gl/WLxbUw)
Transistor Timer circuit: [https://startingelectronics.org/beginners/start-electronics-now/tut2-transistor-timer/](https://startingelectronics.org/beginners/start-electronics-now/tut2-transistor-timer/)

**Further Explore:**
Go to Arduino starter activity - [https://goo.gl/6XhJFd](https://goo.gl/6XhJFd) (a good next step)
Design and Make are REAL Breadboard - [https://goo.gl/sY9R3b](https://goo.gl/sY9R3b)
What is a breadboard: [http://wiring.org.co/learning/tutorials/breadboard/](http://wiring.org.co/learning/tutorials/breadboard/)

**How to show and share your learning:**
- Write about the tool and activity on your blog.
- Write a proposal or Infographic to share with principal or parent to PURCHASE Breadboard Kits for a Circuit Club at school.
- Create an instructional video explaining both the circuit and the coding for one of the projects

**Resources:**
Review: [https://startingelectronics.org/beginners/](https://startingelectronics.org/beginners/)
Breadboards for Beginners: [https://goo.gl/NRNu5r](https://goo.gl/NRNu5r)

**Troubleshooting tips!**
- Intermittent contact can occur when wire is loose in clip
- Don't force large wires and component leads into the breadboard, this will stretch the clips
- Test contacts by inserting 22 gauge wire and pulling on the wire
- If a lot of holes are loose with a 22 gauge wire, it's time to replace the board

**Safety:**
*Regular AA batteries will get hot if shorted (enough to cause burns/fires after a while). Use power supply with with an adjustable current limit which helps avoid damaging equipment or people.*
Some components like capacitors can explode if run over their voltage rating or with polarity reversed
United Nations Global Goals:
*How can 3D printing impact Goal 2 - End Hunger and Achieve Food Security? How can 3D printing impact Goal 3 that focuses on Health and Well-being?*

<table>
<thead>
<tr>
<th>Tool: 3D Printer</th>
<th>Learning Connections:</th>
<th>Websites Instruction Videos:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Language</td>
<td><a href="http://3dprintingsystems.com/education-stem-apps/">http://3dprintingsystems.com/education-stem-apps/</a></td>
</tr>
<tr>
<td></td>
<td>Math</td>
<td>Tinkercad:<a href="https://www.tinkercad.com/">https://www.tinkercad.com/</a> (Make an account with a parent if 12 or under)</td>
</tr>
<tr>
<td></td>
<td>Science</td>
<td>Thingiverse: <a href="https://www.thingiverse.com/">https://www.thingiverse.com/</a> (Lots of 3D designs already)</td>
</tr>
<tr>
<td></td>
<td>Engineering</td>
<td>Top 5 Design Apps: LINK</td>
</tr>
<tr>
<td></td>
<td>Arts</td>
<td></td>
</tr>
</tbody>
</table>

**Activity**

1. Follow along with the tutorial on Tinkercad (use your own account or sign into the classroom account) until you understand how to create a 3D design that can be effectively printed. Check the size, the level of detail, the grouping. Does your print serve a purpose, is it an art piece?
2. IF YOU ARE FAMILIAR with Minecraft try the next step -> Printcraft: http://www.printcraft.org/getstarted Create a Printcraft account. Using Minecraft make a design and upload to PRINT IT!
3. Try another TOOL: Create a Design using “Onshape”, then save the design to an image or print the design on 3dPrinter
4. When the design is complete, click “SAVE AS” -> STL FILE. File will download onto a computer. Then, open the file (it will open into the 3D printer program)
5. Print! -> Be sure to follow Safety rules - never put your hand or anybody part near printer while it is printing. Only have an adult or older student remove the print from the plate.

**Next Steps:**
Extend your learning of 3D printing by learning a more advanced 3D printing tool, found at http://3dprintingsystems.com/education-stem-apps/

**How to show and share your learning:**
*Do an Inquiry about 3D printing and how it is revolutionizing Health and Wellness*
*Create a Blog Post about the Safety issues of 3D printing in the classroom*
*Create a Green Screen Video about 3D printing that WOW the audience*
*Create a comparison of types of 3D printers (cost/summary)-submit to school principal or parent.*
*Create a tutorial for beginners and add to your website or blog.*

**Resources:**
*https://www.makerbot.com/*
*https://www.makerbot.com/media-center#education*

**tips!**
*It is important that the 3D printer Surface plate is perfectly level.*

**Safety:**
*Safety Sheets: http://download.makerbot.com/filament/ABS_MSDS_MakerBot_Stratasys.pdf*
*Hazards ● Extruder and motors are HOT during operation ● Extruder and motors may be HOT at any time ● PINCH POINTS while machine is moving ● Removal tools are SHARP ● Do inform a mentor of machine errors or damage ● Do inform a mentor/teacher of missing tools or supplies*
# United Nations Global Goals:

*How can the skills learned by programming a robot impact Goal 3 - to ensure healthy lives? How can Robotics impact Goal 7 - Access to affordable reliable modern energy?*

<table>
<thead>
<tr>
<th>Tool: 3D Printer</th>
<th>Learning Connections:</th>
<th>Websites, Software Needed Instruction Videos:</th>
</tr>
</thead>
</table>
|                 | Language<br>Math<br>Science<br>Engineering<br>Arts | *mBot App: [https://www.youtube.com/watch?v=i1J1-W_onz0](https://www.youtube.com/watch?v=i1J1-W_onz0)<br>*mBlockly App: iPad<br>*mblock software [LINK](https://www.makeblock.com/en/)

### Activity

*Fantastic tool because you can use Block Programming or Arduino - or both.

1) Start by learning how to use the programming. Once the mblock ([http://www.mblock.cc/download/](http://www.mblock.cc/download/)) program is installed, try a simple program by following these tutorials: [http://learn.makeblock.com/mbot-programming/](http://learn.makeblock.com/mbot-programming/)

2) Advanced: Once you have a solid understanding of the program, try something more advanced: mBot with Me LED Matrix

3) Advanced programming with ARDUINO - mBot: [https://youtu.be/ZxVw-avYuYo](https://youtu.be/ZxVw-avYuYo)

4) Learn how to program Mbot with CLanguage [LINK](https://www.makeblock.com/en/)

5) Try to create and save your own program or challenge!

### Next Steps:

- Try the Arduino Kits Project

### How to show and share your learning:

*Do an Inquiry about Robotics - what are the positive and negative impacts of robotics for industry? Robotics in medicine? Robotics in warfare?*

*Create a Robotics comparison chart - and explain the features of each. Add it to blog.*

*Create a challenge for someone else ([use screen capture tool](https://www.makerbot.com/media-center#education)) to help them learn more complicated programming*

*Create a demonstration or presentation for your class*

### Resources:

* [https://www.makerbot.com/](https://www.makerbot.com/)
* Educator Resources: [https://www.makerbot.com/media-center#education](https://www.makerbot.com/media-center#education)

### Troubleshooting:

*Make sure you’ve installed the Drivers ([link](https://www.makerbot.com/media-center#education))*

### Safety:

*Some of the parts can be sharp; *Watch for battery erosion or any small shocks with the electrical components *Be sure to keep small parts away from small children *Do not bend the wires as they may break;*
**United Nations Global Goals:**

*How can programming and robotics help further innovation with sustainable management of water?*

*Can the use of coding empower individuals to further invent ways to solve world issues?*

<table>
<thead>
<tr>
<th><strong>OZO BOT</strong></th>
<th><strong>Learning Connections:</strong></th>
<th><strong>Website / Instruction Videos:</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="http://ozobot.com/play/color-code-language" alt="OzoBot" /></td>
<td><strong>Language</strong>&lt;br&gt;<strong>Math</strong>&lt;br&gt;<strong>Science</strong>&lt;br&gt;<strong>Engineering</strong></td>
<td><strong>OzoBlockly Tutorial</strong>&lt;br&gt;<strong>Calibrating &amp; Tuning OzoBot</strong>&lt;br&gt;<strong>Drawing with OzoBot</strong></td>
</tr>
</tbody>
</table>

**Activity**

**Drawing Code:** Using the colour code reference sheet ([http://ozobot.com/play/color-code-language](http://ozobot.com/play/color-code-language)) have fun designing obstacles, tracks, and mazes for the OzoBot. Race a friend! Can you design a track that takes 19 seconds to complete? 12 seconds?

**APP Play:** Check out the various Ozobot apps! Dance with OzoGroove! Draw with OzoDraw! Strategize in OzoPath!

**Blockly Coding:** Log onto OzoBlockly ([http://ozoblockly.com/](http://ozoblockly.com/)) Code our tiny friend to do amazing tricks! Coding levels from beginner to advanced

**Further Explore or next steps:**

**OzoBot Lesson Library**

*Use the same Blockly coding language with Sphero, Dash or on Scratch.*

**How to show and share your learning:**

- Write about the tool and activity on your blog by capturing a picture, link and a reflection about they type of math
- Send a letter or audio podcast (soundcloud) to the developers (Be Active in the world of Engineers!)
- Write a proposal or Infographic to share with principal or parent to PURCHASE your own OZOBOT
- Write a review of the tool or robot and compare it to other programming devices that you are familiar with
- Create a presentation with your favourite presentation software (preszi, Google Presentation, Video)

**Resources:**


**Troubleshooting tips!**

The OzoBot will not work if the OzoBot has not been accurately calibrated. Follow steps in link above. If you do not receive the correct lights begin the process again. *Paper codes must be calibrated on paper and online coding calibrated online.*
**United Nations Global Goals:**
How does learning hands-on skills like sewing help us achieve **Goal 8** - to promote sustained, inclusive and sustainable growth or promote **Goal 3** - Ensuring healthy lives and promote well being?

<table>
<thead>
<tr>
<th>Tool:</th>
<th>Learning</th>
<th>Instruction Videos:</th>
</tr>
</thead>
</table>
| [Image of sewing machine] | Language  
Math  
Engineering  
*Sewing Machine Basics: Video to learn how to thread [LINK](http://www.wikihow.com/Use-a-Sewing-Machine)  
*Learn how to use the Machine - Excellent Video: [https://www.youtube.com/watch?v=rnTwT-ifLkU](https://www.youtube.com/watch?v=rnTwT-ifLkU) |

**Skills:**
- Colour combinations, fabric types
- Computational Thinking
- Patterning
- Code and linear thinking
- Hands-on learning
- Creative expression

(Before starting, read and understand the Safety Guidelines!)

**Beginner:**

**Intermediate:**
1) Try following a pattern and create something using the ideas found here; [http://www.skiptomylou.org/hanging-rainbow-cloud/](http://www.skiptomylou.org/hanging-rainbow-cloud/)
2) Make a headband

**Advanced:** Make your own Pattern. Don’t just wing it. Follow an existing pattern first and then improvise and be creative: [http://www.madeeveryday.com/2008/07/tutorial-make-your-own-pattern.html/](http://www.madeeveryday.com/2008/07/tutorial-make-your-own-pattern.html/)


**Next Steps**
- At school or home, work on a more complicated pattern
- Visit a local sewing shops to learn about different types of machines
- Find a local sewing class (for example, [http://www.iloveneedlework.com/collections/all-workshops](http://www.iloveneedlework.com/collections/all-workshops))
- Experiment with sewing and CONDUCTIVE THREAD

**Show & share your learning:**
- Take pictures of the project and explain what worked or what didn’t
- Consider creating a mini sewing lesson for others interested in sewing

**Troubleshooting and Safety**
*Always have a mentor or leader help you before you start
*Hands away from the needle
*Long hair must be tied back
*Long sleeves or baggy clothing must be pushed back
*Always wear shoes when using machine
**United Nations Global Goals:**
How does learning hands-on skills like knitting & crocheting help us achieve **Goal 8** - to promote sustained, inclusive and sustainable growth or promote **Goal 3** - Ensuring healthy lives and promote well being?

