PROMOTING GROWTH MINDSET IN MIDDLE SCHOOL WOODWORKING CLASS: AN ELEMENTARY TEACHER'S JOURNEY FROM THE CLASSROOM TO THE WOOD SHOP

by

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Promoting Growth Mindset in Middle School Woodworking Class: An Elementary Teacher's Journey from the Classroom to the Wood Shop.

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To my parents, who encouraged me to pursue my educational goals while remaining grounded by working with my hands. To my partner for her unrelenting encouragement and support. To all those who supported me throughout this journey, a heartfelt thank you.

Abstract

Woodworking in middle schools today owes a great debt to the work of Salomon who developed Educational Sloyd in Sweden at the turn of the 20th century. The aims were less about promoting manual training with tools and more about promoting the development of an appreciation for hard work, perseverance, and problem solving in school children.

This forms the backdrop for my research and is further informed by Dewey's view that children should be actively engaged in the process of learning in a hands-on manner. In addition, Vygotsky's theory that education is a social process where students are guided by more advanced peers to their learning allows one to see that woodworking is the ideal class to apply these concepts. By challenging students with difficult yet engaging projects, woodworking allows them to exercise their agency where they are able to develop what Bandura refers to as their self-efficacy. Combining these notions together with Dweck's concept of growth mindset, where it is argued that one's abilities can be improved through hard work, persistent effort and asking for help when they are stuck, students can develop a growth mindset.

Creating a middle school woodworking program that infuses a growth mindset approach into all areas of the curriculum allows students to learn in a supportive environment that promotes self-reflection and encourages learners to develop a positive mindset. As students learn to woodwork, they strengthen their belief that they can gain the necessary skills and abilities needed to successfully create the artifacts in class. In providing challenging projects for the students to work on, it affords them the opportunity to work hard, persevere in the face of adversity and learn to problem solve. This allows students to develop a growth mindset and

view learning as an ongoing iterative process where setbacks are seen as normal and necessary course of action.

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Promoting Growth Mindset in Middle School Woodworking Class: An Elementary Teacher's Journey from the Classroom to the Wood Shop

Chapter 1: Introduction

Introduction

Through narrative inquiry, this paper will explore how middle school woodworking Technology Education teachers can help students embrace a growth mindset. With individualized support, classroom activities and assignments as well as challenging hands-on curriculum, students in woodworking classes can learn to see setbacks and challenges as merely a part of their learning journey.

Background Information

In my own life, I hit the reset button a few years ago. It was an unsettling, challenging yet invigorating time for me. Faced with daunting circumstances, I knew that I would be able to successfully overcome the obstacles and challenges that were to come my way because of my perseverance. My determination was due to learning from past experiences where I had managed to successfully navigate difficult situations. The growth mindset that I had developed over the years had prepared me for that very moment in time. Buoyed by my resilience, I decided that it was also time to move out of my comfort zone in my professional life. After 18 years teaching grade two and three French Immersion, I felt that I had reached a point of professional stagnation and it was time for a radical change. Auspiciously, an opportunity to

pursue higher education presented itself that gave me the chance to reimagine my career. Midway through this Master's degree program, I accepted a position to teach woodworking at a new middle school; I had taken the first few steps and walked on to a new career path. I knew that I had much to learn, but I had the drive to succeed.

As I prepared to make the transition from the classroom to the woodshop, I drew upon my life's experiences and the lessons learned to help guide me in this new adventure as a woodworking teacher. I had two guiding questions that would help me define my new role. Firstly, I wanted to know what the original intent was for the inclusion of woodworking in middle schools. This would allow me to understand the historical and philosophical context of my new position. Secondly, I wondered if I could also help my students develop a growth mindset within the woodworking program that I was developing. This is particularly important to me, as I realized that a significant number of students that I teach live in high-density neighbourhoods where they have limited space and opportunities to work with their hands. The answers to these questions would lead me to discover for myself what it means to be a middle school woodworking teacher while at the same time provide students with opportunities to explore working with their hands and embracing a growth mindset.

In the following pages I will explore both of these questions, with a focus on how woodworking at the middle school level can be particularly well-suited to developing a growth mindset in young learners.

Historical Underpinnings Of Woodworking In Canadian Schools

To understand the raison d'être for the inclusion of woodworking in middle schools, it's important to acknowledge the origins of craft education in Europe and how it made its way into

Canadian schools. During in the Industrial Revolution, which reimagined Europe's educational systems, Johann Pestalozzi (1746-1827) advanced the idea that "craft training had to be embedded in peoples' general education" so that education would be both practical and relevant to their lives (Olafsson & Thorsteinsson, 2012, p. 3). Building on Pestalozzi's ideas, Uno Cygnaeus (1810-1888) argued that "because craft education was not geared to gaining a profession, the teaching was also supposed to be conducted by a folk school teacher with pedagogical training" (Kantola, & Rasinen, 2006, p. 60). In this way, a teacher would be better able to focus on the individual needs of the child rather than solely on the manual skills needed for vocational training (Olafsson & Thorsteinsson, 2012).

Cygnaeus was also influenced by the works of Friedrich Fröbel (1782-1852), who promoted the notion of play and active learning as essential to a child's education, in order to promote an exploratory educational model that would take advantage of the natural curiosity of children (Ruth, Campos et al, 2010), (Borg & Erixon, 2006), (Kantola, Nikkanen, Kari, Kananoja, 1999) & (Rasinen, & Rissanen, 2010). Taking Fröbel's ideas further, "Cygnaeus emphasized the school's role in developing children's personality and emotional and physical resources" (Rasinen, & Rissanen, 2010, p. 183) through active hands-on learning. It is clear that Cygnaeus understood the modern parlance of "teaching the whole child" and the need to allow for students to develop what is now referred to as 'social and emotional learning' skills. Cygnaeus' ideas influenced his contemporary Otto Salomon (1849-1907), who in turn developed the Educational Sloyd model, instituted in Swedish schools at the turn of the 20th century and later adopted in many other countries (Olafsson & Thorsteinsson, 2012), (Borg & Erixon, 2006). The main focus of Salomon's Educational Sloyd model was not on manual skills, but rather the development of psychological attributes and mindsets in children through woodworking

(https://inside.ewu.edu, 2021). According to Salomon, the aims of Educational Sloyd were divisible into two classes – formative and utilitarian.

The formative aims were:

- To instill a taste for and an appreciation of work in general;
- To create a respect for hard, honest physical labour;
- To develop independence and self-reliance;
- To train in the habits of order, exactness, cleanliness and neatness;
- To train the eye and sense of form;
- To give a general dexterity of hand, and to develop touch;
- To accustom to attention, industry, perseverance and patience;
- To promote the development of the physical powers;

The utilitarian aims were:

- To directly give dexterity in the use of tools; and
- To execute exact work (Salomon, 1898, pp. 6-7).

Salomon further elaborated that "Educational Sloyd has also in view the development of mental power, or, in other words, is disciplinary in its aim" (Salomon, Nordendahl & Johansson, p. 1891, p. 2). Salomon recognized the interconnected nature between the physical and mental aspects necessary for learning; through hands-on work, positive habits of mind could be developed. Educational Sloyd allowed students to not only develop their manual dexterity and hone their skills with tools, but also taught students mental fortitude and discipline, the value of hard work, the ability to develop their sense of self-reliance, and to foster perseverance when faced with adversity. Many of these attributes are foundational in promoting the development of a growth mindset. Salomon further argued that his Educational Sloyd system helped in the

development of well-rounded European citizens as a result of the focus on the formative aims and not solely as a means to provide technical education for vocational work (Salomon, 1898). The wholistic approach of Educational Sloyd; however, would seem to have been at odds with the political and economic challenges of industrialization faced by many countries at the time, including Canada. Nevertheless, a form of Educational Sloyd made its way into the Canadian educational system in the early 1900's.

Through a sizable donation by Sir William Macdonald, a major Canadian tobacco manufacturer and philanthropist, manual training gained a foothold in Canada (British Columbia, 1909); (Wikipedia, 2021). Macdonald donated funds to establish manual training centers in a number of high schools located in large cities across Canada in order to train and produce a skilled workforce on which to draw upon (British Columbia, 1909). The two high school training centers in British Columbia were located in Victoria and Vancouver. As a result, manual training became part of the general education of students at these schools by 1900 (British Columbia, 1909). Harry Dunnell, the first Inspector of Manual Training schools for the province at the time, promoted Salomon's Educational Sloyd model in these two schools and strongly suggested that every manual training "instructor must also be a qualified public school teacher" as they would emphasize the formative aims of Sloyd above the utilitarian ones (British Columbia, 1909, p. B33). Dunnell's successor John Kyle, who became the organizer of Technical Education in the province, took manual training in a different direction. Kyle's approach was more geared towards vocational training and gave rise to Industrial Arts programs in schools (British Columbia, 1917). Under his direction, the program expanded to include more schools throughout the province. In junior high schools manual training was taught, which loosely followed some of Salomon's aims, and in high schools, students had the opportunity to

enroll in pre-vocational training which would better prepare them to enter the workforce (British Columbia, 1917). Today, Technology Education falls under the purview of Applied Design, Skills and Technology (ADST) and to a large extent, it follows the model established by John Kyle (https://curriculum.gov.bc.ca, 2021).

Although schools in British Columbia follow Kyle's approach, with manual training leading to vocational training, much of the core argument for its continued inclusion in education to this day still relies heavily on the work of Salomon. A document posted in 2018 on the Vancouver School Board website blog entitled "21 reasons why school shops are important in the 21st century" highlights this fact - See Appendix A (New England Association of Woodworking Teachers, (n.d.). Many of the reasons listed in this document echo the formative and utilitarian aims of Salomon's system of Educational Sloyd which had been developed over 120 years ago. The impact of Salomon's contributions are still felt today in the manual training programs found in middle schools throughout British Columbia.

The preceding brief historical and philosophical overview of Educational Sloyd, and the influence it had on manual training programs in British Columbia, provides an important context and helps inform my efforts to create a woodworking program which fosters growth mindset in students.

Educational Context for Growth Mindset

Carol Dweck's work advances the idea that "a growth mindset is the belief that personal characteristics, such as intellectual abilities, can be developed" (Yeager & Dweck, 2020, p. 1270). Dweck argues that "intellectual abilities can be cultivated and developed through application and instruction… and that everyone can improve their underlying ability" (Dweck,

2014, p. 2). In an educational context, this means that students must put forth the necessary effort and practice the desired skills or abilities. Conversely, teachers provide support with appropriate strategies and guidance to help students move towards a growth-oriented mindset (Dweck, 2009). By encouraging students "to try new strategies and seek input from others when they're stuck" teachers can demonstrate their belief in their students' ability to succeed (Dweck, 2015, p. 1). With guidance and encouragement, students can learn to embrace the idea that they are capable of acquiring the skills and knowledge needed to achieve their goals and over time develop growth mindset.

Growth mindset emerges out of the constructivist and social learning theories. John Dewey (1933-1998) states that in order to engage students in the learning process, "the teacher should observe the interest of the students, observe the directions they naturally take, and then help them develop problem-solving skills" (Sikandar, 2016, p. 197). Starting with the interests of children as the impetus for learning helps to promote student engagement which in turn encourages them to persevere when faced with setbacks. With carefully planned lessons teachers can engage students in personally relevant curriculum through which they will learn to problem solve. The teacher's role then is to help guide the child's efforts in this process and allow them to discover and learn for themselves rather than to simply provide the solution to them.

Dewey argued that the classroom is a social environment where students work together to problem solve alongside peers while constructing knowledge for themselves (Williams, 2017). Through peer to peer mentoring and with the help of the teacher, students can use problems they encounter as opportunities to build knowledge and develop skills to overcome them. Working in a supportive cooperative learning environment helps to encourage students to persevere in the face of adversity. Further, when students see their peers struggle and eventually succeed as a

result of hard work, problem solving and learning new skills, they themselves are more apt to push themselves to do the same.

This is particularly important as it forms the basis of Vygotsky's social learning theory argument that students learn from each other and that skills can be developed through the social interactive process of constructing meaning and learning. Vygotsky's Zones of Proximal Development (ZPD) "reflects a cultural process of assistance through cooperation and collaboration" (Levykh, 2008 p. 90). Learning then is most effective, Vygotsky argues, when a child can work in collaboration with a person who is more advanced than them in order to accomplish a task that was once beyond their grasp (Levykn, 2008). Thus, a collaborative and supportive learning environment allows students to see the acquisition of intelligence and abilities as a malleable process; a key tenet of growth mindset. As students build on their successes, become more able to problem-solve and complete tasks independently as well as being given the chance to assist their peers, they gain a greater understanding of what it takes to be successful.

In my teaching practice, this process can be readily observed in the classroom. When I may be temporarily unavailable to offer assistance, students are able to draw upon their classmates' skillset for help. Peer to peer teaching and problem-solving is actively encouraged in class as it allows the 'teaching' peer to deepen their understanding of the process and the 'student' peer to learn the steps needed in order to complete the task. Students need to be reminded periodically, that to mentor a peer entails explaining and demonstrating how to perform a task as well as reteaching if necessary, rather than simply doing the work for someone for the sake of expediency. Peer mentoring also allows students to realize that the skills they've learned enable them to contribute to the process of fostering a growth mindset in others. In the

case of problem-solving, students can draw on upon the collective knowledge and skills of peers in order to come up with possible solutions to a problem. For novice woodworkers with limited skillsets, this can prove to be difficult and at time frustrating which may require some teacher intervention to help guide the process along and help strengthen their problem-solving skills.