<table>
<thead>
<tr>
<th>Spreadsheets</th>
<th>Learning Connections:</th>
<th>Websites Instruction Videos:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Language</td>
<td>Math</td>
<td>• Spreadsheet Template (google sheets) <a href="https://goo.gl/gyT08p">https://goo.gl/gyT08p</a> <a href="http://www.toroidalsnark.net/mathknit.html">http://www.toroidalsnark.net/mathknit.html</a></td>
</tr>
<tr>
<td>Arts</td>
<td>Social Studies</td>
<td></td>
</tr>
</tbody>
</table>

**Skills:**

**Beginner:** STEP BY STEP LINK:


**Next Steps**

- Consider making projects (such as hats and scarves) that could be donated to local charitable groups
- Search out and try simple patterns
- Try designing your own pattern that another person could follow

**Show and share your learning:**

- Take pictures of the project and explain what worked or what didn't
- Donate your creation to the class to be weaved into the Class Blanket

**Troubleshooting and Safety**

Patience! Fine motor skills with your hands are needed to complete projects. Practice is required to get the repetitive motions needed. Learn how to use the hooks and needles to grab the wool and **DO NOT** rely on your fingers to do the work. Keep stitches loose. When they become tight you cannot get the hooks and needles in very easily. Watch out for tangled wool!

**Resources:**

Recommended Bloggers:
[http://www.toroidalsnark.net/mathknit.html](http://www.toroidalsnark.net/mathknit.html)
**Conductive Paint**

Created by: Zoe Branigan-Pipe @zbpipe and Kristy Luker @lukerkristy

### United Nations Global Goals:
*How can coding help ensure our cities become more sustainable, inclusive, safe, and resilient?*
*How understanding of “how things work” help to empower those who are disenfranchised?*

<table>
<thead>
<tr>
<th>Conductive Paint</th>
<th>Learning Connections:</th>
<th>Website / Instruction Videos:</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image" alt="Draw a circuit" /></td>
<td>Language; Math; Science; Engineering; Music Geography and History</td>
<td>Technology that could change the world: <a href="http://www.cnn.com/2013/05/23/tech/innovation/bare-electrically-conductive-paint/">http://www.cnn.com/2013/05/23/tech/innovation/bare-electrically-conductive-paint/</a></td>
</tr>
</tbody>
</table>

### Activity:
**Beginner to Advanced**

- **Make a Proximity Sensor:** [https://goo.gl/R9GWi2](https://goo.gl/R9GWi2)
- **Make a house that lights up:** [https://www.bareconductive.com/make/5-fun-facts-about-your-glowing-house-set/](https://www.bareconductive.com/make/5-fun-facts-about-your-glowing-house-set/)
- Print out for house: [https://goo.gl/44ScPR](https://goo.gl/44ScPR)

### Further Explore:

### How to show and share your learning:
- Write about the tool and activity on your blog. Be sure to include links, images, and your own reflections.
- Describe the connection between Arduino coding and writing in the English language.
- Write a proposal or Infographic to share with principal or parent to PURCHASE

### Resources:
- **Where to buy:** [https://www.sparkfun.com/products/10994](https://www.sparkfun.com/products/10994)
- **How to make conductive paint:** [https://www.youtube.com/watch?v=eqMr9kk1uHk](https://www.youtube.com/watch?v=eqMr9kk1uHk)

### Troubleshooting:
**tips!**
*Electric Paint is water soluble so there’s no risk of permanent damage to clothes or furniture.* — *Wet wipes will make the clean-up easier*

### Safety:
*Regular AA batteries will get hot if shorted (enough to cause burns/fires after a while). Use power supply with an adjustable current limit which helps avoid damaging equipment or people.* Some components like capacitors can explode if run over their voltage rating or with polarity reversed - sometimes with a very. Never put wires or equipment into electrical sockets or other equipment using high levels of energy to run;
Maker Resources

Starting a small Makerspace in your school?

Over the past few years, I have been fortunate to have had the opportunity to co-create two Makerspaces within my school District – both very different and yet both fall under similar approaches and philosophies that were inspired by the Emilia Reggio approach which is commonly described as being, “based on the principles of respect, responsibility, and community through exploration and discovery in a supportive and enriching environment based on the interests of the children through a self-guided curriculum.”

Ask: Who on staff can sew? Crochet? Knit? Cook? Change a car tire? Change a bike tube? Who has any lego and loves to build? Who can draw? Who knows programming? Who owns a robot? Finally, is there interest in creating an atmosphere of making? Does the room/area talk about pedagogy? what is the philosophy behind it?? Can a work table be brought in? A couch or two with coffee table? Small plants for growing/eating? How about a whiteboard for designing, writing? Does the environment make kids and adults want to be there?

Let’s say you have $1,000.00 to spend for your startup. Survey your staff – teachers, education assistants, consultants, coaches – to see what would be the tools/products that would bring in the community. Is anyone interested being the ‘resident’ expert? Through a shared document (OneNote or Google Drive), ask them to add to the list or just sign up. The space doesn’t need to be about one thing or one person.

Don’t forget about the Parents and Community! You might be surprised at how many people have things laying around the house and would love to donate these to a community space, be it Lego, puzzles, cubes, and small tools.

Other resources to visit for developing a Makerspace:

(1) The Maker Lounge
(2) Start a School Makerspace from Scratch
(3) A Librarian’s Guide to Makerspaces
(4) Five Questions to Ask When Planning a Makerspace
<table>
<thead>
<tr>
<th>Maker Tools or Activity</th>
<th>Skill, knowledge building AND why</th>
<th>Estimated START UP Cost</th>
<th>Staff Interested?</th>
<th>Link or resource for purchase</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electric Sewing Machine Material and supplies</td>
<td>Math - Applied understanding Measurement, Geometry, Patterning, Algebra PROJECT BASED LEARNING</td>
<td>150.00 each 100.00</td>
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<tr>
<td>Sewing Materials</td>
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<tr>
<td>Knitting/Crocheting Materials (Yarn, needles)</td>
<td>Math - Patterning, Geometry, Spacial, Ratio, Symmetry</td>
<td>$100.00 (approx)</td>
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<tr>
<td></td>
<td>Does anyone have anything to donate?</td>
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<tr>
<td>OZOBOT Robotics</td>
<td>Great for ages 5 - 99 Coding through colour or block programming Lots of great challenges and an amazing website to help teachers</td>
<td>$100.00 (approx)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>MAKEY MAKEY</td>
<td>Circuits and manipulation of wires/circuits to control a computer Great for exploration, play and making connections to “how things work” and electricity.</td>
<td>$50.00 (approx) (buy at least two)</td>
<td></td>
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<tr>
<td>Hyperduino</td>
<td>An excellent kit that teaches students to code with a purpose and how they can combine coding with presentations!</td>
<td>$100.00</td>
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</tr>
<tr>
<td>Sphero</td>
<td>I highly suggest this fun robot. Not only do students learn how to drive and manipulate the robot but they can also use blockly programming! This is one of our favourites and learners of ALL love the Sphero.</td>
<td>$150.00</td>
<td></td>
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<tr>
<td>Art</td>
<td>Bean Art - Use Pulses (dried beans, chickpeas, lentils...etc.) and have students create beautiful</td>
<td>$100.00 (approx) for a few easels</td>
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</tbody>
</table>