The work that students produce demonstrates the development of their manual skills as well as the growth in their problem-solving abilities. The artifacts that they produce encapsulate the struggles encountered in the pursuit of their goals. It is important to allow students the chance to repeat an operation or an entire project, if they so choose, as their results will be superior to their first attempts. In order for students to gain personal insight from, and for the learning to be deeper as a result of these experiences, it is important to periodically point out the strides and setbacks that students have made and encountered in their learning journey. Once students complete their projects, reviewing both the successes and failures during the evaluation phase allows students to see this as a normal part of the learning process. By reframing students' experiences and focusing on what they learned as a result of their triumphs and setbacks puts more emphasis on the learning rather than the end result. These discussions with students should endeavour to uncover the internal mental dialogue, both positive and negative, which contributed to or negatively influence their ability to be successful. This debriefing process allows students to learn about themselves and how they respond when faced with adversity. As a result of these one on one discussion, students are able to see for themselves that they were able to learn the necessary skills needed to overcome the problems they encountered and as a result find success. Parallels can be drawn as to how this same approach could apply in the students' own personal lives outside of the wood shop. This would encourage students to embrace growth mindset in other areas of their lives. By engaging students in an ongoing conversation about their learning

while in class, students are able to gain perspective on the growth they've made as a result of the struggles and hard-fought successes.

Helping students to develop the manual skills as well as the mental fortitude to persevere through difficult challenges, supports the development of what Duckworth calls 'grit' (Duckworth, 2007) & (Duckworth & Gross, 2014). As students start to internalize the idea that in order to succeed, they must work hard at the task and demonstrate 'grit', then they will be less likely to give up when faced by adversity. Bandura states that "if people experience only easy successes, they come to expect quick results and are easily discouraged by failure. A resilient sense of efficacy requires experience in overcoming obstacles through perseverant effort" (Bandura, 1994). By providing curriculum that is engaging yet challenging, with plenty of opportunities for failure, while at the same time being encouraged and supported by their peers and their teacher, students are much more likely to see themselves as being capable of success. What better classroom environment where students can gain experience overcoming setbacks and start developing a growth mindset than in a middle school woodshop.

Growth Mindset in The Wood Shop

Middle school woodworking teachers are uniquely positioned to take advantage of their distinctive course to promote a growth mindset in students. Because of the inherent hands-on nature of woodworking, students are more receptive to the idea that they will need to step out of their comfort zone in order to be successful. Additionally, the fact that woodworking is a novel experience, most students are motivated to actively participate in part because they haven't yet had the opportunity to test their natural woodworking abilities. Further, due to the fact that it is assumed that students possess little to no previous woodworking experience, and it is made clear

that they will be taught and supported throughout the entire process, students trust that they will be successful in learning the necessary skills. As Dweck states "students can show greater motivation to learn when they are led to construe their learning situation as one in which they have the potential to develop their abilities" (Dweck, 1999, as cited in Yeager, Romero, Paunesku et al., 2016, p. 374); (Dweck, 1988). With an eye on Educational Sloyd's formative aims, the shop teacher can guide students as they develop new skills and abilities, learn to problem solve in order to fix their mistakes while at the same time encourage them to cultivate positive habits of mind throughout the learning process. Through carefully chosen and engaging projects that will challenge both their physical and mental abilities combined with classroom discussions and activities discussed below, students are afforded the opportunity to adopt more advantageous habits of mind.

By developing a three-year woodworking program within the middle school framework, which employs a scope and sequence of the skills needed to build the progressively more complex projects, students not only learn to master skills, but they also become more open to the idea of learning skills in the future to undertake new challenges. This gradual development of skills in the woodshop allows students to transpose this approach to new challenging situations in other areas in their lives with greater ease and confidence in themselves. This also helps students come to the realization that if they are not able to solve their problem with their current skillset, then by learning new skills they may be able to overcome any future setbacks.

In the program that I created, the scope and sequence of skills begin with the use of hand tools and a drill press. These tools are developmentally appropriate for novice grade six students. In the first year of this program, students focus on measuring accurately, cutting with handsaws and drilling holes. They then use various fasteners to assemble a two-piece beach

chair. Once the chair frame is complete, students learn to sew a hem along the edges of the canvas which will form the backrest. The canvas is then attached to the frame to complete the project. While being a relatively simple assignment, students struggle with a number of the steps involved. The opportunities for peer to peer support and problem-solving are plentiful throughout this project. This challenging beginner endeavour also supports the work done by their regular classroom teachers. It does so by allowing students to apply the measurement and geometry skills learned in Math class which helps them experience, what Bandura terms, mastery of experience (Bandura, 1994). Many of these skills learned and applied in grade six are reinforced in the following years.

In grade seven, students create a lidded wooden box from a predetermined length of wood stock. Using an assortment of tools, such as: a handsaw, bandsaws, routers and sanders, students complete the project. By introducing machinery, students are given more responsibility and learn to work to a higher degree of accuracy. As in the previous year, students will problem solve in order to overcome various mistakes made during the process. When students face catastrophic setbacks and are forced to completely restart all or part of their project, they invariably demonstrate a higher degree of proficiency and mastery of the skills needed for each process. Students catch up quickly to their peers and most often produce superior results to their first attempts. The skills mastered and lessons learned over the past two years are caried forward into their third year of woodworking.

In their final year in middle school, eight grade students have the choice to either challenge themselves to design and build their own project or to construct a pre-designed project, following step by step instructions, made available to them. This affords students the chance to learn how to use the final few machines in the shop and to demonstrate their level of mastery of

their aggregate skillset to date. While each class is unique, the majority of students elect to design and make their own project to meet an identified personal need. This demonstrates that many students are not only confident that they'll be able to successfully apply their newly acquired skills to create desired artifacts, but more importantly, it shows that they are also willing to work hard and to acquire more skills in order to accomplish their goal. This suggest that students are embracing a growth mindset.

Because the woodworking projects that students work on each year are challenging, they derive a great deal of satisfaction and pride and enjoy once complete. Students return the following year eager and motivated to further develop their manual skills in the wood shop with a greater openness to taking risks in their learning. Having experienced success in the past in part: due to their growing skillset, the on-going one on one discussions and whole class activities, students become increasingly aware of their internal thoughts and beliefs. As a result, students are able to take further steps along their journey towards developing and embracing a growth mindset.

Classroom Activities to Help Promote a Growth Mindset

As an educator, I am consciously aware of the need to create classroom activities to help move students beyond limiting beliefs and to promote the development of a growth mindset. The following discussion outlines some of my efforts to date.

At the beginning of each new class rotation throughout the year, establishing rapport with students is crucial in order to build trust. Building trust is essential as students are more likely to take risks in their learning when they trust that that they are cared for and that their learning needs will be met (Levykh, 2008; Noddings, 2012; Ryan & Deci, 2000). During the first class, I

allow myself to be vulnerable in front of my students as I introduce myself by sharing some of my family history and invite them to do the same by sharing a little about themselves. By focusing the conversations on their unique family characteristics and their individual interests, a respectful and accepting tone is established that celebrates diversity and individual unique talents. The intention is for students to realize that no two people are the same nor do they possess the same aptitudes. As such, everyone brings a different set of skills and abilities to the woodworking classroom. This activity helps to establish trust and understanding between teacher and students as well as peer to peer and helps to reinforce the message that everyone is accepted and belongs (Katz & Lamoureux, 2018). Once complete, this is followed up with a whole class "growth mindset / fixed mindset preassessment" activity (Silver & Stafford, 2017, p. 77). This assessment tool allows me to get a sense of where students are at with regards to their beliefs and mindsets and helps direct future whole class as well as individual discussions.

The next few classes are devoted to shop safety, setting classroom expectations and outlining the details of each grade specific project(s). Students are then introduced to their goal-based journal in which they will document their learning while in the shop. For their first journal entry, students discuss their experience to date with using tools; woodworking or otherwise. They are also encouraged to identify any skills they wish to acquire or further develop in order to be successful in the woodworking Explorations course. The goal-based journal is a tool that students can also use at any point during the class to document and reflect on their learning process; including successes and setbacks they encounter (Hussein, 2018). I advance the idea for students to see setbacks as "First Attempts In Learning" or 'FAIL' moments, a phrase coined by Dr. A.P.J. Abdul Kalam (cited by Karelius, 2021). I encourage my students to view 'FAIL' moments as being beneficial experiences, as much can be learned as a result of these struggles.

Interestingly, once students have experienced a 'FAIL' moment and have had the chance to reflect on what went wrong as well as identifying what their next steps need to be, students are very receptive and much more focused on learning the skill(s) necessary to move forward. At the end of the course, the students' final entry into their goal-based journal is to review their stated goals and determine their level of success. They are also encouraged to explore whether they feel they have greater confidence in themselves to learn the necessary skills or abilities to overcome future challenges. The purpose of the goal-based journal is to provide students with the opportunity to set goals, to be self-reflective and to document their learning journey while in the wood shop.

One grade seven student shared a story of her growth and how she overcame her fear of using the bandsaw in her growth-based journal. This quiet and reserved student remarked that she had been absolutely terrified of the bandsaw upon seeing the exposed blade's sharp teeth during the initial shop tour. Her fear was reinforced during the safety talk and demo for the bandsaw as it cut so frighteningly easily through wood. She remarked that it reminded her of the meat cutting bandsaw she'd seen at her local grocery store and couldn't get the thought of the saw slicing through her hand, out of her mind. As time went on and after seeing her peers be successful using the saw with help from me, she decided to try using it. After also experiencing success with the saw with my help, she continued to be apprehensive about using the saw and had her peers help her double and triple checking that she'd taken all the safety precautions necessary before operating the machine. By the time this student had completed building a box with a lid and was ready for the evaluation, she joyfully exclaimed that she had successfully overcome her fear of using the bandsaw and it was now her favourite machine in the shop and that she felt comfortable using it. After the evaluation was complete, she decided to make

another project using the bandsaw and was also helping her classmates stay safe by pointing out safety violations other students were committing with the bandsaw.

Beyond the goal-based journal, grade eight students are tasked with documenting the process they go through with their projects. This entails taking photographs of the iterative process that they go through from designing, building, and redesigning to fix any areas that may need to be improved upon. These images are then uploaded to the student's individual online digital portfolio with a brief caption for each image of what they were working on at the time. This is done for two reasons. The first reason is to help keep students accountable to themselves during the designing and building stage and to be used later in the assessment process at the end of the woodworking course. The second reason why students are asked to document their work is to contribute examples of their learning in different learning environments and to remind themselves of instances where they were able to demonstrate growth mindset. These memories can also be used in future years as part of their Grade 12 graduation portfolio.

Once students complete their projects, they take part in an evaluation of their work as well as a discussion on their personal growth. During the evaluation, student present the artifact that they made and review the challenges and successes they encountered while working on their project. The evaluation is comprised of two parts. The first part of the assessment looks at the object that the student created and is measured in relation to the rubric, which the students are able to refer to at any time in order to inform their decisions when working on their projects. The second part of the evaluation is where students have the opportunity to discuss how they feel their manual skills have progressed in relation to what they outlined at the beginning of the course in their goal-based journal. Students also highlight any intrapersonal growth they made towards embracing a growth mindset as well as the highs and lows of their learning journey

throughout the course. The purpose of these discussions is to frame the students' experiences as part of their learning as journey and to encourage them to embrace the challenging moments as necessary in order to move their learning forward. Once complete, the overall mark is determined in conjunction with the students and encompasses both the quality of the object they created while taking into account the development of their skillset and the growth that the student made.

As a final way to encourage student self-reflection, at the end of each class as the they clean up, I ask a few students to share what they learned that day and what they hope to accomplish the following class. I give intentional feedback and encourage the students to be reflective of their work and facilitate the opportunity for them to see how their skills have developed. I will often ask them, if they had another opportunity to create the same project what they would do differently. This is all done with the goal of building and nurturing honest and supportive relationships with my students in the hopes of encouraging them to embrace a growth mindset.

Statement of the Issue/Problem

After an extensive review of the literature, to my knowledge there have been no studies done on how woodworking can be used to promote growth mindset. There have been; however, numerous studies and articles written about how growth mindset can be promoted where academic subjects are taught (Boaler, 2013; Bean, 2019; Strahan, Hansen, Meyer et al., 2017; Wakefield, 2019) as well as non-academic subject such as: Makerspaces, engineering, STEM and industrial design (Dougherty, 2012; Kamaruzaman, Ismail, Daud & Jusoh, 2020; Martin, 2015; Steier & Young, 2016). Unfortunately, in many of these studies, mindset skills are taught as standalone lessons which leads to limited long-term adoption of more advantageous mindsets

in students (Dweck & Yeager, 2019). For efforts to have deeper and longer lasting positive effects, growth mindset needs to be fully integrated into every aspect of the classroom setting (Dweck & Yeager, 2019). As was discussed above, and what will be presented later in chapter three, the goal of program that I am developing is to integrate and promote growth mindset into all aspects of the woodworking course. However, before this program can be successfully implemented by other shop teachers, they would first need to ensure that how they communicate to and interact with students supports of these aims.

Prior to implementing these strategies, teachers would first want to become aware of their personal belief, bias and unconscious tendencies that may reinforce fixed mindsets. Teachers need to "confront their own beliefs and ensure that they are able to communicate a growth mindset to their students" (Zeeb, Ostertag & Renkl, 2020). To simply encourage students to take learning risks and to push themselves to develop new skills is not enough. Teachers' own mindsets have profound influence on whether students adopt growth mindsets (LaCosse, Murphy, Garcia, et al., 2020; Wakefield, 2019). One area where shop teachers should pay particular attention when working with students, is to guard against 'helping' students by doing the work themselves as this only reinforces a fixed mindset. In these instances what is unfortunately communicated to the student is that they aren't capable of independently doing the particular task themselves. Instead, by taking the time to teach students how to perform an operation themselves and by reassuring them that making mistakes is part of the learning process, students will eventually develop the specific skill(s). More importantly, however, by encouraging students and supporting them through their learning, they will gain greater self-confidence. This is evident in the fact that the student shows competency in the development of a new skill and further evident in the pride they express. In an effort to not inadvertently

promote a fixed mindset in their teaching practice, shop teachers need to examine all areas of their teaching practice; this includes all types of communication and interaction with students. This paper puts forth my efforts to integrate growth mindset into all aspects of my middle school woodworking program.