Does anyone have anything to donate?
<table>
<thead>
<tr>
<th>tactile art</th>
<th>Sketch Pencils and notepads</th>
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</thead>
<tbody>
<tr>
<td>Chess...</td>
<td>$100.00</td>
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<tr>
<td>Puzzles...</td>
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<tr>
<td><strong>Reggio Emilia Approach</strong></td>
<td>Discovery is emphasized through facilitated inquiry, play and exploration. Strong relationship with teacher and classmates over extended period. Exposure to Arts, history and literature. Exposure to plants and natural materials. Autonomy and flexible learning spaces, responsive to needs of student and teacher. Students assigned Jobs, duties to contribute to community. Exposure to real-world materials and problems.</td>
<td>Opportunity for team teaching and strong collaboration. Teachers are encouraged to plan based on unique qualities of each child. Opportunity to learn through practice and ongoing research. Availability and support to use atypical resources and tools. On-going learning through reflection and observation of students and self. High degree of trust in the teacher’s creative abilities.</td>
<td>Supportive parent, school partnership. Strong partnership with classroom, school. Varied age-groups provided a variety of perspectives. Parents are often seen as “teacher” and invited to play that role in the classroom.</td>
</tr>
<tr>
<td><strong>Montessori Approach</strong></td>
<td>Individualized learning. Exposure to a variety of tools, resources. Drive their own learning based on interest, learning needs, style. Strong relationship with teacher. Benefits from strong partnerships between family and school. Exposure to environmental Education and.</td>
<td>Availability of variety of resources that encourage different methods. Creative and innovative approaches and lessons are encouraged. Commitment to learn along with students. Use of Environmental Education as part of everyday learning. Team Approach emphasized.</td>
<td>Community oriented projects. Community Partnerships are emphasized. Parent/family contribution activities. Student Projects are often focused on community issues. Parent and community members are invited to share in celebrations.</td>
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<tr>
<td><strong>Waldorf Approach</strong></td>
<td><strong>Constructivism</strong></td>
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<tr>
<td><em>Hands-on and self-directed learning emphasized</em></td>
<td><em>students exposed to hands-on projects enabling authentic problem solving opportunities</em></td>
<td></td>
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<tr>
<td><em>Students learn to approach learning through imagination, creativity and self-guided inquiry</em></td>
<td><em>Building, designing and creating artifacts is fun and open-ended and encourages students to</em></td>
<td></td>
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<tr>
<td><em>Student leadership is encouraged and supported through real-world experiences/ opportunities</em></td>
<td><em>Teachers benefit from learning in collaboration with students</em></td>
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<tr>
<td><em>Authentic experiences are emphasized, including wilderness trips, hiking, survival activities</em></td>
<td><em>Makerspaces accessible in libraries, community centres and pop-up MakerFaires.</em></td>
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<tr>
<td><em>Strong relationship with mentors, peers and community is promoted</em></td>
<td><em>Curriculum embedded through Maker Activities and not taught in isolation</em></td>
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<tr>
<td><em>Social and emotional well-being is supported</em></td>
<td><em>Assessment through observation and self-reflection and feedback cycle happen based on the needs of students during an activity</em></td>
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<tr>
<td><em>Hands-on and self-directed learning emphasized</em></td>
<td><em>Assessment isn’t always pre-planned but depends on students’ needs at the time of a project or inquiry</em></td>
<td></td>
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<tr>
<td><em>Teachers committed to reflective practice and documentation</em></td>
<td><em>Maker projects have a strong link to Design Thinking and Wicked Problems</em></td>
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<tr>
<td><em>work together in creating curriculum that is guided by a model of child-development</em></td>
<td><em>Availability of materials, instructions</em></td>
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<tr>
<td><em>Strong relationship with students</em></td>
<td><em>Availability of technology</em></td>
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<tr>
<td><em>Trained to use a holistic approach that values the body, mind and spirit</em></td>
<td><em>Group mentorship is encouraged but not forced</em></td>
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<tr>
<td><em>Teachers explore innovation and creativity to encourage students to be imaginative and creativity from a young age</em></td>
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<tr>
<td><em>Curriculum is structured in years and grades</em></td>
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<tr>
<td><em>Curriculum is broad rather than specific</em></td>
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<tr>
<td><em>Strong focus on humanities, history, geography</em></td>
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<tr>
<td><em>Focus on environment and outdoors</em></td>
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<tr>
<td><em>Assessment for and of learning is emphasized</em></td>
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<tr>
<td><em>Relationship between student and teacher is strong</em></td>
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<tr>
<td><em>Students are regarded as important members of a global community from the start of school</em></td>
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<tr>
<td><em>Assessment is naturally occurring evidence</em></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Assessment is viewed as important part of learning</em></td>
<td></td>
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<tr>
<td><em>Assessment is natural as a strong element to mindfulness, and attention to whole self (spirit, mind, body)</em></td>
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</tr>
</tbody>
</table>
| Design Thinking and Inquiry | *exposed to problems that inspire innovative solutions and encourage deep and critical thinking* | *Teachers learn to use a layered approach to Problem Solving that involves critical thinking, creativity* | *Problems and Inquiries* are authentic and usually focus on local or global issues  
*Community integration and Critical Literacy* allows students to learn their role and voice in activism and being change agents | *Integrated approach that uses Big Ideas and Concepts to drive an Inquiry* | *Assessment is focused on process of learning rather than the actual product*  
*Observation and on-going discussion can help student reflect on their own learning growth and progress*  
*Use of prompts and guided questions assist in directing student learning* | *Global Goals can drive all Inquiries and help students and teachers see a variety of perspectives locally and globally* | *Questions, Big Ideas Posted*  
*Artifacts in the room enhance and inspire inquiries (an indoor garden, a worm centre, rocks, shells and natural materials)* |
| First Nations Metis Inuit | *benefits from worldviews and principles that value mentorship and leadership* | *Teachers can incorporate Indigenous world views in classroom with or without Aboriginal students*  
*Teachers implement mentorship opportunities, respect for group process, and respect for environment* | *bringing in parents, grandparents and community members emphasizes the role of the elders and storytelling, *Relationship with community, peers, teachers help students see their place an* | *Curriculum is holistic in nature and focuses on needs of individual student* | *Assessment is natural and driven by student needs*  
*Past, present and future perspectives are interwoven into curriculum and Big Ideas in order for students to better understand the role they play in social justice and restorative practices* | *Use of artifacts connected to environment demonstrate a deep respect for the environment* |
| New Pedagogies and 21st Century | *exposed to collaborative projects*  
*access to current tools and resources*  
*Blended Learning and online learning supports curriculum and allows multi-approaches and individualized instruction*  
*Integrated curriculum allows students to see the interconnected nature of learning and project management* | *Teachers are encouraged to be reflective, innovative and use a variety of creative approaches*  
*Teachers have access to online networks for support and leadership*  
*Transparency and availability of resources and tools allows teachers that address learning needs*  
*teachers are designers of the learning experiences*  
* teachers become models of the learning attitudes* | *Digital Citizenship allows students to use new tools in meaningful, respectful ways*  
*Community Engagement is emphasized through digital and non-digital means*  
* Teachers and students from the partnership’s school clusters who are at the forefront of developing and using new pedagogies (F  
ullan, pp.10)* | *Curriculum is standardized but individualized and differentiated instruction is emphasized* | *Use of Standardized assessment to drive instructional practices* | *Learning is driven through authentic topics, problems and projects* | *Availability of current tools, resources*  
*Areas promote collaboration*  
*Room promotes discovery and inquiry through available materials, use of prompts and questioning* |
and creative, connected, collaborative, skills they seek to instill through their learning activity designs. (Fullan and Langworth, 2013)

The Informational Posters are displayed throughout the Maker room as to support pedagogical choices and help teachers, parents and students recognize the strong benefits of playful learning that involves making, creating, taking apart, thinking through puzzles and collaborating on a project that has meaningful intentions.

Image 486: Informational Posters displayed throughout learning space.
# SEWING/TEXTILES

**Did you know?**
- That sewing assists students in critically thinking, fine motor control, self-confidence, finger dexterity. It teaches the listening and following of instructions. Students use a variety of Math (measurement & numeration) and science skills.

- In addition, connections between STEM activities and fashion and design have been demonstrated to increase student interest in learning programming (Lau, Ngai, Chan, & Cheung, 2009)

**IN THE CLASSROOM:**
- Have a sewing machine area in the classroom
- Bring in parents, grandparents and mentors from secondary or post-secondary schools to come in one day per week
- Offer hand and machine sewing options
- Time sewing into computer programming and electronics

**Research:**

**Who might benefit?**
- Students who are strong on math, but not demonstrating skills in paper tasks
- Students who are kinesthetic learners and enjoy seeing real world connections to concepts (ex. Trade and sweatshops)
- Students who enjoy working on abstract problems and have strong geometric sense
- Students who need to develop mathematical processes in a practical application
- Students who struggle with the relevancy of school
- Students who have strong fine motor skills
- Students who are ready to apply multiple math strands simultaneously

**Who may struggle?**
- Students who may not follow the safety guidelines
- Students who require an abundance of supervision
- Students who may not respect the cost of the machine
# Puzzles

## Did you know?
- Puzzles are useful to teach students to reason about space, and how to manipulate objects in space which is “a critical part of everyday life” Puzzle, special and reasoning skills are especially important for success in particular academic and professional domains, including science, technology, engineering, and math (STEM).
- Puzzles include jigsaw, logic, cross-word, word-search and game
- Helps build logical thinking skills
- Children learn to work directly with their environment and change its shape and appearance when they work with puzzles
- Increase visual and special skills and overall cognitive functioning (Janice Davis, 2013)
- Involves Problem-Solving and Reasoning and promotes social skills and collaboration
- “…findings suggest that engaging both boys and girls in puzzle play can support the development of an aspect of cognition that has been implicated in success in the STEM disciplines,” Levine said.
- Levine, the Stella M. Rowley Professor in Psychology at UChicago, is lead author on a paper, “Early Puzzle Play: A Predictor of Preschoolers’ Spatial Transformation Skill,” published in the current early view issue of Developmental Science

## Who might Benefit?
- Students who need to further develop Spatial Sense.
- Students who enjoy and/or need to work on thinking in a logical way.
- Students who need to work on their problem-solving skills.
- Students who require something to constantly do.
- Students who may be become overexcited with other tasks and need a chance to be mindful

## Who may struggle?
- Students who can become overwhelmed with divergent activities.
- Students who struggle to spend a long time on one task or want an immediate completed project

## Research and Resources:
  By Elissa Sungar for GalTime.com
- Why are Puzzles so good for kids learning Janice Davis, 2013
  http://www.learning4kids.net/2012/02/21/why-are-puzzles-so-good-for-kids-learning/
- Why Puzzles are good for your child’s development:
  https://childdevelopmentinfo.com/child-activities/why-puzzles-are-good-for-your-childs-development/
- Early Puzzle Play: A predictor of preschoolers’ spatial transformation skill
  https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3289766/
# Chess/Checkers

**Did you know?**
- That playing chess helps students develop:
  - logic
  - attention to detail
  - patience
  - persistence & collaboration

- “As children play chess, they begin to see the importance of thinking ahead, trying to figure out what their opponent might do next and what their alternatives are too. This ability to anticipate outcomes can transfer to their reading comprehension. Students can predict outcomes, and realize that characters in their stories are interconnected, just as just as they and their opponent, and the pieces on the chessboard are.” (Fischer, *Educational Value of Chess*, 2013)

**Research and Resources:**
- Teaching Chess the Easy Way with Mini Games:  


- Try it!: [http://computerchessonline.net/chess-online-against-computer/](http://computerchessonline.net/chess-online-against-computer/)

- [http://education.jhu.edu/PD/newhorizons/strategies/topics/thinking-skills/chess/](http://education.jhu.edu/PD/newhorizons/strategies/topics/thinking-skills/chess/)

---

**Who might benefit?**
- Students who enjoy complex puzzles and problem solving tasks?
- Students that pay attention to details?
- Students that demonstrate patience.
- Students who require a challenge.

**Who may struggle?**
- Students that become easily frustrated with complex tasks
- Students that struggle with following a specific set of rules
Plants / Gardening in the Classroom

Did you know?

- A study by John Daly and Margaret Burcheet (Centre for Environmental Sustainability, Faculty of Science at the University of Technology) concluded that classroom plants consistently led to improved performance across the curriculum. In their research, they cite many instances where plants can significantly improve the air quality in buildings.
- Potted plants in the classroom can reduce absences, improve behaviour and increase grades among primary-aged students.
- Plants in classrooms improve performance and lower feelings of discomfort in university students.
- Both students and staff report more positive feelings and satisfaction around learning with plants in classrooms.
- Plants in workspaces can improve memory retention.
- In addition to their aesthetic beauty, indoor plants have been shown to offer psychological and restorative values, such as reduced tension, better coping mechanisms, and increased concentration and attention.

Resources and Research:

- Bringing Nature in the classroom: https://www.plt.org/story/bringing-nature-into-the-classroom/

Who might benefit?

- Students who feel a strong connection to nature and the world around them.
- Students with anxiety.
- Students with attention and focusing issues.
- Students with various health issues.
- Students who enjoy have responsibilities and jobs.
- Teachers benefit too! Plants give off smells and oxygen that provide benefits to the environment.

Who may struggle?

- Students with specific allergies.
- Plants just need light - it doesn't have to be from the sun.
## Yarn Work (knitting, crocheting, weaving)

### Did you know?

#### Research on the benefits of knitting & crocheting include:

- Better ability to cope with physical and mental illness
- Decreased risk of cognitive impairment as you age
- Knitting & Crocheting involve relaxed repetitive motions that calm the body and brain.
- It can be a very mindful, meditative and relaxing activity
- Knitting & Crocheting can also be used to connect with the math curriculum. Students can dive into measurement skills and learn proportional reasoning and patterning
- Knitting & Crocheting can assist in the development of linear thinking and following directions
- Cornell University professor Daina Taimina realized that she could create a hyperbolic plane with crochet, which helped her students to visualize this complex concept. For more background on this crochet application, visit The Institute for Figuring. On a less complicated level, crochet shapes have been used to help students visualize triangles, squares, rectangles and other basic geometric shapes.

#### Resources:

- Knitting is more important than Homework: [http://www.huffingtonpost.com/mara-menachem/knitting-is-more-important-than-homework_b_3612321.html](http://www.huffingtonpost.com/mara-menachem/knitting-is-more-important-than-homework_b_3612321.html)
- [http://www.craftyarncouncil.com/mathconnections.html](http://www.craftyarncouncil.com/mathconnections.html)

### Who might benefit?

- Students who require fidgeting to increase listening skills and ability to focus
- Students who need to reduce stress and requiring coping strategies to get through a learning day
- Students who enjoy having a finished product and gain a sense of self through what they create
- Students with strong patterning skills and a need to apply them in a real-life situation
- Students with proportional reasoning skills that could be further developed in a real-life situation
- Students who need to further develop math skills, but may struggle with the relevancy of math concepts in paper pencil tasks
- Students who are visual learners

### Who may struggle?

- Students that struggle with fine motor skills
- Students who are extremely tense (gets yarn too tight)
- Students who have perceptions about certain tasks being appropriate for certain genders
# Alternative Seating and Classroom Space

**Did you know that Classroom space is?**

- That providing alternative seating is linked to higher academic performance, better health, and improved behavior
- A comfortable and inviting environment allows students to feel a sense of control over their learning and empowered
- Learning can be enhanced by engaging students in a greater variety of postures (lying down, moving, learning against a wall or desk, perching, or even squatting)
- “We need to think about creating classroom environments that give children the opportunity for wonder, mystery and discovery; an environment that speaks to young children’s inherent curiosity and innate yearning for exploration is a classroom where children are passionate about learning and love school.” (Heard & McDonough, 2009) From - Capacity Building Series, Ontario, 2016 - CBS_ThirdTeacher.pdf
- Improves health by moving around

**Resources/Research**

- [https://www.edutopia.org/blog/flexible-seating-student-centered-classroom-kayla-delzer](https://www.edutopia.org/blog/flexible-seating-student-centered-classroom-kayla-delzer)
- [Brain-Based methods to redesign the classroom](https://www.edsurge.com/news/2016-03-01-10-tips-for-using-brain-based-methods-to-redesign-your-classroom)
- [Flexible Seating in Reggio Inspired School:](http://fairydustteaching.com/2016/10/flexible-seating-reggio-inspired-school/)

**Who might benefit?**

- Students that get distracted easily and need an alternative place to work
- Teachers may enjoy working in an environment that is less “institutional looking” and may have mental health benefits when the environment speaks to them on a personal level

**Who may struggle?**

- Students or parents that are expecting a very traditional education setting may need more education about how/why these types of environments can inspire creativity
Reggio Emilia Approach in the Classroom?

<table>
<thead>
<tr>
<th>Did you know?</th>
<th>Who might benefit?</th>
</tr>
</thead>
<tbody>
<tr>
<td>● Reggio Emilia is a Place in Northern Italy</td>
<td>● Students driven by internal motivation</td>
</tr>
<tr>
<td>● This is known as an educational approach that was developed in Northern</td>
<td>● Students who enjoy thinking for themselves and actively participating in their</td>
</tr>
<tr>
<td>Italy by Loris Malaguzzi between 1920 and 1994 (Edwards, 2002)</td>
<td>learning</td>
</tr>
<tr>
<td>● That the Reggio Emilia approach values that every student brings with them</td>
<td>● Students who feel disconnected in a regular classroom</td>
</tr>
<tr>
<td>a deep curiosity and potential and this innate curiosity drives their</td>
<td>● Students that enjoy seeking out information and refining learning as they go</td>
</tr>
<tr>
<td>interest to understand their world and their place within it</td>
<td>● Students that may not have their needs met through regular curriculum</td>
</tr>
<tr>
<td>● It values that when student are driven by their interests that they are</td>
<td>● Students that enjoying learning through hands-on activities that allow students</td>
</tr>
<tr>
<td>capable of constructing their own learning</td>
<td>to construct and be in charge of their own learning</td>
</tr>
<tr>
<td>● It values that the teacher is not the giver of knowledge and that knowledge</td>
<td>● Students with diverse interests and abilities</td>
</tr>
<tr>
<td>is built together</td>
<td>● Students who are versatile.</td>
</tr>
<tr>
<td>● It values the adults in the room are mentors</td>
<td>Who may struggle?</td>
</tr>
<tr>
<td>● It recognizes that the environment is a third teacher that inspires</td>
<td>● Students driven by external rewards</td>
</tr>
<tr>
<td>students</td>
<td>● Students who struggle with self-motivation</td>
</tr>
<tr>
<td>● It values natural light, order and beauty</td>
<td>● Students who do not see themselves as creative</td>
</tr>
<tr>
<td>● The Reggio Emilia approach includes a focus on the child as an active</td>
<td>● Students with learned helplessness</td>
</tr>
<tr>
<td>part of the learning process (Gardner &amp; Jones, 2016, pp. 602)</td>
<td>● Students who enjoy organizing things and people into structure and order.</td>
</tr>
<tr>
<td>● Initially, this way of teaching was developed for children at the</td>
<td>Seeks to systemize things</td>
</tr>
<tr>
<td>pre-school level</td>
<td></td>
</tr>
</tbody>
</table>

Resources/Research

### Robotics

**Did you know?**

- "In the same way that the printing press facilitated the spread of the three Rs, computers can facilitate the spread of computational thinking (Wing 2006)

- When children learn a programming language, they are not “just learning to code, they are coding to learn” (Resnick 2013, pp. 5)

- When children learn through robotics and coding, they are solving problems in systematic ways, struggling to learn new powerful ideas, and expressing themselves with a variety of computational media” (Sullivan & Bers, 2017)

- That using Robotics in the classroom connects with Reggio Emilia and Seymour Papert’s theories of constructing one’s learning

- The science aspect of robotics involves the students’ experimentation and modifications with the robots. This can be very engaging, because the students are designing their own plans for the robot to follow. When the students are engaged in designing and creating successful solutions, they are acquiring engineering skills to solve the robotic challenges. (Bianco, 2014, pp. 32-38)

**Resources and Research:**


### Who might benefit?

- Students who need to work through various Mathematical Processes in a practical manner.

- Students who need to apply Mathematical concepts in a real life situation.

- Students who lack engagement in Mathematics.

- Students who enjoy an element of play in their learning.

- Students who enjoy or need to work on collaboration and problem solving skills.

- Students who enjoy working with formulas and rules.

### Who may struggle?

- Students who struggle to think independently.

- Students who struggle with “failure”.

- Students who want specific instructions or a how to guide.

- Student who may become overly excited.

- Students who need to continue to develop collaboration skills.

- Students who prefer paper and pencil tasks.

- Student who struggle with trouble shooting.
| Seymour Papert and Constructionism |
|-----------------------------------|-------------------------------------------------------------|
| **Did you know?**                 | **Who might benefit?**                                       |
| • Seymour Papert (1980) coined the  | • Students who enjoy autonomy over their own learning       |
| phrase constructionism and the    | • Students who enjoy discovery based teaching               |
| theory asserts that “children     | • Students who are hands on learners                        |
| build their own intellectual      | • Students that enjoy creative outlets                      |
| structures with materials         | • Students with high energy and alertness, and eagerness    |
| drawn from the culture” (Papert,  | who have periods of intense effort                          |
| 1980, pp. 32)                    | • Students who acquire and retain information quickly.      |
| • Constructing and making         | **Who may struggle?**                                       |
| can encompass many types of       | • Students who are comfortable with following the rules.    |
| Making activities, including      | • Students who require Success Criteria to be successful.   |
| writing a book, a poem or song    | • Students who extrinsically motivated.                     |
| and can construct learning through |                                                            |
| the discovery of a math problem   |                                                            |
| • Constructionism is when a       |                                                            |
| scenario of Making and Creating   |                                                            |
| may force students to ask         |                                                            |
| further questions and engage in   |                                                            |
| authentic inquiry and discovery    |                                                            |
| • Constructionism and             |                                                            |
| makerspaces go hand in hand       |                                                            |
| (Grassick, 2016, pp. 15-23) and   |                                                            |
| aligns with, and builds on,       |                                                            |
| constructivism (Sheridan et al.,   |                                                            |
| 2014, pp. 50)                     |                                                            |
| • The Makerspace environment is    |                                                            |
| based on the constructivist       |                                                            |
| approach that recognizes students  |                                                            |
| learn by actively building upon   |                                                            |
| prior knowledge and experiences   |                                                            |
| (Schunk, 2012)                    |                                                            |

**Resources/Research:**

## Lego in the Classroom

### Did you know?
- Rebecca Lagden, who teaches at Felsted School in Essex, used Lego in her year 13 English class to put texts into context and help students analyze them. “The individual bricks represent literary devices and the final model is the text,” she says. “Many students start with the bricks and try to build an argument without understanding the meaning of the whole text. I get pupils to break apart the completed Lego model they’ve built to show the main message of the text and look at it’s component parts.” (Marsh, “Five ways teachers use Lego creatively in class,” 2015)
- Lego provides tools that develop lateral thinking in a fun environment
- It teaches kids to think in three dimensions
- It improves literacy as kids work with instructions
- It develops problem-solving, organization, and planning by construction
- It improves creativity, communication and critical thinking
- It boosts kids motor development

### Who might benefit?
- Students with strong spatial and geometry sense
- Students developing creativity skills
- Students needing to boost motor development
- Students working on literacy skills

### Who may struggle?
- Students with fine motor difficulties
- Students who struggle with open ended tasks
- Students who prefer linear tasks.

### Resources/Research:
**United Nations Development Goals**

*Did you know?*

- The UN Goals On September 25th 2015, countries adopted a set of goals to **end poverty**, **protect the planet**, and **ensure prosperity for all** as part of a new sustainable development agenda.
- Each goal has specific targets to be achieved over the next 15 years.
- For the goals to be reached, everyone needs to do their part: governments, the private sector, civil society and people like you.

*Resources/Research:*

- Link to document on UN Goals and Math Programming: [https://goo.gl/se3o0N](https://goo.gl/se3o0N)

**Who might benefit?**

- Students who struggle with understanding the relevancy behind curriculum expectations and why they need to have certain skills.
- Students who are passionate about social justice issues and have a strong sense of what is right and what is wrong.
- Students who are sensitive to the needs of others.
- Students who love truth, equity, and fair play.

**Who may struggle?**

- Students who have difficulties with the ideas and opinions of others.
- Students who struggle with articulating their beliefs and opinions.
<table>
<thead>
<tr>
<th>United Nations Goal</th>
<th>What needs to happen around the World for this Goal to be met?</th>
<th>What do we need to learn?</th>
<th>What questions do you have</th>
</tr>
</thead>
<tbody>
<tr>
<td>1) End poverty in all its forms everywhere</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2) End hunger, achieve food security and improve nutrition and promote sustainable agriculture</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>3) Ensure healthy lives and promote well-being for all at all ages</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>4) Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>5) Achieve gender equality and empower all women and girls</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6) Ensure availability and sustainable management of water and sanitation for all</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7) Ensure access to affordable, reliable, sustainable and modern energy for all</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8) Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9) Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10) Reduce inequity within and among countries.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11) Make cities and human settlements inclusive safe, resilient, sustainable.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12) Ensure sustainable consumption and production patterns.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>13) Take urgent action to combat climate change and its impacts.</td>
<td></td>
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<td>---</td>
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<td></td>
</tr>
<tr>
<td><strong>14)</strong> Conserve and sustainably use the oceans, seas and marine resources for sustainable development.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>15)</strong> Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification and halt and reverse land degradation and halt biodiversity loss.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>16)</strong> Promote peaceful and inclusive societies for sustainable development, provide access to justice for all and build effective, accountable and inclusive institutions at all levels.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>17)</strong> Strengthen the means of implementation and revitalize the global partnership for sustainable development.</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
We took the wording right off of the United Nations website and turned it into the border surrounding the Sustainable Development Goals.

Take the time to read the thoughts of the UN and find the words that fill in the blanks below.

The **17 Sustainable Development Goals** and _______ targets which we are announcing today demonstrate the scale and ambition of this new universal Agenda.

As we embark on this collective journey, we pledge that ____________ will be ______________ behind.