Purpose of the Paper

The middle school model employs teachers for the academic disciplines and others for the Explorations subjects. Explorations courses are non-academic classes such as: Art, Drama, Home Economics, Makerspace, Music and Woodworking which help to provide a more well-rounded education for students. Middle schools in the district where I teach have an organizational structure which allows for the entire student body to rotate through all of the various Explorations courses during each of the students' three years at the school. In the Explorations classes, teachers offer exploratory hands-on learning opportunities for students which are built upon year after year, throughout their the three-years in middle school. These creative and at times challenging experiences can push students out of their comfort zone to learn new skills and abilities, and with a purposefully designed and intentionally implemented program, can also encourage them to embrace a growth mindset.

The purpose of this paper is to addresses a gap in the literature which looks specifically at the role middle school woodworking teachers can play in helping students develop a growth mindset. To this end, this narrative inquiry explores my ongoing efforts to develop a middle school woodworking program with this goal in mind.

Thesis Statement

Woodworking in middle school is not just about teaching students how to create artefacts and to learn manual skills. The woodworking course for middle learners can be seen as a microcosm of life in general where students learn about themselves and can develop positive habits of mind as a result of the successes and challenges that they face in class. The intention of a woodworking course would be for students to come away from the experience with a clearer understanding that learning, as with life, is a journey with triumphs and setbacks. Learning to navigate this path and embracing a growth mindset will enable students to be more successful along the way. By creating and implementing a middle school woodworking program that is fully integrated and designed around the promotion of growth mindset, Technology Education teachers can help students be more successful at overcoming challenges in their lives by embracing positive habits of mind.

Significance of the Study

With much of the focus in schools placed on the promotion and development of the social and emotional wellbeing of students, having middle school woodworking teachers integrate growth mindset into all aspects of their programs is critical as it would allow students to learn positive habits of mind in a practical, hands-on environment.

Middle school shop teachers are advised to look at the origins of woodworking programs in order to guide their teaching of what Otto Salomon saw as the ‘formative aims’ of manual training. Given that all middle school students enroll in woodworking class, shop teachers should seize the opportunity to combine the development of manual skills with promoting growth mindset as well.

By looking at all areas of their woodworking programs and ensuring it provides developmentally appropriate and challenging curriculum, as well as lessons, instructions, and feedback that support the promotion of growth mindset, shop teachers can contribute to the teaching of the whole child. Through the complexities of the unique hands-on nature of the course, students are afforded valuable opportunities to adopt positive habits of mind. By doing so, this allows students to build their self-confidence and their belief in themselves that they are capable of overcoming challenges through perseverance, hard work and by learning new skills. These efforts in the wood shop also help support the work done by school counsellors and youth care workers as they reinforce the notion that all staff work together in support of students, especially for vulnerable students (Claro, Paunesku, & Dweck, 2016). This work also supports the efforts by principals to encourage all staff to work collectively towards the development of the whole child and the Socio Emotion Learning (SEL) goals set out in the school's and the district's mission statement. In addition, the efforts of promoting growth mindset in our students have important implications for parents as it supports their efforts to develop the belief that children are capable of learning virtually any skill, ability or concept with enough effort, practice and support. Further, this work should inform efforts by senior administrative staff in developing professional development opportunities for Technology Education teachers on how they can support district and school level efforts to promote the growth mindset and SEL initiatives. Parallel to this idea, this work can inform discussions of training for pre-service Technology Education teachers. Finally, this paper has implications for Technology Education teacher associations to actively educate shop teachers of the current research and benefits of including growth mindset training into all areas of the curriculum.

Outline of the Remainder of the Paper

In the next chapter, I will define terms discussed in this paper. I will position my work within a theoretical framework and will examine the literature to uncover what researchers, and teachers alike, have done to help students develop growth mindset. The final chapter will explore in more depth the implications of this work for all stakeholders as well as recommendations of areas for further research.

Chapter 2: Literature Review

Introduction

In this chapter, key terms will first be defined. Subsequently, a more in depth look at the philosophies and theories that led to the formation of craft education will be explored along with the theoretical framework behind growth mindset. In addition, this section will explore how researchers have endeavoured to foster growth mindset in various educational contexts. Their findings which will be discussed in relation to how this can be apply to a woodworking classroom setting. Parallels will also be drawn to the promotion of a maker mindset in a Makerspace classroom setting. This chapter will conclude with a brief look at some implications for the various stakeholders. Throughout this chapter, discussions will revolve around the implications for teaching growth mindset in a woodworking classroom with middle school learners.

Definition of Terms

Constructivism – "Constructivist learning is a process of constructing meaning and people themselves make sense of their experience" (Merriam & Caffarella, 1999 as quoted by Amineh & Asl, 2015).

Growth mindset (incremental intelligence theory) – "A growth mindset is the belief that personal characteristics, such as intellectual abilities, can be developed" (Yeager & Dweck, 2020, p. 1270).

Grit – Grit is defined as perseverance and passion for long-term goals (Duckworth, Peterson, Matthews & Kelly, 2007, p. 1087).

Maker mindset – Dale Dougherty describes the maker mindset as a ‘‘growth mindset that encourages students to believe they can learn to do anything” (Dougherty, 2013 as quoted by (Martin, 2015, p. 35).

Resiliency – Resiliency is defined as: “the process of adapting well in the face of adversity, trauma, tragedy, threats, or significant sources of stress—such as family and relationship problems, serious health problems, or workplace and financial stressors. As much as resilience involves “bouncing back” from these difficult experiences, it can also involve profound personal growth” (www.apa.org, 2020).

Self-efficacy – “Self-efficacy is defined as people’s beliefs about their capacities to produce designated levels of performance that exercise influence over events that affect their lives” (Bandura, 1994).

Theoretical Frameworks

Theoretical Origins of Pedagogical Craft Education

The historical theoretical origins of Pedagogical Craft Education in Scandinavia influenced the works of numerous modern educational theorists and have also informed efforts to provide a holistic education for students. In their journal article, “The Intelligence of the Hands: Studying the Origin of Pedagogical Craft Education,” Olafsson and Thorsteinsson (2011) outline the foundations of craft and manual education. Philosopher Comenius (1592-1671) advanced the idea that schooling should include both “manual and liberal arts” and that handicraft education should “start with simple things familiar to the students” (pp.1-2). Locke (1632-1704) promoted the notion of “woodwork as a healthy and good preparation for theoretical studies” and Rousseau (1712-1778) realized “the value of learning through problem-solving within an apprenticeship

rather than rote learning in a classroom" (p. 2). Theorists Rousseau (1712-1778), Franke (1663-1727) and Basedow (1723-1790) each promoted the idea and the importance of the "body and spirit being in harmony when they nourish each other" and that academic studies done alongside craft education are mutually beneficial (p. 2). This then led Pestalozzi (1746-1827) to develop "pedagogical craft or manual training" which aimed to combine the theoretical and practical pursuits to provide a more holistic education (p. 3). In addition, Pestalozzi advanced the notion of education needing to address the head, heart and the hand in order for students to develop into well-adjusted members of society.

This idea of addressing the head, heart, and the hands, helped to create an educational model that looked to support students not only academically, but also emotionally and physically (Olafsson & Thorsteinsson, 2011). The latter two aspects are critical to the development of students' physical and mental wellbeing. Later, Froebel (1782-1852) "converted Pestalozzi's theories into practice with the development of the first 'Kindergarten' in 1837" with emphasised learning through exploration and play (p. 3). Combining Pestalozzi and Froebel's work, Cygnaeus (1810-1888) developed and implemented craft education in the Finish public education system (Thorsteinsson & Olafsson, 2014). Cygnaeus maintained that craft education should be a part of the regular curriculum for all students and both Cygnaeus and Salomon (1849–1907) held that "handicrafts should be taught by regular teachers, not by special craftsmen" (Bennett, 1937 as quoted by Olafsson & Thorsteinsson, 2011, p. 4). This meant that the teacher could attend to the development of the students' socioemotional needs through the use of physical activity in the form of woodworking. Finally, Salomon then amalgamated these philosophies, and ideas to form Educational Sloyd which included the formative and practical aims discussed in Chapter one.

The Scandinavian model of craft education eventually led to the formation of manual training in Canadian schools. More importantly, many of these theories and ideas have helped to inform and lay the groundwork for a more holistic approach to education.

Dewey and Vygotsky's Philosophies of Education

Dewey's constructivist theory of education is predicated upon learning being presented in a systematic and logical manner with activities purposefully chosen and organized around "the needs, desires, interests, and cognitive development of the students" (Sikandar, 2015, p. 193). It comes as no surprise then that Dewey was a strong advocate for hands-on learning and argued that the child learns best by doing and by being an active participant in the learning process (Glassman, 2001). In addition to providing hands-on learning opportunities, Dewey argued that education should also encompass "the intellectual, social, emotional, physical, and spiritual growth of the whole child, and not be narrowly focused on academic growth (Shiro, 2013 as quoted by Williams, 2017, p. 93). By addressing some of the students' physical, social, emotional and spiritual needs and remaining child centered by providing a caring inclusive classroom community, students are more apt to feel safe and supported in their learning. This holistic approach to education draws from the educational philosophies of Rousseau, Franke, Basedow, and Pestalozzi's work.

Dewey felt that the teacher's role is to provide and facilitate learning experiences, both at school and in the natural environment, within which the child can explore and make connections between these experiences to highlight the learning (Sikandar, 2015, p. 193). This way, "any relevant knowledge or information is in some sense experiential as it relates directly to the lived experience of the individual" (Sikandar, 2015, p. 195). For both Dewey and Vygotsky,

they saw the social context of learning as highly influential in the role it plays in the shaping of a child's understanding the world around them as it makes learning more meaningful and relevant to the child's lives (Glassman, 2001).

While Dewey and Vygotsky had similar educational philosophies, they also had important differences in their view of how children learn best. Glassman states that "Dewey sees the child as a free agent who achieves goals through her own interest in the activity. Whereas Vygotsky suggests there should be greater control by a mentor who creates activity that will lead the child towards mastery" (Glassman, 2001, p. 3). This key difference is highlighted by Vygotsky's view that learning is made most effective through the interplay of the Zones of Proximal Development (ZPD) which is "an emotionally positive collaboration and cooperation between teacher and student in a caring and nurturing environment" (Levykh, 2008, p. 83). In Vygotsky's ZPD model, learning tasks should challenge the child sufficiently and be just outside of their current range of skills and abilities without discouraging the learner, thereby requiring some support by a more advanced peer or teacher. Vygotsky states that "where there is no struggle, there is no development" (Levykh, 2008, p. 100). This delicate balance of challenging while not discouraging allows the teacher to "look into the near future of the child's mental development and uncover his or her true potential for development" (p. 90). Vygotsky further provides insights into child development by stating that as students begin to become overwhelmed in their struggle, they will start to vocalize their egocentric inner mental dialogue (p. 96). For teachers this is important to know and to watch for in class as the way students talk in those stressful learning moments, is also the way that they speak and treat themselves (p. 97).

For Vygotsky, learning occurs in a social context and that the "educational process" was "a source rather than a consequence of the development of cognitive and learning skills"

(Kozulin, 2004, p. 3). For Vygotsky, this meant that "education does not coincide with development, but is constructed in such a way as to develop those psychological functions that will be needed for the next educational step" (p. 3). In other words, as a child's "socioculturally-based development" expands, so too does the child's ability to understand curricular content (p. 5). The social context of all learning, Vygotsky argued, is rendered more profound with the interplay of 'Obucheniye,' a Russian word meaning teaching and learning simultaneously (Levykh, 2008). This social aspect accelerates the child's learning as it infuses emotion into the experiences to the benefit of the development of the whole child (Levykh, 2008). It is clear from Vygotsky's educational theory that the physical task in which the child is involved is secondary to the development of the child's socioemotional skills and abilities.

Bandura's Self-Efficacy

Bandura differentiates between one's "perceived self-efficacy" and one's "belief in personal efficacy" (Bandura, 1994, p. 16). A person's perception of their self-efficacy revolves around their belief in their ability to influence themselves and their lives. A person's beliefs in their "personal efficacy affect life choices, level of motivation, quality of functioning, resilience to adversity, and vulnerability to stress and depression" (p. 16). A person's sense of self-efficacy, he asserts, is built in four ways. The first method is by gaining experience overcoming challenging situations by demonstrating perseverant effort; in short, mastery experience. The second is by living vicarious through their peers' experiences of struggling and eventually succeeding at a difficult task. The third way is where people are persuaded and encouraged verbally by others and come to believe that they have the skill or abilities necessary to be successful. The final method of strengthening self-efficacy is by reducing "people's stress

reaction and alter their negative emotional proclivities and misinterpretations of their physical states" (Bandura, 1994, p. 3). Bandura states that "mastery experience consistently emerges in empirical studies as the most powerful source of self-efficacy across domains" (Usher & Pajares, 2008, p. 763). Mastery experiences are the most important and most reliable way in which students can build their belief in their own level of self-efficacy. This then helps to affirm their beliefs as to their ability to master subsequent undertakings (Usher & Pajares, 2008).