This agenda is a plan of action for ___________________, ___________________, and ___________________.

There can be no sustainable development without _______________ and no ______________ without sustainable development.

We are resolved to free the __________________ from the tyranny of ________________.

We are determined to end poverty and hunger, in all their forms and dimensions, and to ensure that all human beings can fulfill their potential in _______________ and _______________ and in a _______________ environment.

We are determined to take the bold and transformative steps which are ______________ needed to shift the world onto to a _______________ and _______________ path.
Answer Key:

1. 169
2. no one
3. left
4. people
5. planet
6. prosperity
7. peace
8. peace
9. world
10. poverty and want
11. dignity
12. equality
13. healthy
14. urgently
15. sustainable
16. resilient
CURRICULUM CONNECTIONS

This document is a collaborative/collective inquiry on how the Ontario Social Studies curriculum fits with the 5 over-riding concepts of the Global Sustainable Development Goals.


FOR A COLLABORATIVE DOCUMENT LISTING POSSIBLE CURRICULUM CONNECTIONS GO TO: https://goo.gl/W3CZDb

GOAL ONE

End poverty in all its forms everywhere

Resource: http://sustainabilityworkshop.autodesk.com/blog/3d-printing-developing-countries-untapped-potential#sthash.rDXN8Splt.dpuf

HOW CAN 3D PRINTING BENEFIT DEVELOPING COUNTRIES?

The number one social sustainability goal is eradicating poverty, especially in developing countries.

3D printing may help, and people are already trying to use it for this. However, its greatest potential remains mostly untapped, not making products for the rural poor, but acting as venture capital for small urban manufacturers.

Investigation/Activity:

Add an EXAMPLE, IMAGE, FACT OR LINK to one PAGE in this DOCUMENT that demonstrates an IDEA that may impact this goal/question.

LINK TO COLLABORATIVE BOOK

Maker Activity:

GO TO TINKERCAD, or other Design Programs AND print something!!
GOAL TWO

**MUSIC - PLAYING FOR CHANGE**

Listen/Reflect

https://www.youtube.com/watch?v=oiPzU75P9FA&list=RD oiPzU75P9FA

OR GO TO THIS LINK: https://goo.gl/Bte7WH

What makes this powerful? How does this relate to the UN Goals?
Can social media impact social justice around the world?

**Blog it:**
Create a short post and EMBED a Playing for Change video into your blog with a short discussion about the intention. What is the impact of creating music collaboratively around the world?

**Make:**
Can you create a video similar to Playing for Change using the classrooms around your school?

GOAL THREE

The CANADIAN GOVERNMENT

**Facts and Stats - [LINK](#) to Targets**

Ensure Healthy Lives and promote well-being for all at all ages

**WORLD HEALTH**

What makes this powerful? How does this relate to the UN Goals?
Can social media impact social justice around the world?

**Blog it:**
Create a short post and EMBED a Playing for Change video into your blog with a short discussion about the intention. What is the impact of creating music collaboratively around the world?

**Make:**
Can you create a video similar to Playing for Change using the classrooms around your school?

Thinking both INSIDE and OUTSIDE the box!!

What strategies and suggestions is the NEW CANADIAN GOVERNMENT employing that has a focus on HEALTH??
**ORGANIZATION**

**HEALTHY CHILDREN**
Health for the ELDERLY?
Health in Schools??
Medications?

**Activity (You will need your computer):**
CREATE (or begin) A “DID YOU KNOW” info chart about HEALTH and HEALTH PROGRAMS in Canada. You will need to get an account at any of the following:

http://piktochart.com/
https://infogr.am/

ADD THE INFOGRAPHIC TO YOUR BLOG BY FINDING THE EMBED CODE AND INSERTING THE EMBED CODE.

---

**SPREADING THE MESSAGE ON SOCIAL MEDIA**

What makes this powerful? How does this relate to the UN Goals? Can social media impact social justice around the world?

**Blog it:**
Create a short post and EMBED a Playing for Change video into your blog with a short discussion about the intention. What is the impact of creating music collaboratively around the world?

**Make:**
Can you create a video similar to Playing for Change using the classrooms around your school?

**Does red meat cause cancer?**
**How can PULSES improve Health in impoverished countries?**

What impact might this have on the food industry and trade in Canada?

**Activity:**
Paper FACEBOOK POST (REACTION) - On the KITCHEN BULLETIN BOARD, POST A “Reaction” to this study. Also post a response to another reaction. What do you think?
### GOAL FOUR

**WHAT IS INNOVATION IN EDUCATION?**

What makes school and education innovative? Thinking OUTSIDE THE BOX, how would you implement strategies in our current system that would increase the capacity to learn?

**Activity:** As a team, add the following to the CHART:

- *one big question about learning and teaching as it pertains to children and adults (A critical thinking question that might encourage others to think more deeply, for example)*
- *one example from another COUNTRY that demonstrates INNOVATION in Education (think Big).*
- *one thing that you want changed.*
- *how education might look in 2030*
- *one PLACE in the WORLD that doesn’t value Education or support education the same way as Canada (give location and fact).*
- *Is the Education System fair for all people?*

### GOAL FIVE

**WHAT ARE THE STATS**

Compare Canada to at least THREE DIFFERENT COUNTRIES - What are the disparities between Men and Women in these countries? Between the the COUNtries?

**Activity:**

On a strip of paper, add one “Did you know??” fact with SHOCKING statistic about inequity FOR WOMEN give your SOURCE on the back of paper.

### CLEAN WATER AND SANITATION

**WRITERS CHALLENGE**

Tell a story.

How can you address this goal through literature? How can a personal story, a children’s story, a historical fiction or a fact/fiction story DRIVE this goal home?

Start a story on this document [https://goo.gl/zs9blX](https://goo.gl/zs9blX)
<table>
<thead>
<tr>
<th>GOAL EIGHT</th>
<th>STATS CHALLENGE</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>8</strong> DECENT WORK AND ECONOMIC GROWTH</td>
<td><strong>NEWSPAPER SEARCH</strong>….</td>
</tr>
<tr>
<td>What are local stats to demonstrate Economic Growth?</td>
<td>Find and cut out articles and help create a GOAL EIGHT WALL!!</td>
</tr>
<tr>
<td>How does your city match up to impoverished countries?</td>
<td>• What are local stats to demonstrate Economic Growth?</td>
</tr>
<tr>
<td>Why is there such a difference from Country to Country?</td>
<td>• How does your city match up to impoverished countries?</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>GOAL NINE</th>
<th>WORD WORK.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>9</strong> INDUSTRY, INNOVATION AND INFRASTRUCTURE</td>
<td>Share words and definitions that FOCUS ON</td>
</tr>
<tr>
<td>Build resilient infrastructure and promote inclusive and stable industrialization</td>
<td>Industry</td>
</tr>
<tr>
<td></td>
<td>Innovation</td>
</tr>
<tr>
<td></td>
<td>Infrastructure</td>
</tr>
<tr>
<td></td>
<td>Resilient</td>
</tr>
<tr>
<td>GOAL TEN</td>
<td>REFUGEE CRISIS</td>
</tr>
<tr>
<td>----------</td>
<td>----------------</td>
</tr>
</tbody>
</table>
| **10** REDUCED INEQUALITIES | **Promoting Questions:**
| [Image] | What TARGET does this focus on?  
Does this relate to any other Sustainable Development Goals?  
What is Canada doing compared to other COUNTRIES? |
| **Activity:** Using the paper strips provided, help to create an INFORMATION WALL about the Syrian Crisis. Add:  
- One key fact (One Sentence)  
- One Success Story (something good that has been reported)  
- One Question for others to ENCOURAGE deep thinking |
| Extention: Find an article of interest to post. |

<table>
<thead>
<tr>
<th>GOAL ELEVEN</th>
<th>The Sustainable City</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>11</strong> SUSTAINABLE CITIES AND COMMUNITIES</td>
<td><strong>What makes a CITY SUSTAINABLE?</strong></td>
</tr>
<tr>
<td>[Image]</td>
<td><strong>ACTIVITY:</strong> Find ONE example in HAMILTON that meets this goal. Share a picture and explanation on this collaborative book:</td>
</tr>
<tr>
<td></td>
<td>Share an EXAMPLE from ANYWHERE IN THE WORLD that demonstrates A SUSTAINABLE CITY that is innovative and creative</td>
</tr>
<tr>
<td></td>
<td><a href="https://goo.gl/r9MiS0">LINK</a></td>
</tr>
<tr>
<td></td>
<td>OR GO TO THIS LINK --&gt; <a href="https://goo.gl/r9MiS0">https://goo.gl/r9MiS0</a></td>
</tr>
</tbody>
</table>

|  | In the News |
|  | Cut out and post articles that focus on SUSTAINABLE CITIES and COMMUNITIES.  
Challenge: Use a sticky to add thought provoking questions about your own city. What innovations make cities stronger and healthier? |
<table>
<thead>
<tr>
<th>GOAL TWELVE</th>
<th>Create a Kahoot</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Responsible Consumption and Production</strong></td>
<td>(Sign up for an account).</td>
</tr>
<tr>
<td>Protect, Restore and Promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification and halt and reverse LAND degradation</td>
<td>With your partner, create 10 QUESTIONS about this goal. Share the Kahoot with another group, a classroom or your family.</td>
</tr>
<tr>
<td></td>
<td>*Do questions encourage safe and responsible ways to consume? What does it mean to be a responsible consumer?</td>
</tr>
<tr>
<td></td>
<td>Share the link on your own BLOG for others to play. You may need to read the instructions in the KAHOOT website for information on how to do this!</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>ART with a message.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sketch, draw, create a message that showcases the IMPROVEMENTS our world has made in the last 10 years. Maker your message a positive one!</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Poem, Picture Book and Storytelling</th>
</tr>
</thead>
<tbody>
<tr>
<td>Can you create a poem, story or fictional letter to share “Life Below Water? Use the Green Screen to add real images, along with your own Narrative</td>
</tr>
<tr>
<td><strong>MINDMAP IT</strong></td>
</tr>
<tr>
<td>----------------</td>
</tr>
<tr>
<td>Create a cartoon to showcase the conditions necessary to ensure that our environment is safe.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Goal 16</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>The Syrian Refugee Crisis - INFORMATION WALL</strong></td>
</tr>
<tr>
<td><strong>Promoting Questions:</strong></td>
</tr>
<tr>
<td>What TARGET does this focus on?</td>
</tr>
<tr>
<td>Does this relate to any other Sustainable Development Goals?</td>
</tr>
<tr>
<td>What is Canada doing compared to other COUNTRIES?</td>
</tr>
</tbody>
</table>

| **Activity:** |
| Using the paper strips provided, help to create an INFORMATION WALL about the Syrian Crisis. Add: |
| • One key fact (One Sentence) |
| • One Success Story (something good that has been reported) |
| • One Question for others to ENCOURAGE deep thinking |

| **Extension:** |
| Find an article of interest to post on the wall. Add a post on your blog with some key facts and why we, as Canadians should be paying attention! |

| **Classroom connection?** |
| Create a mini-lesson (google slideshow) to bring back to the classroom. |

<p>| <strong>PUZZLE MANIA -</strong> |
| In partners, work on solving puzzle problems. Why are partnerships important in all areas of life and work? How does solving puzzles help with our understanding and ability to tackle bigger problems, like the UN GOALS? |</p>
<table>
<thead>
<tr>
<th>PLEASE HELP US TO CREATE A NEWSPAPER BOARD.</th>
</tr>
</thead>
<tbody>
<tr>
<td>What international Organizations are on-board with the UN Sustainable Development Goals?</td>
</tr>
</tbody>
</table>
# RESOURCES

Linking Pedagogy and Makespaces

## Pedagogies, Theories and Methods

### Waldorf Schools Resources:

<table>
<thead>
<tr>
<th>Research and Literature</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Websites and Blogs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Waldorf Teacher Resources: <a href="https://www.waldorfteacherresources.com/">https://www.waldorfteacherresources.com/</a></td>
</tr>
<tr>
<td>Association of Waldorf Schools, North America: <a href="https://waldorfeducation.org/waldorf_education/faqs">https://waldorfeducation.org/waldorf_education/faqs</a></td>
</tr>
<tr>
<td>Waldorf Schools in Canada: <a href="http://www.ourkids.net/waldorf-schools.php">http://www.ourkids.net/waldorf-schools.php</a></td>
</tr>
<tr>
<td>10 Lessons ART Educators can learn from Waldorf Schools: <a href="https://www.theartofed.com/2015/02/19/10-lessons-art-educators-can-learn-from-the-waldorf-approach/">https://www.theartofed.com/2015/02/19/10-lessons-art-educators-can-learn-from-the-waldorf-approach/</a></td>
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</tbody>
</table>

### Classroom Examples

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109
<table>
<thead>
<tr>
<th>A Day in the Life of the Waldorf Classroom:</th>
<th><a href="http://simplehomeschool.net/a-day-in-the-life-of-a-waldorf-kindergarten/">http://simplehomeschool.net/a-day-in-the-life-of-a-waldorf-kindergarten/</a></th>
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</table>

<table>
<thead>
<tr>
<th><strong>People</strong></th>
</tr>
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<tbody>
<tr>
<td>Rudolf Steiner: <a href="https://en.wikipedia.org/wiki/Rudolf_Steiner">https://en.wikipedia.org/wiki/Rudolf_Steiner</a></td>
</tr>
<tr>
<td>Twitter: <a href="https://twitter.com/waldorfed?lang=en">https://twitter.com/waldorfed?lang=en</a></td>
</tr>
<tr>
<td>Rudolf Steiner College: <a href="https://twitter.com/RSteinerCollege">https://twitter.com/RSteinerCollege</a></td>
</tr>
<tr>
<td>Vancouver Waldorf: <a href="https://twitter.com/vws_waldorf">https://twitter.com/vws_waldorf</a></td>
</tr>
</tbody>
</table>
## Constructivism, Constructionism Resources:

### Research and Literature

<table>
<thead>
<tr>
<th>Topic</th>
<th>Resource</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reconstructing Constructionism</td>
<td><a href="https://philpapers.org/rec/NOSRC">https://philpapers.org/rec/NOSRC</a></td>
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</tbody>
</table>
### Websites and Blogs

<table>
<thead>
<tr>
<th>Title</th>
<th>URL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Situating Constructionism</td>
<td><a href="http://www.papert.org/articles/SituatingConstructionism.html">http://www.papert.org/articles/SituatingConstructionism.html</a></td>
</tr>
<tr>
<td>What does constructivism have to do with my classroom?</td>
<td><a href="http://www.thirteen.org/edonline/concept2class/constructivism/index_sub2.html">http://www.thirteen.org/edonline/concept2class/constructivism/index_sub2.html</a></td>
</tr>
<tr>
<td>Resources for Constructivism</td>
<td><a href="http://www.sedl.org/pubs/sedletter/v09n03/resources.html">http://www.sedl.org/pubs/sedletter/v09n03/resources.html</a></td>
</tr>
<tr>
<td>Constructivism in Math</td>
<td><a href="http://mathforum.org/mathed/constructivism.html">http://mathforum.org/mathed/constructivism.html</a></td>
</tr>
<tr>
<td>Constructivism and online education</td>
<td><a href="http://www.trainingshare.com/resources/doo2.htm">http://www.trainingshare.com/resources/doo2.htm</a></td>
</tr>
</tbody>
</table>

### Classroom Examples

<table>
<thead>
<tr>
<th>Title</th>
<th>URL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constructionism in the classroom</td>
<td><a href="http://constructionism2014.ifs.tuwien.ac.at/papers/1.3_1-8524.pdf">http://constructionism2014.ifs.tuwien.ac.at/papers/1.3_1-8524.pdf</a></td>
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</tbody>
</table>

### Influential People

<table>
<thead>
<tr>
<th>Name</th>
<th>URL</th>
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</table>
### Design Thinking Resources:

#### Research and Literature

<table>
<thead>
<tr>
<th>Author(s)</th>
<th>Title</th>
<th>Journal</th>
<th>Year</th>
<th>Volume</th>
<th>Pages</th>
<th>URL</th>
</tr>
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<tbody>
<tr>
<td>Buchanan, R.</td>
<td>Wicked Problems in Design Thinking</td>
<td>Design Issues</td>
<td>1992</td>
<td>(2)</td>
<td>5</td>
<td><a href="#">Retrieved April 17, 2017</a></td>
</tr>
<tr>
<td>Coyne, R.</td>
<td>Wicked problems revisited</td>
<td>Design Studies</td>
<td>2005, January 1</td>
<td>26</td>
<td>5-17</td>
<td>doi:10.1016/j.destud.2004.06.0</td>
</tr>
<tr>
<td>Jarrett, K.</td>
<td>Makerspaces and design thinking</td>
<td>Education Digest</td>
<td>2016</td>
<td>(4)</td>
<td>50</td>
<td><a href="#">Retrieved February 8, 2017</a></td>
</tr>
<tr>
<td>Mathew, M. M., Perry, E., &amp; Wilson, C.</td>
<td>Design thinking and making across the curriculum</td>
<td>IS: International School</td>
<td>2015</td>
<td>18(1)</td>
<td>31-32</td>
<td></td>
</tr>
<tr>
<td>Matthews, J. J., &amp; Wrigley, C. C.</td>
<td>Design and Design Thinking in Business and Management Higher Education</td>
<td>Journal of Learning Design</td>
<td>2017, January</td>
<td>10(1)</td>
<td>41-54</td>
<td></td>
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</tbody>
</table>

#### Websites and Blogs

<table>
<thead>
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<tbody>
<tr>
<td>The design thinking process [Digital image]</td>
<td><a href="http://dschool.stanford.edu/redesigningtheater/the-design-thinking-process/">http://dschool.stanford.edu/redesigningtheater/the-design-thinking-process/</a></td>
</tr>
<tr>
<td>Design Thinking for Educators</td>
<td><a href="https://designthinkingforeducators.com/">https://designthinkingforeducators.com/</a></td>
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</table>

#### Classroom Examples

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<tr>
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</thead>
<tbody>
<tr>
<td>Design Thinking Lessons for the classroom</td>
<td><a href="https://www.edutopia.org/blog/design-thinking-betty-ray">https://www.edutopia.org/blog/design-thinking-betty-ray</a></td>
</tr>
<tr>
<td>Six Design Thinking Projects that inspire students to dig deeper</td>
<td><a href="https://www.nureva.com/blog/6-design-thinking-projects-that-inspire-students-to-dig-deeper">https://www.nureva.com/blog/6-design-thinking-projects-that-inspire-students-to-dig-deeper</a></td>
</tr>
<tr>
<td>Explore Stem Challenges, Design thinking and More</td>
<td></td>
</tr>
</tbody>
</table>
### Makerspaces Resources:

#### Research and Literature

<table>
<thead>
<tr>
<th>Reference</th>
<th>Title</th>
<th>DOI</th>
</tr>
</thead>
</table>


Fontichiaro, K. (2016, October). "Help! My Principal Says I Need to Start a Makerspace in My Elementary Library!". *Teacher Librarian*, 44(1), 49-51


**Websites and Blogs**


Transformative learning and Makerspaces: [https://www.edutopia.org/blog/classroom-makerspaces-transformative-learning-stephanie-west-puckett](https://www.edutopia.org/blog/classroom-makerspaces-transformative-learning-stephanie-west-puckett)

Makerspaces, Meeting of the Mindsets: [http://az480170.vo.msecnd.net/99596ac9-4edb-4ec1-ac49-3165040e91c4/docs/f37e359d-907a-4086-92a6-6b6cbbda06f/district-adminstration-meeting-of-the-mindsets.pdf](http://az480170.vo.msecnd.net/99596ac9-4edb-4ec1-ac49-3165040e91c4/docs/f37e359d-907a-4086-92a6-6b6cbbda06f/district-adminstration-meeting-of-the-mindsets.pdf)
<table>
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<tr>
<th>Classrooms and Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>How to turn any classroom into a Makerspace: <a href="http://www.edudemic.com/turn-classroom-makerspace/">http://www.edudemic.com/turn-classroom-makerspace/</a></td>
</tr>
<tr>
<td>Create a school classroom in 3 simple steps: <a href="https://www.iste.org/explore/ArticleDetail?articleid=103">https://www.iste.org/explore/ArticleDetail?articleid=103</a></td>
</tr>
<tr>
<td>The Maker Inspired Elementary Classroom: <a href="https://www.kaplanco.com/blog/post/2014/06/05/The-Maker-Inspired-Elementary-Classroom.aspx">https://www.kaplanco.com/blog/post/2014/06/05/The-Maker-Inspired-Elementary-Classroom.aspx</a></td>
</tr>
<tr>
<td>Renovated Learning, Makerspace Resources: <a href="http://renovatedlearning.com/makerspace-resources/">http://renovatedlearning.com/makerspace-resources/</a></td>
</tr>
<tr>
<td>Makeder Resource Library: <a href="http://makeder.org/resources/">http://makeder.org/resources/</a></td>
</tr>
<tr>
<td>The Makerspace For Education: <a href="http://www.makerspaceforeducation.com/">http://www.makerspaceforeducation.com/</a></td>
</tr>
<tr>
<td>Thinkers and Tinkers: <a href="http://hernbergm.wixsite.com/maker-movement">http://hernbergm.wixsite.com/maker-movement</a></td>
</tr>
</tbody>
</table>
People
Samatha Roslund http://samantharoslund.weebly.com/
Sylvia Martinez http://sylviamartinez.com/
Laura Fleming http://worlds-of-learning.com/
Dale Dougherty http://makezine.com/author/dalepd/
Robert Pronovost http://www.robertpronovost.com/
Krissy Venosdale http://krissyvenosdale.com/
John Spencer: https://twitter.com/spencerideas

Montessori Resources:

Research and Literature

Playful Learning and Montessori Education by Angeline S. Lillard


## Websites and Blogs

<table>
<thead>
<tr>
<th>Title</th>
<th>Link</th>
</tr>
</thead>
<tbody>
<tr>
<td>What is Montessori?</td>
<td><a href="http://www.ccma.ca/what-is-montessori">http://www.ccma.ca/what-is-montessori</a></td>
</tr>
<tr>
<td>Montessori and Nature Study</td>
<td><a href="https://s3.amazonaws.com/arena-attachments/164209/315ef2eb7921044551a801783d379a1c.pdf">https://s3.amazonaws.com/arena-attachments/164209/315ef2eb7921044551a801783d379a1c.pdf</a></td>
</tr>
<tr>
<td>Makerspace, The Montessori Message</td>
<td><a href="https://montessorimessage.net/tag/makerspace/">https://montessorimessage.net/tag/makerspace/</a></td>
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## Classroom Examples