People with strong beliefs in their self-efficacy will attribute failures to a lack of effort while those with a weak sense of self-efficacy will ascribe their failure to their low abilities (Bandura, 1994). Low self-efficacy leads to depression and anxiety due to unfulfilled aspirations in the person's inability to attain the goals they've set for themselves (Bandura, 1994). Bandura states that a person's self-efficacy can be developed through different stages of life. Bandura also argues that the benefits of setting challenging goals as it can "enhance and sustain motivation" towards the attainment of the stated goal (p. 5).

In addition to Bandura's methods of building self-efficacy, Usher and Pajares (2008) identified another source and proposed an 'invitational approach' as an additional way for students to build self-efficacy. This approach focuses on reframing students' struggles and their negative self-talk to provide some perspective and to refocus their energies.

Bandura's Human Agency

In addition to efficacy, Bandura asserts that by focusing on self-development and by employing human agency's core properties, which are intentionality, forethought, self-reactiveness and self-reflectiveness, people can positively affect and shape the outcome of their lives (Bandura, 2006).

Bandura (2006) argues that the most important aspect of human agency is one's belief in their personal efficacy.

> Unless people believe they can produce desired effects by their actions, they have little incentive to act, or to persevere in the face of difficulties. Whatever other factors serve as guides and motivators, they are rooted in the core belief that one has the power to effect changes by one's actions. (p. 170)

A person's sense of self-efficacy affects whether they have a positive or negative outlook on life or an optimistic or pessimistic way of thinking. Bandura argues that people with low efficacy will give up easily while those with high efficacy will demonstrate resiliency and persevere in the face of adversity. One can see aspects of fixed and growth mindsets stemming from this idea. Additionally, a person's view of their efficacy can affect their emotional wellbeing as well as their mental health. Consequently, "efficacy beliefs determine the choices people make at important decisional points" which can have immense implications on a person's life course (Bandura, 2006, p. 171).

Growth Mindset

Growth mindset research fall within a constructivist framework that posits that intelligence is malleable such that people can improve their intelligence (Dweck, 1988). Dweck argues that there are two types of mindsets that people can hold, a fixed or growth mindset (Dweck, 1988). "People can believe that a particular attribute, such as intelligence or personality, is simply fixed. Or they can believe that it can be shaped and developed" (Dweck & Yeager, 2019, p. 2). Dweck (2008) states that "motivation and self-regulation often have more impact on achievement and the growth of ability" (p. 56). Consequently, by being willing to

develop new skills or abilities, work hard, persevere through the setbacks, learn from mistakes, and ask for help when they're stuck, a person can succeed at a task. Once a person has adopted a willingness to take these necessary steps needed to be successful, they are said to poses a growth mindset.

Review of Research Literature

Application of Vygotsky's Zone of Proximal Development

Author Debbie Silver (2011) states that students need to face challenges and adversity in order to develop grit and resiliency. She argues that,

> in a world of enabled, entitled, 'protected' offspring, we often rob children of the very essence of what builds resiliency, persistence, courage, patience, and joy. We rush in to make sure children 'feel good' all the time. We don't want to risk getting their egos bruised or their 'comfort zones' violated. (Silver, 2011).

Silver further states that a teacher's role is to facilitate experiences and to support students find the joy that comes as a result of hard-fought victories. The author draws on Vygotsky's model of Zones of Proximal Development (ZPD) as a way of scaffolding learning to facilitate student success. Silver (2011) argues that "nothing is so motivating as hard-earned success" and that these moments can help students persevere and demonstrate grit during future setbacks (p. 30).

Although this piece is a continuation of a larger body of well referenced work the author has produced in her book on teaching students to be successful in schools, this article provides more of a superficial exploration of the topic. The author writes from a perspective of providing strategies to educators while including a very brief overview of Vygotsky's theory of ZPD. As such, this article would be more of interest to teachers than researchers.

This article, and other works written by this author, provide teachers with valuable strategies on how to put the ZPD into practice in the classroom. Silver's work also provide a plethora of useful links to current research and practical solutions in many areas including motivation, resiliency, growth mindset, and grit.

Building 'Grit'

Duckworth et al. (2007).

Researchers Duckworth, Peterson, Matthews and Kelly (2007) reported on and summarized six separate studies which they conducted where they sought to determine the role that grit played in the participants' success associated with their various pursuits. Their first (n=1545) and second studies (n=690) looked to validate the survey they developed entitled the Grit Scale. The studies were cross-sectional with participants over 25 years of age. Both studies revealed that the higher educated a person is the more grit they display and the more they tend to stick to their chosen career. The researchers surmised that "grit grows with age and one learns from experiences that quitting plans, shifting goals, and starting over repeatedly are not good strategies for success" (Duckworth et al., 2007, pp. 1091-1092). The remaining four studies looked for links between grit and grade point average (GPA) at an elite university, enrollment retention at a prestigious military college and extra-curricular accomplishments. The studies demonstrated a predictive relation between grit and success even if a person's intelligence was less than their peers.

Each of the six studies relied upon participants to self-report their level of grit on a questionnaire which the authors had created and verified using the first two studies. Using self-reporting measures can invite people to provide overinflated responses to make themselves look

better; which could skew the results. With the exception of the first two, the majority of the participants in these studies were very intelligent as demonstrated by their high IQ scores. This would call into question the researchers' ability to transfer their findings to the general public.

The findings of these studies provide helpful insight for my program. If grit is as linked to success as talent is related to distinguished accomplishment, then by encouraging students to work hard physically in the shop on challenging projects, then perhaps they will be able to cultivate a greater sense of grit as a result of their three years of woodworking in middle school (Duckworth et al., 2007). While some of my shop teacher colleagues may choose to have their students make a series of easier projects in each grade to allow students to quickly attain a sense of completion in their course, I choose not to follow suit. At each grade level, students work on a single project for the duration of the course which requires sustained effort and attention; in so doing they develop a degree of grit. In their closing remarks, the authors suggest that "we should prepare youth to anticipate failures and misfortunes and point out that excellence in any discipline requires years and years of time on task" (Duckworth et al., 2007, p. 1100). Through the iterative process of woodworking, students come to understand that failures are a normal part of learning in the shop and that it leads to success and over time.

Tang, Wang, Guo & Salmela-Aro (2019).

Researchers, Tang et al. (2019) developed a study to examine "whether adolescents who have a growth mindset and high commitment to their educational goals tend to be gritty in academic learning" (Tang, Wang, Guo & Salmela-Aro, 2019, p. 850). The researchers used the short grit scale, as developed by Duckworth and Quinn (2009) to determine the participants' grit and mindset. This longitudinal study (2013-2016) of Finish students (n=2018), from sixth

through nineth grades “indicated that grit, specifically the perseverance of effort facet, makes a unique contribution to promoting students’ academic outcomes and engagement” (Tang, et al., 2019, p. 858). The authors concluded that growth mindset had little to no effect on students’ level of grit and perseverance, rather it was their commitment to their academic goal which was a stronger predictor of grit than growth mindset.

The researchers acknowledge that the Finish culture characterizes itself as being courageous, tenacious, and perseverant which could account for the strong correlation between grit and their academic achievement (Tang, et al., 2019). Grit is a relatively new area of study and to date there are only two such studies on grit including the one in question. Future studies should also include participants from other cultures and of different developmental periods in order to validate or disprove the claims made in by the researchers. One of the major problems with this study is that “growth mindset was only measured in sixth grade” and not at the three other grade levels. Having only measured the students’ growth mindset in grade six and not the following years, one wonders how reliable their conclusions are given no other data exists in their study to compare it to. The focus of this study was to measure the students’ academic grit. However, it is possible that students who scored low on the grit scale may have other personal goals outside of the academic realm in which they may have scored high. Unfortunately, these areas are outside of the survey’s scope and don’t give an accurate portrayal of the participants overall level of grit.

This study highlights the importance of giving students educational opportunities to develop non-cognitive skills such as grit, perseverance and positive mindsets. It also reinforces the need for students to set learning goals for themselves as goals can provide a source of

motivation. Striving towards and committing to the accomplishment of their goals can, as these researchers conclude, help to build grit.

Growth Mindset Studies

Blackwell, Trzesniewski et al., (2007).

Researchers Blackwell, Trzesniewski and Dweck (2007) conducted two longitudinal studies to test whether mindset interventions taught to students transitioning from elementary to junior high school could encourage them to adopt a theory of incremental intelligence within their two years of junior high. Both studies were carried out in a similar manner with the most notable difference being that the students in the second study came from less favourable socioeconomic conditions. The researchers were not looking to base their findings solely on a self-assessment metric and the grades, but also on the students' positive behavioural changes towards learning, as observed and spontaneously reported on by the students' teachers. In both studies, the researchers focused on math as the concepts tend to build upon each other year after year and students can quickly fall behind. The groups who received the mindset interventions benefited significantly stopping, even reversing, the traditional downward spiral in grades within a single semester. The authors found that "it was the incremental theory message in particular that was responsible for the achievement benefit, rather than some other positive motivational factor in the experimental condition" (Blackwell, Trzesniewski & Dweck, 2007, p. 258). Further, the researchers concluded that

> adolescents who endorse more of an incremental theory of malleable intelligence also endorse stronger learning goals, hold more positive beliefs about effort, and make fewer ability-based, 'helpless' attributions, with the result that they choose more positive,

> effort-based strategies in response to failure, boosting mathematics achievement over the junior high school transition. (Blackwell, Trzesniewski & Dweck, 2007, p. 258)

These two studies relied on the spontaneous and subjective observations of student behaviour as reported by the math teachers involved. As such, the teachers' own biases and past experiences with students could have had an impact on the results of the studies. The researchers might consider using multiple math teachers at each school to help account for such tendencies. Further, the authors noted that the math teachers' lessons were unremarkable. For this reason, the researchers could have also included the teachers in the incremental intelligence training sessions, rather than simply providing the students with it. By training the teachers to use supportive positive messaging with students, one wonders if the net positive effects of the intervention would have been greater.

The researchers highlighted the fact that students who hold a fixed mindset in the early years tend to be sheltered by the more supportive environment of elementary school (Blackwell et al., 2007). By the time they reach middle school, those same students would likely struggle more given the challenging curriculum and lower levels of support. This has tremendous implications for my teaching practice. Since woodworking is a non-academic course and virtually all grade six students find themselves on equal ground as far as their level of woodworking experience, it can also be the only class in which they feel relaxed enough to entertain discussions about growth mindset. As they build their skills and work through the various challenges with each project, students can learn to embrace a growth mindset. Over the three years in a middle school shop class, as students develop and strengthen positive mindset skills, it is hoped that they will then be able to carry those abilities forward into other aspects of their lives.

Rhew et al. (2018).

In my teaching experience, I have noticed that students who struggle academically, tend to do well in subjects that involve more hands-on learning opportunities, such as woodworking. As a result of their success, these students tend to be more motivated in class. It was interesting to find this next study where researchers investigated "whether a growth mindset intervention would improve adolescent special education students' self-efficacy and motivation" (Rhew, Piro, Goolkasian, & Cosentino, 2018, p. 1). The authors identified that research has shown that, "having both low self-efficacy and a disability is a dangerous dynamic because it was essential for special education students to have increased perseverance to meet the same standards as their typical peers (Bergen, 2013 as quoted in Rhew et al., 2018, p. 4). In this study, the researchers wanted to see if an online intervention could positively affect special education students. Grade six, seven and eight students (n=68) who were receiving learning support for reading, were asked to complete a pre and post assessment followed by an online Brainology intervention. The authors measured whether there were any "significant differences between the reading self-efficacy and motivation of participants in the treatment and comparison groups" (Rhew et al., 2018, p. 9). The researchers found that the intervention had no effect on the students' level of self-efficacy towards reading, but it did have a significant effect on improving special education students' level of motivation.

Some of the limitations of this study were the fact that the intervention was short term and was carried out entirely online. Further, the pre- and post-assessment tests that the student took part in involved independent reading. Given that the participants struggled with reading, this could have negatively affected the results due to the students' incomplete comprehension or lack of motivation, at least for the control group. The authors also point out that special

education students tend to “miscalculate their self-efficacy positively” which skews results and makes accurate measures of self-efficacy difficult to obtain (Rhew et al., 2018, p. 13). Another limitation of the study is that teachers were given training and support by the researchers, however, the teacher assistants were not afforded the same opportunity. Given that the teacher assistants work directly with the students to help them, this could have helped them better support the special education students while the pre and post-tests were being administered.

The implications of this study have important ramifications in the shop, as well. Expecting the administration of a series of online lessons to affect positive change in students’ level of growth mindset, seems unrealistic. It is reasonable to assume that to be more effective, online interventions would need to be supported by in person activities with the support from a trained teacher or other support staff. As the authors suggest, all staff should be given growth mindset training in order to encourage and support students adopt positive self-beliefs.

In my classroom, the feedback I give is primarily focused on the process and the effort that students put forth which helps encourage students towards embracing a growth mindset. However, when new Special Education Assistants, visiting classroom teachers and or administrators interact with my students, their comments that praise the students’ abilities rather than their level of effort can reinforce fixed mindsets. Due to this fact, professional development for the entire school staff should be made available in order to have school wide common language in place with emphasises student effort and growth mindset in order to best support the psychological development of middle school students.

Li & Bates (2019).

Researchers Yue Li and Timothy Bates attempted to corroborate the findings of the Mueller & Dweck, (1998) qualitative study, conducted 21 years prior, as to the "relationship of mindset to resilience to failure, and school grades" (Li & Bates, 2019, p. 1640). The authors recreated the similar conditions for their study as were present in the Mueller and Dweck, (1998) study. The researchers administered pre and post-test assessments to grade five Chinese students (n=624) to ascertain their mindsets as well as assessing their motivation levels in performing the various mathematical tasks. Li & Bates found that, "contrary to the (Muller and Dweck, 1998) study we found no positive effects of growth mindset on response to failure" thus disproving the growth mindset theory (Li & Bates, 2019, p. 1649). A closer inspection is needed to uncover some inconsistencies.

The authors stated that the results from the first of their three studies did demonstrate "a significant effect of the growth mindset condition on post-failure performance. This was not replicated in Studies 2 or 3" (Li & Bates, 2019, p. 1652). The change in the outcomes, from the first study to the rest, could be attributed to the weakening of the effect from the feedback given to the students by the researchers in the way of positive or negative comments. What is also interesting to note is that in the data tables included in their article, students in the Muller & Dweck (1998) study earned an average score of 52% on the math tasks whereas in the Li & Bates (2019) study the average was 89%. This suggests that in the latter group, students were stronger in math and were likely more motivated to do well in this subject.

Interestingly, the researchers did not account for whether or not the learning environment in the schools in question were competitive, as variables in their studies. Competitive learning environments are associated with reinforcing fixed mindset (Blackwell et al., 2007). Given the

strong focus on math in Chinese schools, it is likely that more competitive learning environments were present in the classrooms used in this study, which could influence the students' receptiveness to growth mindset interventions. The researchers also did not account for the mindsets held by the participating teachers as possible variables which could have also had significant impacts on the results. It is also possible that the different classroom and school cultures within the Muller & Dweck (1998) study, conducted in the United States, and the Li & Bates (2019) study, conducted in China, could have had an effect on the widely divergent results.

While the authors argue that growth mindset should yield similar results across all ethnicities, in competitive environments or cultures, however, students who are familiar with fixed mindset learning environments may be less influenced by feedback given to them about the level of effort they put forth. The authors did note that in one of their studies, the comments that were given to the students about their poor test scores had the opposite effect of what they had expected; the students showed higher scores on the subsequent test after receiving such feedback. Thus, students who are accustomed to learning in a fixed mindset environment, with the focus on grades and intelligence, could possibly do better than their counterparts on a math-based assessment for this experimental study. Further, in the analysis of their study's results and their comparison with the original (Mueller and Dweck, 1998) study, the authors attempt to also draw parallels with the (Blackwell, Trzesniewski & Dweck, 2007) study, Unfortunately, while the two studies are similar in scope, they have significant and important differences, such as the age of the participants, for example, which renders such comparisons and conclusions questionable.

This study raises a few important issues for the student population at my school. The families living in the area surrounding the school where I teach are culturally diverse and are affected by a wide range of socioeconomic factors. As such, the students have unique

backgrounds which may or may not influence their receptiveness to the idea of changing their mindset as it may run counter to their family's or culture's views. This study highlights the fact that my efforts to encourage students to adopt a growth mindset would have to be mindful of these factors. Further, students who have recently emigrated to Canada may also have some difficulties adjusting to a new school or classroom climate which is less focused on competition and grades. Students may also need more time to feel comfortable working in a growth mindset educational environment.

While this study on growth mindset in Chinese schools may not have replicated the same results as the original study, looking at a more recent study conducted in Ireland may reveal some interesting developments in the methodology of mindset interventions.

Murphy & Gash (2020).

This qualitative study in an Irish primary classroom looked "to examine key ideas in growth mindset in a well-designed constructivist educational framework concerned with learning to learn" (Murphy & Gash, 2020, p. 83). As a result of a comprehensive and multidisciplinary intervention, which included picture books to anchor learning and class discussions, the authors concluded that the students' "views of themselves as learners" and the teacher's "views of learning and intelligence" changed in a positive way (p. 83). As a secondary aim of the study, the researchers were able to encourage the early career classroom teachers to embrace a teaching approach that is "free from the unnecessary limits imposed by ability-based practices" (p. 85). The authors also highlighted the fact that an adherence to "competitive performance goals" is linked to fixed mindset thinking in teachers (p. 91). They argue that more work needs to be done for teacher training since

> … the perceived impact of the growth-mindset intervention on the teacher is reciprocally related to the impact on the children, as any positive changes in the children are partly determined by the teacher's attitudes, actions, words, expectations and teaching. (Hart et al., 2004; Boaler, 2006; Dweck, 2015, as quoted in Murphy & Gash, 2020, p. 90)

While the findings of this study are encouraging, the authors reference a number of sources that date back over 30 and 40 years. Reference to more recent publications would strengthen and further corroborate their research. Also, given the limited scope of this study where only one class of primary students was investigated, the generalizability of the findings is limited and warrants further study.

This study presents numerous ideas and strategies that were used which can be helpful to implement growth mindset in a holistic manner in any classroom setting, including a woodworking shop. Reading specifically chosen picture books to students, of any age in a multitude of learning environments, can be instrumental in starting discussions and provides a way to have students reflect on their own experiences. A particularly salient point that this study brings up, is that teachers interested in implementing growth mindset in their classrooms need to be congruent throughout their teaching practice for students to feel comfortable and supported in making a switch in their way of thinking. The authors suggest that the kinds of assignments given to students to the type of feedback given should be geared towards promoting a growth mindset. Also, the authors discuss the need to engage students in school by allowing them to have positive experiences in school in order to lessen the possibility of students dropping out of school later on. By emphasising mastery experiences, students can focus on the joy that comes from learning, rather than on what grade they received or how they compare in relation to their peers. In order for teachers to have similar experiences encouraging students to embrace a

growth mindset, teachers will likely need professional development in order to help change their own mindset to be congruent with their efforts of promoting growth mindset.

Tecker (2017).

Supporting teachers in their efforts to implement growth mindset-oriented pedagogy into their teaching practice is what one California school district did. The researcher's goal was to "examine how teachers implement a growth mindset intervention and related strategies and the perceptions of their students' about the classroom goal-orientation and growth mindset strategies" (Tecker, 2017, p. 5). The secondary goal of the study was to ascertain if the growth mindset interventions positively affected and reversed the decline in grades, as measured by math scores. All of the middle school grade six teachers, from a relatively small school district, took part in growth mindset professional development training in order to implement the strategies set out in the study with their students. The five strategies chosen were: "classroom goal orientation" towards mastery rather than performance, "celebrating mistakes" and learning from them, "praise the process not the person" by giving process related encouragement, "feedback and assessment for learning" and by providing "challenging math tasks" (pp. 106-108). In this study, the author gathered both quantitative and qualitative data from students' test scores and survey responses as well as feedback from teachers. The researcher found that the teachers were able to successfully implement two strategies in class, "celebrating mistakes and challenging math tasks", but that further training and collaboration with colleagues was needed in order to implement the others (p. 108). While the results from the standardized math test did not indicate improved scores, the students' overall grades in math, based on various forms of assessments by the teachers throughout the year, had improved. It was established that the

growth mindset interventions had "slowed the downward trajectory of GPA over the course of the year" normally found with middle school students (p. 109). While there were varying degrees of successful implementations and willingness on the behalf of the teachers to implement all five strategies, they all saw the benefit of the growth mindset interventions. All of the teachers involved in this trial changed parts of their practice for the better as a result of their participation in this study.

There are some important limitations of this study. This study was the result of the author's doctoral degree who was also a current administrator in change of professional development in the district in question. As such, there may have been some level of influence put upon some of the participants, both teachers and students, which may have skewed the responses, results and or willingness to participate in the study. Further, this was a field research study and no researcher was present to lead the in-class activities in order to standardize the classroom norms and test procedures as well as the growth mindset messaging used in class. As one would expected, there would be inconsistencies in the interpretation and implementation of the strategies. For example, the math assessment test that was used in this study was inconsistently administered by the various teachers which most likely affected the reliability of the results derived from it.

This study draws attention to what can be realistically expected in a real-world scenario when implementing a program such as this in a whole school or for an entire school district. This article presents numerous strategies that can be used by teachers in their classrooms to transform their teaching practice and to encourage students to embrace a growth mindset. In addition, this dissertation included comments from some of the teachers which highlight the struggles they faced in changing their habits and teaching methods from a fixed perspective

towards a growth mindset. The author encourages teachers to start with implementing the easier strategies and then move to include the more challenging ones as a way to ensure success over the long term. This study points out that to be successful in implementing such a program, changes need to be done over time in order to establish classroom norms and for the teacher to embrace classroom pedagogy that supports a holistic integrated growth mindset approach.

Zeeb, Ostertag, & Renkl, (2020).

Training was provided to the grade seven physics teacher who participated in this next quasi-experimental study on how to integrate "mindset-friendly elements, such as growth mindset feedback and helpful classroom norms" into the course as well as how to deliver the mindset training to the students (Zeeb, Ostertag, & Renkl, 2020, p. 3). The researchers investigated the impact of integrating growth mindset training into a physics teacher's courses "on students' beliefs and motivation" (p. 1). The authors chose to focus their investigation on this type of course as it is new to the grade seven German students and it is common for them to hold fixed mindsets in relation to science education. The students were surveyed to determine their "growth mindsets, self-beliefs and motivation" prior to the start of the five weeks of training sessions, immediately after as well as six months after the start of the study (p. 4). The authors found that the students' "growth mindsets were strengthened", "however, the training was unsuccessful regarding the students' beliefs about their own abilities" (p. 9). However, the researchers found that the positive effects of the training "lasted until the follow-up assessment half a year after the training" (p. 9). The authors argue that the integration of mindset ideas into regular classroom instruction may enhance the impact of the training. The researchers suggest

that in future studies and for teachers wanting to integrate this into their classroom "there should be an additional focus on students' self-beliefs when implementing a mindset training" (p. 11).

Some of the limitations of this study are that the sample size of the participating students is small (n=59) and therefore the results are not necessarily applicable to other situations. Further, being that this was a field study facilitated by the classroom teacher, the validity of the findings can be called into question as there is no way to standardize the teaching conditions of similar future studies. Also, it is difficult to ascertain which had a greater effect on the student's mindsets; the whole class training sessions or the integration of the growth mindset friendly elements into the classroom norms. Further studies are necessary to ascertain this.

There are several implications that emerge from this study for any classroom, including the wood shop. The authors urge teachers to first become aware of their own beliefs, and mindsets prior to implementing growth mindset into their classrooms. Teachers need to fully internalize growth mindset before implementing it with students. Failure to do so can result in teachers creating a "false growth mindset" which can "cause students to get frustrated if they say everyone can learn, and the student continues to struggle" (Zeeb et al., 2020, p. 10). Further, this study supports the idea that integrating mindset friendly elements into the classroom will greatly enhance growth mindset interventions. This type of training is especially advantageous when introducing new or difficult subjects. The authors encourage teachers to review growth mindset principles to remind students that learning is a process which requires sustained effort and the use of strategies to be successful (Zeeb et al., 2020). This article is particularly helpful as it provides links to online resources that can be readily used with students including scripts to help teachers learn how to provide feedback to students in such a way that it creates a classroom culture that encourages the adoption of a growth mindset.

Similar to the aforementioned study, researchers not only enlisted the help of a teacher to integrate growth mindset promoting methods in their teaching practice, this next study also utilized the classroom teacher to help design the mindset activities in such a way that they were integrated into curricular lessons.

Strahan, Hansen, Meyer, Buchanan, and Doherty (2017).

The participating teacher in this year-long study worked closely with researchers Strahan, Hansen, Meyer, Buchanan, and Doherty (2017) to revamp their course syllabus and teaching methods to provide a growth mindset informed middle school Language Arts program. The researchers first draw attention to the National Middle School Association's (now the Association for Middle Level Education – AMLE) seminal paper, entitled "This We Believe" (2010), which asserts that "the curriculum, pedagogy, and programs of middle grades schools must be based upon the developmental readiness, needs, and interests of young adolescents.

This concept is at the heart of middle level education" (NMSA, 2010 as quoted by Strahan, et al., 2017, p. 2). With this as a backdrop, the researchers worked to determine if "intentional efforts to engage students in activities to help them learn more about their mindsets would facilitate their awareness and understanding" (p. 5). The grade seven teacher, in conjunction with the authors, developed a series of mindset activities that were integrated into language arts lessons which were then assigned to the students throughout the school year. Over the course of their year-long study, the researchers observed lessons, examined writing samples, and conducted interviews with the teacher and participating students to determine the outcome of their efforts. The authors found that of the 12 students they had permission to conduct in depth interviews with, ten demonstrated significant growth in tangible ways (Strahan, et al., 2017).

The researchers concluded that the integrative approach of exploring mindset within the regular curriculum "was especially powerful when class texts explicitly related to the nature of thinking and decisions were the foundation of multiday lessons that connected reading, discussion, and writing" (p. 14). In the end, the authors also found that,

> … even though the data from the from the test scores at the end of the year demonstrated growth in reading for most of the students, it is difficult to know the extent to which they internalized mindset concepts. (p. 14).

One of the significant limitations to this study is that even though the entire language arts class did the mindset activities, the researchers were only able to interview a small number of participants (n=12) for the in-depth interviews. Thus, this limits the generalizability of this study's findings to a wider audience. The authors also noted that they were unable to obtain the parental consent for all 23 students in the class which included the students who struggled the most with reading (Strahan, et al., 2017, p. 14). The researchers further state that of the 12 students they worked closely with, most demonstrated a strong growth mindset at the outset and were able to articulate their thinking around it clearly throughout the study. These same participants were also involved in extra-curricular activities outside of school, were conscientious students and used various strategies to stay organized and on top of their studies. One wonders if these non-academic pursuits had a greater influence over the students' development of growth mindset than the intervention and activities put forth by the teacher and authors of this study. Further research is needed to account for these outside influences.