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<tr>
<td>Inside a Montessori Classroom</td>
<td><a href="https://montessori-nw.org/inside-a-montessori-classroom">https://montessori-nw.org/inside-a-montessori-classroom</a></td>
</tr>
<tr>
<td>Montessori Learning materials</td>
<td><a href="http://undercroft.org/montessori-learning-materials">http://undercroft.org/montessori-learning-materials</a></td>
</tr>
<tr>
<td>Montessori Makespace</td>
<td><a href="http://westvancouverschools.ca/eagleharbour-montessori/portfolio/makerspace/">http://westvancouverschools.ca/eagleharbour-montessori/portfolio/makerspace/</a></td>
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## People

<table>
<thead>
<tr>
<th>Name</th>
<th>Twitter</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maria Montessori</td>
<td><a href="https://twitter.com/hashtag/montessori?lang=en">https://twitter.com/hashtag/montessori?lang=en</a></td>
</tr>
<tr>
<td>Montessori Epiphany</td>
<td><a href="https://twitter.com/__Montessori__?lang=en">https://twitter.com/__Montessori__?lang=en</a></td>
</tr>
<tr>
<td>Pedagogue Alter</td>
<td><a href="https://twitter.com/AlterPedagogue">https://twitter.com/AlterPedagogue</a></td>
</tr>
</tbody>
</table>
# Emilia Reggio Resources and Links

## Research and Literature

<table>
<thead>
<tr>
<th>Resource</th>
<th>Description</th>
</tr>
</thead>
</table>

## Websites and Blogs

- [Reggio Emilia, Room to Grow](http://www.roomtogrowcommunity.com/reggio-emilia)
- Bring Emilia Approach to higher grades: [http://dspace.library.uvic.ca:8080/bitstream/handle/1828/6958/Galloway_Alison_MEd_2015.pdf?sequence=1&isAllowed=y](http://dspace.library.uvic.ca:8080/bitstream/handle/1828/6958/Galloway_Alison_MEd_2015.pdf?sequence=1&isAllowed=y)

### Classroom and Curriculum Examples

<table>
<thead>
<tr>
<th>Fairy Dust Teaching: <a href="http://fairydustteaching.com/">http://fairydustteaching.com/</a></th>
</tr>
</thead>
<tbody>
<tr>
<td>Inspired by Reggio Emilia: Emergent Curriculum in Relationship-Driven Learning Environments: <a href="http://www.naeyc.org/yc/node/324">http://www.naeyc.org/yc/node/324</a></td>
</tr>
<tr>
<td>Reggio Approach: <a href="https://prezi.com/zzzpkt5mwa0p/reggio-emilia-curriculum-approach/">https://prezi.com/zzzpkt5mwa0p/reggio-emilia-curriculum-approach/</a></td>
</tr>
<tr>
<td>The Curious Kindergarten: <a href="https://thecuriouskindergarten.wordpress.com/tag/reggio-inspired-classroom-setup/">https://thecuriouskindergarten.wordpress.com/tag/reggio-inspired-classroom-setup/</a></td>
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<tr>
<td>The Third Teacher: <a href="https://thethirdteacher.wordpress.com/2013/09/02/photo-jpg/">https://thethirdteacher.wordpress.com/2013/09/02/photo-jpg/</a></td>
</tr>
<tr>
<td>The Environment is the Third Teacher: <a href="https://static1.squarespace.com/static/509c0d15e4b058edb8f35a86/t/50ec7590e4b0a0ad0261576c/1357673872861/TTTIdeasFlashCards.pdf">https://static1.squarespace.com/static/509c0d15e4b058edb8f35a86/t/50ec7590e4b0a0ad0261576c/1357673872861/TTTIdeasFlashCards.pdf</a></td>
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</table>

### People

| --- |
# Resources for Teaching and Learning using Indigenous Practices in the Makerspace classroom

## Research and Literature

<table>
<thead>
<tr>
<th>Resource</th>
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</tr>
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<tbody>
<tr>
<td><a href="https://education.alberta.ca/media/563982/our-words-our-ways.pdf">https://education.alberta.ca/media/563982/our-words-our-ways.pdf</a></td>
<td>Culture Matters: The Arts, the Classroom Environment, and a Pedagogy of Entewate’Nikonri:Sake : A Study in a First Nations Pre-School</td>
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## Websites and Blogs

<table>
<thead>
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<tbody>
<tr>
<td>How Indigenous Worldviews inspired a Makerspace classroom:</td>
<td><a href="http://ankn.uaf.edu/index.html">http://ankn.uaf.edu/index.html</a></td>
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<tr>
<td>Alaska Native Knowledge Network</td>
<td><a href="http://crae.mcgill.ca/article/download/1/3">http://crae.mcgill.ca/article/download/1/3</a></td>
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<tr>
<td>Our Words, Our Ways</td>
<td><a href="https://education.alberta.ca/media/3615876/our-words-our-ways.pdf">https://education.alberta.ca/media/3615876/our-words-our-ways.pdf</a></td>
</tr>
<tr>
<td>BCTF RESOURCES, British Columbia</td>
<td><a href="http://www.bctf.ca/AboriginalEducation.aspx?id=13404">http://www.bctf.ca/AboriginalEducation.aspx?id=13404</a></td>
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## Classroom Tools Examples

<table>
<thead>
<tr>
<th>Tool</th>
<th>Description</th>
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</table>

## People

<table>
<thead>
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<td>CBC Indigenous</td>
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<tr>
<td>First Peoples</td>
<td><a href="https://twitter.com/FirstPeoples">https://twitter.com/FirstPeoples</a></td>
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# Makerspace on Social Media

<table>
<thead>
<tr>
<th>Twitter</th>
<th>Hashtags</th>
<th>Facebook</th>
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| [https://twitter.com/makerspaces_
| com?lang=en](https://twitter.com/makerspaces_co
| m?lang=en) | #makered |
| [https://twitter.com/lamakerspace?
lng=en](https://twitter.com/lamakerspace?la
g=en) | #makerslowchat |
| [https://twitter.com/MakerEdOrg](https://twitter.com/MakerEdOrg) | #makerspace |
| [https://twitter.com/dalepd](https://twitter.com/dalepd) | #elemaker |
| [https://twitter.com/make](https://twitter.com/make) | #inventtolearn |
| [https://twitter.com/arduino](https://twitter.com/arduino) | #dtk12chat |
| [https://twitter.com/hackaday](https://twitter.com/hackaday) | |
| [https://twitter.com/Raspberry_Pi](https://twitter.com/Raspberry_Pi) | |
| [https://twitter.com/adafruit](https://twitter.com/adafruit) | |
| [https://www.facebook.com/ehicleun
| ehmertumakerspacegmbh/](https://www.facebook.com/ehicleun
| ehmertumakerspacegmbh/) | |
| [https://www.facebook.com/757Ma
| kerspace/](https://www.facebook.com/757Ma
| kerspace/) | |
| [https://www.facebook.com/TheM
| akerspace/](https://www.facebook.com/TheM
| akerspace/) | |
| [https://www.facebook.com/groups
| /librarymaker/](https://www.facebook.com/groups
| /librarymaker/) | |
| [https://www.facebook.com/groups
| /rutgersmakerspace/](https://www.facebook.com/groups
| /rutgersmakerspace/) | |
| [https://www.facebook.com/groups
| /429751137090798/](https://www.facebook.com/groups
| /429751137090798/) | |
Makerspace Articles of Interest

- Curriculum Guide – Makerspace for Education

- TeacherOntario Resource
  - [https://www.teachontario.ca/docs/DOC-4307](https://www.teachontario.ca/docs/DOC-4307)

- Defining Makerspaces
  - Defining Makerspaces

- ReMaking Education
  - ReMaking Education: Designing Classroom Makerspaces …

- Curious about Classroom Makerspaces? Here is how to get started:
  - Curious about classroom Makerspaces? Here's how to get …

- DIY Projects – Makerspace in the classroom
  - Makerspace in the Classroom | Make: DIY Projects and …

- Create a school Makerspace in three simple steps
  - Create a school makerspace in 3 simple steps

- Designing a School Makerspace

- ReMaking Education: Designing Classroom Makerspaces …

- The Makerspace Is Doomed

- Makerspaces: Highlights of Select Literature

- Before the Digital: What a History Can Teach Educators …

- Maker Space Ideas

- Where did the makerspace movement come from?

- City Libraries Consider Future as 'Makerspaces'

- Innovation in the Makerspace

- Makerspaces – Why Now, Why Bother

- Worlds of Making @ NMHS
# New, Old and Upcoming Robotics, Programming

## A Collaborative List of Resources (always being updated)

## Coding Tools and Usages

A collaborative doc in progress… Please add and share!

[go.gl/XiPxhr](#)