The authors of this study discuss the need for teachers to align mindset informing activities with the core attributes and characteristics identified in the AMLE's positional paper "This We Believe" (www.amle.org, n.d.; Harrison & Bishop, 2021). By aligning itself with the

core tenets of middle school education, this study provides an example for how I might structure my class so as to provide a more integrated approach to mindset training. Although the participating educator in this study was a language arts teacher, many of the methods that were employed to create a growth mindset learning environment, can also be used in non-academic classroom settings.

Growth Mindset Controversies

Yeager & Dweck (2020).

In their article which explores growth mindset controversies, Yeager & Dweck (2020) highlight four controversial areas worthy of discussion; these are: "do mindsets predict student outcomes, do student mindset interventions work, are mindset intervention effect sizes too small to be interesting and do teacher mindset interventions work?" (p. 1270). After a thorough discussion of the first three controversies and contextualizing misconceptions as well as outlier findings, the researchers come to the conclusion that "the questions we have addressed so far … have strong evidence in the affirmative" (p. 1281). Of particular interest was that after looking at the PISA test data for 72 nations, Yeager & Dweck found that studies, such as Li & Bates (2019) and the PISA test results from students in mainland China, were "conducted in cultural contexts that have the weakest links between mindsets and achievement in the developed world" (p. 1273). The authors added that the PISA survey uncovered that the students in mainland China studied 57 hours a week and they speculate that having a growth mindset cannot increase test scores or the amount of studying any more in a culture which puts so much emphasis on working hard. With regards to the fourth controversy, the authors state that "so far, teacher-focused growth mindset interventions have not worked" (p. 1281). The evidence they

give for these findings are that these types of interventions are in their infancy and little has been done to standardize efforts in this emerging field of study. They further state that addressing teacher mindsets are of utmost importance as this affects teachers' perceptions of their students and how they interact with them. In addition, they assert that "changing teacher behaviour through professional development is known to be exceptionally challenging (p. 1281).

The findings in this article are encouraging for mindset interventions conducted by well-trained researchers; however, the authors present a less favourable landscape for interventions conducted by classroom teachers. The researchers do not discuss what teachers would need to do or what training is necessary in order to become better facilitators of mindset interventions aside from administering their free online student program. It is hoped that an online growth mindset teacher training program complete with supporting resources, as well as an online forum where teachers and researchers would be able to discuss their findings, can be developed as this would greatly advance research in this area.

While the authors of this article suggest that the results of teacher led mindset interventions do not produce reliable and consistent results, certainly integrating growth mindset messaging into all areas of our teaching practice and working to align our own mindsets to support this goal is worthy of the endeavour. As this field of study evolves, recommendations will no doubt be forthcoming for teachers. In the meantime, as any teacher knows experience will dictate what works best for a given population and our practice of teaching growth mindset will evolve over time. What is needed is to remain apprised of the latest developments in growth mindset research and to allow this to inform future directions taken in the day-to-day life in the classroom.

While there is an ever-growing number of studies that focus on encouraging growth mindset through interventions in various academic settings, there are a lot fewer studies that have examined how mindset strategies can be used in non-academic classroom settings. To my knowledge, there have not been any studies done to date which have looked at implementing mindset interventions or exploring the implications of an integrated growth mindset curriculum within middle school woodworking shops. However, similar to and loosely related to the woodworking classroom learning environment are Makerspaces. Given the proliferation of Makerspaces in schools, there have been a number of studies that have explored the idea of helping students develop a maker mindset. The founder of the Maker movement, Dale Dougherty describes a maker mindset as a ‘‘growth mindset that encourages students to believe they can learn to do anything” (Dougherty, 2013, as quoted by Martin, 2015, p. 35). Further, other researchers state that a maker mindset is similar to growth mindset in that it encourages playfulness, collaboration, learning through failure or failing forward, and is growth oriented (Kamaruzaman et al. 2020). This way of learning encourages students to adopt a ‘can do’ attitude, develop grit, build resiliency, and strengthens their self-efficacy (Kamaruzaman et al. 2020; Martin, 2015).

Growth Mindset Links to a Maker Mindset

Kamaruzaman, Ismail, Daud, & Jusoh (2020).

Researchers Kamaruzaman, Ismail, Daud, & Jusoh (2020) explored the role that a Makerspace can play in cultivating a “maker mindset among industrial design students” (p. 1). The authors position the maker movement, and by extension the maker mindset, in a constructivist theoretical framework citing the works of Dweck and Vygotsky as well as the

founder of the maker movement, Dale Dougherty. The researchers argue that the maker mindset includes five "crucial constructs which are resilience, growth mindset, creativity, willingness to tinker and collaboration orientation" (Cohen et al., 2018 as quoted by Kamaruzaman et al., 2020, p. 2). In addition to the aforementioned maker constructs, the authors highlight "creativity, playfulness, growth-oriented, failure positive, and collaboration" as being essential in forming a maker mindset (pp. 2-3). Having established this, the authors urge industrial design educators to develop curriculum that resembles the learning environment of a makerspace for students to develop a maker mindset which, they argue, is needed in order to be successful in "the current 21st century" (p. 4). The researchers conclude their article by stating that the role of an industrial design teacher should be to act as a lecturer as well as a facilitator and to provide students "problem-based learning" opportunities which will offer them the chance to be creative and by extension develop a maker mindset (p. 6).

The authors of this article are from Malaysia and it is clear that they are English Language Learners. While they are able to convey their message in general terms, the article lacks clarity and fluidity which makes it challenging to understand the nuances of their claims. The researchers also gloss over many concepts and constructs that they put forward and they do not fully present a coherent argument as to how a maker mindset is developed. Further, the authors spend considerable time discussing the theoretical basis of the maker movement as well as the essential skills and attributes students need to be successful in the future, but they do not elaborate on how an industrial design instructor might incorporate these ideas into their curriculum. Additionally, no discussion is had as to what the barriers or constrains are that hinder instructors from adopting a more playful and exploratory approach to industrial design.

This article presents some interesting ideas that can be incorporated into a woodworking program. Encouraging students to upload photos, video and other digital documentation of their projects onto platforms such as YouTube, Instructables, and or on blogs, is a great way to interact with a community of likeminded people. The idea of having students document their learning journey also allows students to gain perspective into the designing and building process of their projects. The authors reference Adam Savage, from Mythbusters, as a celebrity maker who documents his iterative approach to proving or disproving myths using science, technology, engineering and math. This article clarified for me the collaborative aspect of the maker movement in that it can include not only two or more people working together on a project, but that it can also involve people coming together, physically or virtually, to share skills, ideas or to just lend a helping hand. Finally, this article supports my initiative of having a three-year woodworking program at the middle school level. This model allows students to gain the necessary skills in the first two years to be able to design and build their own projects in the third year and focus on exercising their creativity in a collaborative environment while having fun.

Chu, Quek, Bhangaonkar, Ging & Sridharamurthy (2019).

While the Maker movement encourages creating artifacts in a playful and collaborative manner, authors Chu, Quek, Bhangaonkar, Ging & Sridharamurthy (2019), argue that there are two different forms that making can take in an educational context. One type, which they simply call Making, involves the use of technology and the second they describe as the typical hands-on activities, such as science labs and arts and crafts, typically undertaken in school (Chu et al., 2019). In their study, the researchers wanted to "present empirical evidence" that links the former type of making to building a maker mindset in children; as they argue that most studies in

this area have not managed to establish this causal link (p. 4). To address this, the study aimed "to investigate how Making may influence self-perceptions by creating a Maker mindset," and by "helping the child envision the idea that 'I am a Maker' as part of her self-identity and self-concept" (p. 4). The participants in this study consisted of 23 children, 14 boys and nine girls, ranging in age from eight to 10. The children worked in teams to create a Maker Theater which involved writing a script then integrating technology, in the form of pre-assembled kits comprised of simple circuitry using LED lights, to illuminate their mini theatre set. The children were surveyed, pre and post workshop, to determine their levels of "self-efficacy, interest and motivation to engage, as well as their 'self-concept' in STEM (science and math) and language arts (storytelling, reading, writing)" (p. 10). The researchers found that their 'Means-to-an-Ends' approach, which focuses on forming a maker mindset rather than simply the learning objectives of Making, was successful in eliciting statements from the participants, such as: "'I can', 'I want to', and 'I like'", which they argue are the precursors to children forming a maker mindset (p. 16).

While the researchers' stated goal was to focus on the formation of maker mindsets in the participants, much of what the researchers did with the participants was to assist them build their Maker Theater and observe and record their spontaneous reactions throughout the process. A more integrated approach, involving discussions with the children and videos about how the brain grows and how mindsets are formed, would likely have more profound long-term effects on their stated goal. Additionally, the limited number of participants in their study limits widespread generalization of their findings. Further, the children who participated in the study came as a result of the researchers advertising in a university. This may have skewed the types of students involved in this study as coming from higher socioeconomic backgrounds. Further

studies involving more diverse populations and a greater number of participants are necessary to validate the researchers' claims.

This study illuminates the need that if the goal is for students to adopt a growth mindset in a woodworking class, then focusing on the process surrounding the building of artifacts is what is most important. Additionally, Makerspaces are generally known for being places where students go through an iterative and problem-solving cycle using technology. What is sometimes overlooked is that woodworking also involves similar processes as students learn to shape wood using a variety of tools and machinery often making mistakes and needing to problem solve. In my program, in addition to wood I integrate textiles and sewing into the grade six project and encourage students to incorporate multiple mediums in addition to wood into their projects in subsequent years. By building their repertoire of skills with different types of tools and machines in a wood shop, the possibilities of what students can create is broadened and they may even begin to develop a maker mindset. Through the process of making and building artifacts in safe, supportive and collaborative environments, students in woodworking classrooms, like in Makerspaces, can learn to see setbacks as a necessary part of their learning process. Providing students opportunities to develop these growth mindset habits, it is possible that they will be able to transfer these same abilities into other areas of their lives including academic subjects.

The discussion this far has focused on efforts made at the classroom level to integrate growth mindset into various academic subjects as well as other learning environments. Many of the articles presented in this chapter have included useful links to online resources that teachers, curriculum developers, policy makers and other educational stakeholders can use to build an educational system that supports the development of growth mindset.

Growth Mindset and Policy Recommendations

Rattan, Savani, Chugh & Dweck (2015).

Looking from a macro perspective, the authors advocate for policy changes that would implement of two types of mindset training in schools across the United States. The authors state that given the poor academic rankings of schools in the United States, as evidenced by the Programme for International Student Assessment (PISA) reports, policymakers from all levels of government would do well to look at low-cost ways of improving students' academic scores across all subjects. The authors state that by implementing both growth and belonging mindsets programs in schools, student learning and achievement will improve because they "are more likely to feel that they belong when academic environments communicate growth mindsets" (Good et al., 2012 as quote by Rattan, Savani, Chugh & Dweck, 2015, p. 722). The article provides actionable, relatively low cost, solutions which stakeholders at various levels can implement to move this objective forward. Adoption of these programs is necessary, the authors argue, in order "to capitalize on academic mindsets to enhance student achievement and, thus, to foster the nation's growth, well-being, and competitiveness" (p. 724).

The authors argue that mindset interventions can be effective with university students in as little as one or two sessions and that online delivery of these programs are also beneficial. By providing a superficial overview of the mindset research, this article seems to suggest that mindset training can be done quickly and "that the time, effort, and cost of scaling up can be minimized, while still delivering faithful and psychologically potent interventions" (Rattan et al., 2015, p. 722). Many of the studies that the authors reference in this article also state that longer term interventions are much more effective. Mindset programs that are fully integrated into the classroom culture are much more efficacious and have longer lasting effects at promoting

positive mindsets. A more collaborative approach, however, requires more time and effort to train and support teachers and staff. Further, the authors state that, "any large-scale implementation of academic mindset programs must be paired with rigorous testing because ineffective implementation of even well-validated practices is all too common and fails to yield results" (Sun, 2015 as quoted by Rattan et al., 2015, p. 724). This statement seems to run counter to the spirit of the growth mindset programs, appears to be overbearing and was likely included to appease stakeholders concerned with regulation and standardization of such an initiative. Rather than providing rigorous testing, it would seem more prudent to ensure teachers were well trained, supported and provided with the necessary materials in order to implement such programs.

While Canada ranks higher on the PISA tests than the United States of America, the suggestions provided in this article offer useful guidance for local stakeholders to implement mindset initiatives (https://caps-i.ca, 2021). Unfortunately, it is unlikely that there will be another complete rewrite of the educational system in British Columbia any time soon to include mindset integration into all areas of the curriculum. However, by making changes at the local level in areas such as: curriculum development, teacher professional development, assessment tools and reporting practices, the various stakeholders can help to create learning environments that promote and encourage students to adopt growth mindsets.

Summary

Salomon's ideas, and those of other educational theorists before him, such as Pestalozzi and Froebel, helped pave the way for not only middle school woodworking programs in British Columbia, but collectively their pioneering work also championed an education system that

aimed to teach the head, heart, and the hands, thereby addressing the whole child. This holistic child centered manual training program sought to create a balance between teaching academic subjects and supporting the development of socioemotional skills, including encouraging positive mindsets through physical activity such as woodworking.

Salomon's ideas inspired me to shift my pedagogy to include these ideas into my teaching practice as a classroom teacher. I realized that my teaching practice was firmly supported by Dewey's constructivist theory of education where he argues that learning is best done when students are actively involved in hands-on activities. By linking their education with their lived experiences, both inside and outside of the classroom, Dewey argued that students will find the education process more relevant and thus be more engaging. The woodworking projects that I chose to have my students make, are such that they can use them inside or outside their home and can thus take pride in their craftsmanship.

Vygotsky's notion of the ZPD, where he argues that learning is a social endeavour and that students need to be supported by peer or a teacher to be able push past the limits of their current level of understanding, confirmed what I knew to be occurring while students worked in groups. Vygotsky emphasised that a relationship based on trust and care between teacher and student must first be established in order to facilitate the ZPD which will allow the child to grow and develop (Levykh, 2008, p. 97). This helps to validate my efforts to help students feel comfortable in my classroom.

Also, as I discovered Bandura's concept of self-efficacy, which put forth the idea that mastery experience was the strongest way in which to build one's belief in their capabilities, it helped me to understand why students who struggled academically, tend to thrive while woodworking. I took advantage of this concept, when designing the scope and sequence for my

woodworking program, to have skills build upon each other year to year. In my experience, I have found that students tend to be quite engaged in my woodworking class. Bandura's theory of human agency explains much of the reasoning as to why this might be the case. Bandura argues that only when one believes that their actions can have a positive effect on their life circumstances will they be motivated to act. The process of shaping wood with their hands allows students the chance to exercise their agency in a creative and rewarding way. Bandura's idea that self-efficacy is built through exercising their agency, and that this would further provide motivation for learning, reaffirmed what I knew to be true in my own experience and with my students. Bandura states that goal setting helps to motivate people into exercising their human agency which in turn builds self-efficacy. Having students use goal-based journals to take inventory of their manual skills, problem-solving abilities as well as setting woodworking goals and accomplishing them can have not only short-term benefits, but also help build advantageous habits of mind that can last a lifetime. Further, setting and accomplishing goals in a hands-on course, like woodworking, allows students to not only gain the immediate feedback of their agency, which is empowering as it highlights their ability to self-actualize, but it also builds their self-confidence and resilience.

I found that students tended to be motivated as a result of their successes and the feeling of accomplishment that arose from having experienced mastering a challenging situation or task. Where I felt that their successful experiences motivated students to push themselves further, Bandura argues that it also builds self-efficacy. This allowed me to understand why some students demonstrated a growing excitement for woodworking as their level of mastery increased. For others, their interest in woodworking developed into a passion where they would demonstrate an extreme level of perseverance towards the accomplishment of their goals, even

when faced with setbacks. This helped illustrate Duckworth's concept of 'grit' and it's motivating influence.

The benefits of my efforts to create a safe, caring, and supportive learning environment that allows students to take risks in their learning, were substantiated in the growth mindset research. In addition, integrating this approach with providing opportunities for students to challenge themselves with curriculum that is relevant to them, and where students are engaged in meaningful discussions that promotes self-reflection, will help to provide the right conditions for learners to adopt a growth mindset. Researchers Yeager and Dweck (2020) claim that while teacher led growth mindset interventions provide the least reliable effect on students adopting a growth mindset in academic settings, my experience in a hands-on classroom like woodworking seems to suggest otherwise.

It is with this research as a reference, that woodworking teachers at the middle school level can design their courses in such a way that it is fully geared towards promoting growth mindset. This can be done by providing opportunities for students to learn about mindsets, having discussions about their learning journey in the shop and by providing mindset interventions all while actively creating artefacts from wood. Having three years in which to introduce, promote, and reinforce growth mindset with students, woodworking shop teachers can have a lasting positive influence on middle school learners.

Chapter 3: Summary, Implications, Recommendations and Conclusions

Summary of Findings

The positive effects that growth mindset interventions can have on students in various educational settings are compelling and warrant more widespread adoption in schools. Various researchers have found that delivering longer term mindset interventions to students using highly trained facilitators and by providing training to the participating teacher(s) to support their efforts, that longer lasting effects can be expected compared to an intervention alone. Further research demonstrated that by fully integrating growth mindset into all areas of their teaching practice and classroom culture, encouraged students to adopt positive mindsets (Rattan et al., 2015). Dweck, the founder of growth mindset theory, and Yeager state that teacher facilitated interventions provide the least reliable effects on students; however, it is clearly the most beneficial and cost-effective way to bring this valuable training into classrooms (Dweck & Yeager, 2020).

Implications

Creating a growth mindset oriented middle school woodworking program has been and will continue to be an ever-evolving process. My program continues to be refined and evolves as it is informed by the iterative nature of teaching each successive cohort of students throughout the school year as well as by keeping abreast of the ongoing developments in growth mindset research. Taken together, this then informs the following discussion on the implications my research has for the various stakeholders.

The growth mindset woodworking program that I have developed has implications for numerous stakeholders including growth mindset researchers, the Ministry of Education, universities and Technology Education (Tech ed.) teacher training programs, as well as for school districts and the British Columbia Technology Education Association (BCTEA) and their efforts to provide professional development for their members. This research also has implications for school administrators, counsellors, youth and childcare workers (YCW) and resource teachers. In addition, it has implications for classroom teachers, including myself, parents, and students.

Growth Mindset Researchers

My research integrating growth mindset into a woodworking classroom environment should be of interest to growth mindset researchers for a number of reasons. Woodworking is a challenging non-academic course intended to provide new experience for grade six students transitioning into middle school. In my experience, many students express apprehension and exhibit degrees of anxiety at the beginning of the course. To address all of this, I have been able to create a program that reflects much of what researchers aim to do in order to have a successful mindset class intervention. In the wood shop, I have found that I am able to make students feel at ease in the unfamiliar classroom setting within the first few classes as a result of how I welcome each new group into the shop. Students work through their anxieties as well as any challenging situations in a safe and supportive, non-competitive learning environment. By facilitating whole class discussions on mindsets, various journaling exercises, providing emotional support for students through setbacks, I enable them to embrace a growth mindset. In my experience, the success that this program to date is a testament to the power of combining the

building of tangible artefacts with supporting students in their development of positive mindsets. Much of the mindset studies have focused on providing interventions and activities such as discussions, reflections, surveys, and creating personal writings. All these activities are centered around students using their heads and their hearts. My woodworking program is unique in that it provides the missing element that most mindset interventions lack. This element is the engagement of the students' hands in the creative process of exercising their human agency. In doing so, they produce tangible evidence of their perseverant efforts which also reinforces their self-efficacy. In addition, by having students build useful and developmentally relevant objects, they learn and develop skills in a socially supportive environment. These factors combine to provide the motivation for students to work through the setbacks as they develop their growth mindset. My role as their teacher, is draw their attention to the learning and development that occurs as a result of these woodworking experiences. Further, by drawing the students' attention to their negative self-talk or disadvantageous behaviours as they navigate challenges, I can help guide their self-reflection which further promote the development of their growth mindset. By infusing a growth mindset approach into all aspects of woodworking and reinforcing this over their middle school experience, students have a greater likelihood of applying a positive mindset in other learning situations.

These promising results, lead me to suggest the need to have researchers study the potential of growth mindset interventions in non-academic subjects, given their practical nature. By creating a supportive and interactive learning environment which allows students to exercise their human agency while utilizing their heads, hearts, and hands, middle school woodworking classes are the ideal context in which to study the effects of growth mindset development.

Ministry of Education, Universities and Technical Educational. Training Programs

In conducting my research, it became evident that there are policy implications for the Ministry of Education in British Columbia, universities, and Technical Education (Tech Ed.) teacher training programs. By promoting growth mindset as an integral part of the K-12 curriculum, the Ministry of Education would be encouraging the importance of establishing positive supportive classroom cultures that integrate the promotion of positive mindsets into all areas of students' educational experience. It would also signal to all stakeholders that teaching socioemotional skills, such as mindset training, is equally as important as the content of all academic subjects. University teacher professional development programs as well as Tech Ed. teacher training directors may want to integrate mindset coursework into their programs. In doing so, it may allow candidates to evaluate their own mindsets, refine their teaching pedagogy to reflect mindset research and thus be able to support the development of student growth mindset. This would give teachers the training needed to implement and fully integrate growth mindset into their classroom culture. While mindset training would help pre-service Tech Ed. teachers at the beginning of their teaching careers, training would also be necessary to help existing shop teachers integrate a positive mindset approach into their existing practice.

British Columbia Technology Education Association

It then follows that this research has implications for school districts and the British Columbia Technology Education Association (BCTEA). The implications include engaging its membership in discussions around emerging trends in teaching methodology and how to better support the socioemotional needs of students. While "changing teacher behavior through professional development is known to be exceptionally challenging", it is certainly worth the

effort (TNTP, 2015 as quoted by Yeager & Dweck, 2020, p. 1281). The intention is to guide Tech ed. teachers to understand the value of mindset interventions and to open up a dialogue to encourage further implementation. This can be effectively done by encouraging Tech ed. teachers to identify ways in which they may already be promoting growth mindset in their classroom and how they might further integrate this into their teaching practice. Tecker (2017) identified five strategies that teachers can use, they are: "classroom goal orientation," "celebrating mistakes," "praise the process not the person," "feedback and assessment for learning," and providing "challenging tasks" (Tecker, 2017, pp. 106-108). By assisting Tech Ed. teachers integrate some of these strategies into their teaching practice, they will be better able to help students develop growth mindsets. Providing support and training from the various provincial and local level professional development organizations, including the BCTEA, middle school woodworking shop teachers can retool their programs to support these aims.

Administrators

At the school level, administrators, various support personnel and teachers can benefit from implementing this research into their daily practice. Administrators can use growth mindset to inform their leadership efforts within the school setting. Many schools develop vision statements that include providing support for students in a variety of ways in order for them to do well at school and later on in life. To achieve these lofty goals, it is necessary to teach socioemotional skills, including encouraging the adoption of positive mindsets. Supporting and promoting the efforts of a growth mindset woodworking program, can encourage other staff members to become interested thus making it worthy of becoming the school's socioemotional goal. Promoting a school wide growth mindset goal can affect positive change in students'

academic grades as well as their psychological well-being. As a result of staff and students pursuing such a goal, a positive and supportive school climate can ensue. Admittedly, measuring the degree to which students have adopted a growth mindset might be difficult to quantify, administrators will find that academic gains can be realized as a result of strengthening of the students' beliefs in their abilities (Blackwell et al., 2007; Strahan et al. 2017; Zeeb et al., 2020). Mindset interventions can also mitigate, and even reverse, the academic slide which occurs with grade six students transitioning to middle school (Blackwell et al., 2007). As such, promoting the development of students' growth mindset is worthy of consideration as a school wide initiative.

Youth and Childcare Workers

Working to foster growth mindset in a woodworking classroom would also have implications for school counsellors, YCWs and resource teachers. Many of the students that school counsellors, YCWs, and resource teachers work with have special needs. In my experience, students who tend to struggle academically and or socially, feel more at ease in the hands-on, non-academic woodworking classroom. By creating a safe and supportive learning environment where students are encouraged to take risks and where experiencing setbacks is normalized, even celebrated, all students are encouraged to embrace a growth mindset. Students with developmental challenges can also be supported and included in woodworking with some adaptations. By welcoming and accepting all students and allowing them to participate to the best of their abilities, it enriches the learning environment and experience for students.

Classroom and Technology Education Teachers

Encouraging classroom teachers to build class cultures that promote growth mindset would support the efforts undertaken by woodworking teachers doing the same. This could make for easier transitions between the two learning environments and would allow students to feel equally at ease taking learning risks in their academic subjects as they are in non-academic classes. In addition, by working in collaboration with Tech ed. teachers, many abstract mathematical or scientific concepts can be made clearer by grounding the learning in the practical physical applications of certain concepts. This would deepen the students' understanding of these concepts as a result of making their learning tangible and thus more relevant to them. Further, by working in conjunction with woodworking teachers, classroom teachers would be afforded the opportunity to see students working in different contexts where they may see a child who struggles in academic subjects thrive in a hands-on learning environment. This could also have the effect of inspiring classroom teachers to incorporate more experiential hands-on learning into other areas subjects. Moreover, by allowing learners to demonstrate mastery of their learning in concrete ways, it provides another way for students to build self-efficacy and their belief in their abilities.

Parents

In addition to having implications for school personnel, this research also has ramifications for parents. Parents want what is best for their children and they want them to succeed in school and in life. Unfortunately, there can be barriers to students achieving their full potential. In my experience there seems to be a growing number of students who struggle with anxiety. Parents can take comfort knowing that by exposing children to anxiety producing

activities, such as woodworking, and supporting them through the process, that over time their child will develop the skills needed to successfully overcome their anxiety. As students learn to manage their anxiety and experience successes, they will then be able to draw upon these past experiences and apply the lessons learned to future situations. In this woodworking program students will not only make wooden artefacts, but they will also learn strategies needed to successfully navigate challenging situations. Over time, children develop a growth mindset and come to realize that they can do anything they set their mind to.

Students

Obviously, this work has tremendous implications for students. Similar to the formative and utilitarian aims of Salomon's Educational Sloyd model, students in this program learn within a carefully developed scope and sequence how to use tools properly in creating useful artifacts. They will also develop their mental and physical faculties of observation, sense of touch and dexterity as they enhance their problem-solving abilities. Students come to realize the reward of a true sense of accomplishment is only achieved after having overcome difficult challenges through perseverant effort and hard work. In addition to these benefits, my middle school woodworking program, focuses on helping learners develop growth mindset that will help them be successful in life. This is facilitated by utilizing Vygotsky's idea of Zones of Proximal Development to support and encourage students in their learning journey which helps to build students' self-efficacy and their belief in their abilities. Projects are designed in such a way that they are sufficiently challenging so that when students face setbacks and struggle, they are required to problem solve, to seek help, to learn a new skill or restart the project in order to be successful. This iterative process of learning, that is a shared experience amongst the students in

the shop, normalizes the setbacks faced by students and encourages them to view learning from a growth mindset perspective. Through individual and group discussions as well as exercises that encourage self-reflection and goal setting, students see themselves along their learning journey where every step they take, whether forwards or backwards, brings them closer to their goal.