<table>
<thead>
<tr>
<th>Tool</th>
<th>Coding Platform</th>
<th>Coding Experience Needed</th>
<th>Lesson Planning Possibilities</th>
<th>Resources Available</th>
</tr>
</thead>
</table>
| **HOUR OF CODE**<br>Drag & Drop/Blockly<br>Online program<br>2D On screen figures | | Beginner | • No teacher preparation  
• Students can partner for tasks if limited devices  
• Limited time needed to complete tasks  
• Can be used when other lessons have been completed | [https://hourofcode.com/ca](https://hourofcode.com/ca) |
| **SCRATCH**<br>Drag & Drop/Blockly<br>Online program<br>2D On Screen figures | | Beginner to Advance | • No teacher preparation  
• Pre designed challenges and lessons  
• Students can make an account or use classroom account  
• Open design capabilities | [https://scratch.mit.edu/](https://scratch.mit.edu/) |
| **Dash & Dot**<br>Drag & Drop/Blockly<br>IPAD Application<br>3D Robot | | Beginner to Intermediate | • No teacher preparation  
• Pre designed challenges  
• Multi-person interaction  
• Collaborative problem solving  
• Open design capabilities | [https://www.youtube.com/watch?v=LA9py48X6_o](https://www.youtube.com/watch?v=LA9py48X6_o) |
<table>
<thead>
<tr>
<th>Robotics Platform</th>
<th>Device Requirements</th>
<th>Learning Levels</th>
<th>Features</th>
<th>URL</th>
</tr>
</thead>
</table>
| Ozo Bot              | IPAD Application    | Beginner to Intermediate | - No teacher preparation  
- Pre designed challenges  
- Multi-person interaction  
- Collaborative problem solving  
- Small (very little storage space needed!)  
- Open design capabilities  
- Multiple entry points | [http://ozoblockly.com/](http://ozoblockly.com/) |
| Sphero               | IPAD Application    | Beginner to Intermediate | - No teacher preparation  
- Pre designed challenges  
- Teacher can set up class accounts and monitor student usage  
- Multi-person interaction  
- Collaborative problem solving  
- Small (very little storage space needed!)  
- Open design capabilities  
| NXT Lego Mindstorm   | Software Required   | Intermediate    | - Changeable Robot design for various challenges  
- Incorporates building and programming  
- Use of sensors  
- Programmable using NXT Programming Language  
- Tutorials available | [https://www.youtube.com/watch?v=UZFoHjnkVCw](https://www.youtube.com/watch?v=UZFoHjnkVCw) |
<table>
<thead>
<tr>
<th>Product</th>
<th>Required Software</th>
<th>Level</th>
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</table>
| VEX Robotics | VEX Robotics Software Required Robot C Programming | Intermediate to Advanced | - Changeable Robot design for various challenges  
- Incorporates building and programming  
- Use of sensors  
| MBOT Drag & Drop/Blockly PLUS: Arduino Programming Language | IPAD Application and Online Program 3D Robot | Intermediate To Advance | - Software downloading  
- Bluetooth capabilities  
- Multi-person interaction  
- Collaborative problem solving  
- Small (very little storage space needed!)  
- Open design capabilities  
- Multiple entry points | [http://www.mblock.cc/download/](http://www.mblock.cc/download/) |
| Circuit Scribe | | Intermediate To Advance | - Small / affordable  
- Predesigned lessons online  
- Links to various Curriculum expectations  
- Open design capabilities | [https://www.circuitscribe.com/](https://www.circuitscribe.com/) |
| Spark Fun's toolkit | | | - Small / affordable  
- Predesigned lessons online  
- Links to various Curriculum expectations  
- Open design capabilities | Kits:  
[https://www.sparkfun.com/products/13086](https://www.sparkfun.com/products/13086) |
| Hummingbird Robotics | Beginner, Intermediate to Advanced | • small / affordable  
• Predesigned lessons online  
• Links to various Curriculum expectations  
• Open design capabilities | Kits:  
http://www.hummingbirdkit.com/  
Hummingbird Tutorials  
http://www.hummingbirdkit.com/learning/tutorials |
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<td>Drag &amp; Drop Programming: Scratch</td>
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<td>Block-based visual programming environment compatible with Windows, Mac, and Chromebooks</td>
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<tr>
<td>Snap!</td>
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<tr>
<td>Like Scratch but supports more complex programs; appropriate for beginners and intermediate programmers</td>
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<td>Visual Storytelling</td>
<td>CREATE Lab Visual Programmer</td>
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<tr>
<td>A story-boarding approach for novice programmers</td>
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</tbody>
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| ARDUINO Arduino Programming Language | Intermediate to Advanced | • Open source program  
• Pre designed challenges  
• Open design capabilities | Tutorials  
https://www.arduino.cc/ |
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<td>Snap Circuits Computer Application Compatible with Java, Python, C, Scratch</td>
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<td>small / affordable&lt;br&gt;Predesigned lessons online&lt;br&gt;Links to various Curriculum expectations&lt;br&gt;Open design capabilities</td>
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<td><strong>Makey Makey</strong></td>
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<td>Makey Makey Computer Application Compatible with Java, Python, C, Scratch</td>
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<td><strong>Lilypad Design Kit</strong></td>
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</table>
| **Minecraft EDU** Computer Application Compatible with Java, Python, C, Scratch | Beginner to Advanced | · small / affordable  
· Predesigned lessons online  
· Links to various Curriculum expectations  
· Open design capabilities | **Tutorial:**  
https://education.minecraft.net/worl ds/tutorial-world/  
https://education.minecraft.net/mine craftedu/ |
|---|---|---|---|
| **Cublets**  
**Cubelets Blockly:** free coding environment for Cubelets® robot blocks. This learning tool is powered by Blockly, which is a visual programming language originally developed by Google  
**Cubelets Flash:** Prefer the traditional approach to programming? With Cubelets Flash you can upload custom programs to any of your Cubelets by dragging and dropping C files. Cubelets Flash is the most powerful way to personalize your Cubelets. Recommended for those that want to move beyond the | Beginner to Advanced | · small / affordable  
· Predesigned lessons online  
· Links to various Curriculum expectations  
· Open design capabilities | **Kit:**  
http://www.modrobotics.com/ |
| visual programming offered by Cubelets Blockly. |   |   |   |
Discussion and Conclusions

The Maker Movement builds upon a broader cultural shift toward a do-it-yourself approach to life, where people take pride and pleasure in creating things personally rather than only consuming mass-produced goods (Resnick & Rosenbaum, 2013). This idea is also tied to Indigenous principles which put high value in learning from the community, the elder, and learning through experiences and by putting the child at the center with emphasis on mentorship. It is also why Makerspaces have a strong connection to the First Nations, Metis and Indigenous worldviews as explained in the next few pages. Further, the connections to space, community, and family are recognized as essential in the Reggio Emilia classroom (Biermeier, 2015) along with Montessori and Waldorf schools, which emphasize connections to history, geography, social justice, and environmental education.

All three approaches view children as active authors of their development, strongly influenced by natural, dynamic, self-righting forces within themselves, opening the way toward growth and learning (Edwards, 2002). They all indicate that a child actively constructs his/her knowledge - which is at the root of the Makerspace classroom.

Reflection

Many years ago, I made the discovery that teaching is not about the tools or the teacher’s lesson, but rather is about the environment, the relationships, the community, and the constructivist pedagogies that made it work. At the time, I was unaware that the Makerspace would be the key to opening the doors to this type of learning!

Early on in my career, I developed an afterschool program called, “The Forget-Me-Nots.” When I look back at this program, I am stunned at the fact that the students attended the sessions each week. What motivated them to learn? We were not programming a robot or playing on Minecraft or Magic the Gathering. We were not creating Arduino projects, making radios with circuits, or designing a 3D object to print. We were not building with Lego, using Wii to build a bridge with Goo, or collaboratively solving physics problems in Portal 2, a Physics game intended to combine game-play with math, engineering, and science. School was not fun. In fact, we extended the school day by two hours, once per week, for these students to work (initially) solely on the pencil-to-paper literacy and math activities. There was no formal grade given for their work, only verbal feedback – and, on-the-spot). I concluded that they were motivated to come under these fairly bleak teaching conditions because they got to spend this time with their parents, and also with students from a variety of age groups and abilities. Their learning was collaborative and non-competitive, and above all, we tackled problems and projects that were authentic, “wicked,” and interesting and engaging for a variety of age groups and abilities. Students and families were served food and tea, and
they ultimately established a learning community of support, encouragement, and belonging that they often felt were missing elsewhere.

Knowledge building can also be defined as intention**al learning**, “the deliberate enhancement of skills and mental content” (Scardamalia & Bereiter, 2010, p. 4). I set out to do intentional learning with this after-school literacy program – but, what we were really doing was knowledge building. What resonates with me the most from this reflection is that knowledge building improved the knowledge of the community. For Scardamalia and Bereiter (2010), and for me, there can be intentional learning with no knowledge building, and knowledge building without intentional learning – but intentional learning with knowledge building is a powerful combination.

Even the parents and grandparents began relying on the comfort of one another, the discussion, the questions, and the support. The room set-up, as I recall, was always in a circle and the adults were asked to participate (model) along with the students. Each week, we set aside time for an art of some sort that ultimately sparked the idea to perform a play. This was my first time fully integrating the ideas and concepts around Papert’s constructionism, Reggio Emilia’s play-based learning, and Montessori’s use of real world projects to engage students. It would be my first experience teaching a project-based learning activity. And, most importantly, it was the first time that I witnessed how incredible teaching and learning can be when passion, community, integrated curriculum, and collaboration all intertwined, and when people truly worked together to reach a goal to create something meaningful to them.

Toward the end of the school year, the students in the Forget-Me-Not group wanted to shift their focus from a more traditional way of learning – and prepping for the standardized test – to something more fun and more useful, something with a purpose beyond a test score. They taught me a lot here: the intentional learning that we set out to do resulted in an authentic task, an application of what they had learned throughout the year. But none of it would have impacted them to that degree without their level of understanding that their success directly influenced their contribution to the community, to something or someone outside of themselves. Along with other students in the school, the students in the Forget-Me-Not program directed, produced, and performed in a play that year – The Lion, the Witch and the Wardrobe – where they performed to more than 1,000 people across the school district.

Since then, I have been involved in some pretty exciting projects, all of which have been documented in my blog, but none stick to my heart as close as this one. These students were so committed to this project, that even in extreme heat, power outages, and long days, they performed in heavy costumes under bright lights as if it were the best thing they ever did. Students who could not read at the start of the year memorized every single line of the play, just in case they had to fill in. Those who were self-proclaimed ‘bad’ artists and builders spent
days painting backdrops and sets, and those that could not build or sew learned the art – and there was no YouTube at that time!

It was the final night and the curtains closed for the last time. I remember feeling incredibly proud as I watched the cast and crew, one by one, come onto the stage to perform the last bow for the cheering crowd. I sat behind the switchboard in the middle of the audience. As co-director of the play, I was charged with the many rehearsals, leading different groups – stage managers, choreographers, sets, costumes and the transitions from scene to scene. This would also be my first time using a sound and light board and creating a mixed CD that would be used to control sound effects during the performance. I had to pause and play through the entire presentation. The rest was up to the students: the set change, the lighting, and even line assistants who sat at the front of the stage, looking up at the little actors and actresses reading line by line, waiting for the cue to help. Ironically, at the start of the year, these were my low readers. By the final applause, I could hardly breathe as the emotion had overtaken me. It was more than the play; these students learned so much more in those eight weeks than they ever did during that Forget-Me-Not program.

I learned that providing my students with a chance to build, design, and create actually, “allowed time to think, to dream, to gaze, to get a new idea and try it and drop it or persist, time to talk, to see other people’s work and their reaction” (Papert & Harel, 1991, p. 1). The play itself formed a Maker Culture. Could this type of teaching and learning be the norm? How could I engage my students enough on a daily basis so that they fully and completely wanted to learn – not for a grade, an assessment, a point, or a reward, but because they felt purpose and wanted to contribute to something bigger than themselves? The emotion that I felt that night was because I recognized that the best thing I could do as a teacher was to provide my students with authentic experiences that matter to them, always.

Around the same time, it was the key messages of the new Ontario curriculum that truly impacted my thinking about education; it had me wondering why we were so rigid in our teaching methods and about the strategies and pedagogies that were being used in the classroom. In fact, it was the message that I posted in my classroom and my daybook that struck me the most, a message that perhaps acted as my catalyst to become what others may see as an outlier – but what I consider to be an activist and advocate for change. This is the message that led me to become an innovative educator with a strong focus on social justice:

*Literacy is about more than reading and writing – it is about how we communicate in society. It is about social practices and relationships, about knowledge, language, and culture. Literacy … finds its place in our lives alongside other ways of communicating. Indeed, literacy itself takes many forms: on paper, on the computer screen, on TV, on posters and signs. Those who use literacy take it for granted – but those who cannot use it are*
excluded from much communication in today’s world. Indeed, it is the excluded who can best appreciate the notion of “literacy as freedom.”

-UNESCO, 2003

The above quote has far greater impact now that students and educators are connected and have greater access to information and tools than we have ever had – at least, in the Western hemisphere. This quote was written as a precursor for what would come and how we would turn education upside down, turning back the clock on a student-centred, inquiry-driven pedagogy where students discover, create, interact, and make.

I conclude with a quote from Hatch (2014):

*Whenever one joins a movement, one changes. This is a good change. Embrace it. Participating in the Maker Movement is a personal journey. Each will look different. No two makers are exactly the same. No two paths will be the same. But you will change. You will begin to see the world through the eyes of someone who participates in creating. You will look with wonder again at great artisanship. You will wonder how someone was able to design this or that, and you will begin to appreciate local artists, designers, architects, and artisanship in your community. You will wonder where something was produced and who made it – you will look for the story behind the artisanship You will ask about local talent and local sources for things you never dreamed you cared about before. (p. 31)*


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