Implications for Me

Finally, this research has implications for me as a researcher and as a middle school woodworking teacher. Due my 18 years of experience as a classroom teacher prior to becoming a woodworking teacher, I am able to easily intermix mini lessons on various academic subjects into woodworking lessons. Being able to connect seemingly unrelated subjects and concepts for students, helps them form a broader contextual understanding of their learning experiences. This gives me great joy as I've always approached education from a holistic perspective. The iterative process of designing, implementing, and reworking this woodworking program has been a tremendously informative and rewarding. As my experience in implementing a growth mindset program grows, I am better able to support my students in their journey of adopting positive mindsets. Further, this work will serve as a reference for me as I develop future professional development workshops for my colleagues in the BCTEA as well as for classroom teachers.

Recommendations

Researchers

Researchers have identified the lack of funding for growth mindset interventions in schools as well as the need for more highly trained facilitators (Dweck & Yeager, 2020). Having

highly trained mindset facilitators in the classroom is certainly helpful. The reality is, however, that for growth mindset interventions to be more commonplace, researchers will have to provide more guidance and training for teachers to conduct mindset interventions on their own. While more research is needed to establish best practices for teacher led classroom interventions, greater access to teacher training opportunities and support materials will undoubtedly accelerate this field of research. Researchers state that growth mindset work is of particular importance for students living in lower socioeconomic neighbourhoods as well as students transitioning to middle schools (Claro et al., 2016). Unfortunately, there are limited opportunities for teachers to obtain the necessary training and resources needed to facilitate this work. For example, Dweck's online Brainology program is cost prohibitive for an entire school, let alone an entire school district to acquire the training and materials for teachers and students.

Given the importance of this work and the need for students to receive growth mindset interventions, researchers can lead the way. Providing free or reasonably priced online growth mindset course materials, complete with supporting resources for students as well as facilitator training workshops for teachers, will make it accessible and affordable for all schools. Doing so will have the effect of not only giving students a better chance at being successful in school and in life, but it will also advance growth mindset research exponentially by engaging and involving many more professional educators in the process of developing best practices for mindset interventions.

Ministry of Education, Universities and Technical Education Training Programs

As Salomon, and the first inspector for manual training schools in British Columbia Harry Dunnell have stated, Tech Ed. educators should first be qualified classroom teachers who are also able to teach Tech Ed. courses (Thorsteinsson & Olafsson, 2014). Finding dually

certified classroom teachers, who can also teach woodworking, is difficult as the majority of Tech ed. educators are specialists in their area of expertise. By formulating and implementing policy that would allow classroom teachers to also become certified middle school woodworking teachers, after one-year of part-time studies, the Ministry of Education would not only be addressing the shortage of qualified woodworking teachers in the province, but they would also be allowing more broadly qualified woodworking teachers to teach to the head, heart, and hands of students. Universities and Tech Ed. training programs should be able to recognize the teaching experience of classroom teachers along with their prior coursework as being sufficient to satisfy almost all of the practicum and coursework required for certification. In doing so, Tech Ed. training programs would only need to focus on how to approach manual training from a growth mindset perspective. In addition, they would need to provide the specific training for the safe use of tools and machinery in an educational context. By including growth mindset coursework into their programs, Tech Ed. teachers would be able to implement this into their practice. This would thereby give students the ability to develop resilient positive mindsets throughout their middle school educational experience.

British Columbia Technology Education Association

For the BCTEA to encourage Tech Ed. teachers to implement growth mindset into their teaching pedagogy, they could arrange for a few teachers to become trained teacher facilitators who would then be responsible for implementing professional development within their district. In addition, these trainers would be responsible for creating an online growth mindset video series that teachers could use with their students to support the teacher led interventions in the

classroom. Moreover, these facilitators could curate online resources and provide support to teachers in their efforts to implement growth mindset into their teaching practice.

Further, the BCTEA could engage Tech Ed. teachers in discussions regarding how to assess students' growth in their willingness to take learning risks and to learn from them. In promoting the notion that failures are a necessary part of the learning process and that they are constructive in advancing the students' ability to move forward when they face setbacks, Tech Ed. teachers can help students develop their positive mindsets as they develop their projects. A more complete measure of the students' learning and development can be achieved by incorporating goal setting and student self-assessments, at the beginning and end of the course, along with the teachers' evaluation of the students' growth, both in terms of their willingness to take risks and work through setbacks as well as the development of their woodworking skills. In doing so, students will be encouraged to challenge themselves to move their skill development forward and to develop growth mindset.

Administrators

In order to successfully implement a school wide growth mindset goal, principals would need to invest time and money into resources for staff and students as well provide training for staff. Similar to how I have structured my woodworking program, it's important to take the time to build positive and supportive professional relationships with all staff members. It is equally important to encourage them to look at incorporating growth mindsets into their practice by providing appropriate professional development and having the necessary supports in place for teachers and staff. This will create momentum towards the attaining these school wide goals. In the meantime, because of the lack of trained teacher facilitators, Yeager and Dweck suggest that:

> it might be preferable to start by administering a direct-to-student program to teach students a growth mindset, such as the (free-to-educators) program we have developed (available at www.perts.net). Then the focus can be on helping teachers to support its effects. (Yeager & Dweck, 2020, p. 1281)

School administrators can further support woodworking teachers by implementing a three-year Explorations course structure. This would entail structuring the school timetable such that all students from grades six, seven and eight rotate through all Explorations classes each year. All students would then have a specified number of woodworking classes each year in which to develop their skills and abilities, but more importantly it would provide middle learners three consecutive years in which to foster growth mindset.

Youth and Childcare Workers

Given that school counsellors, YCW and resource teachers support the most vulnerable students in schools, programs that can bolster students' academic and socioemotional growth are worthy of integration into their practices. Allowing these key support personnel in schools to have access to growth mindset training, as well as having them evaluate their own mindset biases and tendencies, will support the work done in woodworking classes. The key for support personnel working directly with students is not to comment on the students' abilities, as it promotes a fixed mindset, rather they should praise the students' perseverant effort and their use of different strategies to achieve their goals (Dweck, 2008). Working in concert with a growth mindset woodworking program, counsellors, YCW and resources teachers can help foster greater self-efficacy in students.

Teachers and Technology Education Teachers

As researchers have stated, teachers who are considering implementing growth mindset into their teaching practice should first confront their own mindsets so as to be able to convey and establish a truly supportive positive mindset in the class culture and in their teaching methodology (Yeager & Dweck, 2020; Zeeb et al., 2020). While obtaining access to Dweck's entire online program can be cost prohibitive for many, there is still much that teachers can do. Teachers can start to build their knowledge and understanding of growth mindset, as well as obtain limited free resources to implement it into their classroom culture, by exploring Dweck's mindset (www.mindsetworks.com) website. There are numerous other websites that explore and promote positive mindsets as well as YouTube videos, articles and books that discuss this topic in depth.

Teachers are encouraged to explore the work of Debbie Silver and Dedra Stafford (2017) as well as Jennifer Katz and Kevin Lamoureux (2018) for ways of creating an inclusive, supportive and growth mindset classroom cultures. In addition, collaborating with woodworking teachers and teachers alike to find ways to integrate more hands-on and problem-based projects into their course syllabi, is another way that teachers can begin to work with students to build their self-efficacy and growth mindset.

When implementing a growth mindset-oriented woodworking program, Tech ed. teachers would need to examine the ways in which they interact with students to ensure that they are conveying positive and supportive mindset messages. This would include examining the way in which they welcome students to their shops, the ways in which they provide instruction and assistance to middle school learners, how learning is assessed, what kind of feedback is given

and the manner in which it is delivered. Woodworking teachers would need to re-evaluate all of these areas of the teaching practice so as to support students' ability to foster growth mindset.

Middle school woodworking teachers would also want to structure their three-year program such that the skills and abilities are developed from year to year in a logical scope and sequence to give students a greater chance at being successful in the course. In addition, utilizing growth mindset activities, such as teaching students about how their brain works when they are learning, should also be incorporated into the woodworking course.

Parents

Parents can also support teachers' efforts to develop their child's positive mindset. While there are online resources for parents to use at home on the www.mindsetworks.com site, parents are encouraged to focus on providing their child with challenging tasks and praising their level of effort and degree to which they persevere at difficult tasks. Rather than focusing on praising their child's level of natural talent or intelligence, parents are encouraged to praise the process of learning and not the end result. In doing so, children will come to learn that through hard work, determination and employing various strategies, they will be successful in developing growth mindset. In addition, by refraining from jumping in to save their child from experiencing struggles, disappointment, and even frustration at not being able to accomplish a task easily, parents can teach their child that there is much to learn from the challenges we face in life. It is only through repeated exposure to the iterative process of working through setbacks and eventually achieving success that their child will develop a robust growth mindset in many areas of their lives.

Students

This research has centred around providing students with the opportunity to develop growth mindset within a middle school woodworking context. As such, the recommendations for students are that they be willing to approach new opportunities afforded them by school with an open mind and be prepared to endure some degree of discomfort in the learning process. While engaged in woodworking, students' beliefs about themselves and what they are capable of accomplishing will most likely be challenged. It is quite plausible that they will be surprised by what they are able to accomplish.

In the wood shop, students will be encouraged to see their mistakes, setbacks, and challenges as necessary to the learning process. They will learn to embrace a growth mindset as they come to realize that they can accomplish virtually any task if they are willing to work hard, learn from their mistakes, be willing to develop new skills and abilities and be prepared to ask for help when they unsure how to move forward. During their time woodworking in middle school, students will be challenged to do hard things and at times they will not be successful; these experiences should only be seen as first attempts in learning. Students should also understand that a resilient growth mindset is gained by overcoming difficult challenges and that the middle school woodworking classroom is an ideal supportive environment in which to develop these positive habits of mind. As students will come to realize, life is difficult and by developing a growth mindset they will be better prepared to face these realities.

Recommendations for Me

Finally, this research has brought to light the need for leadership in promoting and implementing growth mindset in the classroom in my school and district. In developing this

woodworking program and refining it over time, I have realized that there is a need to share what I have learned with my colleagues, both woodworking and regular classroom teachers. It is my hope that by collaborating with teachers who are interested in integrating growth mindset into their teaching practice and by staying apprised of the latest developments in mindset research, that we can establish effective teacher led mindset interventions in our classrooms. Once we have developed a level of expertise, if there is greater interest from other teachers, we could even facilitate professional development workshops in our schools, district and beyond.

Further, my research has reminded me that this is an ever-evolving field of study and what may work for one group of students may not for another. By remaining informed of the advances made in this area of research and experimenting with different strategies and activities in my practice, I will be able to develop an increased repertoire of approaches that I can use to foster growth mindset with my students.

Conclusions

My journey to get to the point where I am today has involved a lot of hard work, required me to persevere through many challenges, and has necessitated much reflection as to what I wanted to accomplish in my professional and personal life. In a matter of a few short and intense years, I managed to reimagine my teaching career, completely set up a woodworking shop from bare walls to a fully functioning and welcoming space and to develop a woodworking program that does much more than simply teach woodworking skills to middle school students. I knew that, given my teaching background, I wouldn't be content to just teach woodworking in isolation. I decided to focus on helping my students develop resilient positive mindsets while using woodworking as a conduit to teach these valuable life skills. My research on growth

mindset has given me the tools and insight to be able to reframe and contextualize the struggles that students' go through in my course. I try to encourage students to see learning in school, as with life in general, as a journey where inevitably they will make mistakes or will come upon difficult situations. The goal is to learn from these challenges and to work hard to overcome the setbacks by using various strategies. The purpose of my woodworking program then, is to give students the chance to practice using these strategies to successfully navigate themselves through their current challenging situation. In the process of doing so, students develop their growth mindset.

As such, I am pleased with the woodworking program that I have developed for middle school students that focuses on fostering growth mindset. I know that over the years, I will continue to adjust areas I feel need improvement to make it work best for my students. I have also learned from the research that the most powerful influence on my students' willingness to adopt a positive mindset is me. By remaining positive, supportive and attentive to their needs, I know that my students will develop a greater willingness to adopt growth mindset.

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Appendix A

Doug Stowe (Wisdom of the Hands.com), Leroy Noyes, and Jack Grube (Pinkerton Academy and Founder of NEAWT - New England Association of Woodworking Teachers) developed the following list for NEAWT teachers in 2003.

21 Reasons Why School Wood Shops are Important in the 21st Century

A quality woodworking program provides experiences far more important than those typically associated with wood shop. Courses, like woodworking, where students use their hands build confidence, strength of character, and problem solving capabilities useful in all careers and in every educational experience. Furthermore, working with a natural material in a creative manner assists students in connecting the relevance of other subject material to their daily lives.
Woodworking education:

1. Assists students in communicating and understanding ideas non-verbally, through sketches and technical drawings.

2. Enhances the skills of spatial visualization required for geometry, trigonometry and algebra, thereby helping students to prepare for careers in engineering, architecture and science.

3. Provides students with take-home, physical evidence of their mastery of skills. 4. Instills a pride of accomplishment and self-esteem.

5. Gives the student the opportunity to execute precise work and to produce useful products, and become "self-assessors" using measuring tools, squares, etc. and then the fit of things to self-assess the quality of their work.

6. Trains the eye and hand to see accurately and to feel the sense of beauty in form. 7. Inculcates the habits of attention, perseverance and patience.

8. Offers opportunities for students to go where their hearts demand by selecting designs and projects that motivate them not only as a woodworker but also as a student.

9. Provides opportunities for students to overcome setbacks that occur when working on real objects.

10. Provides relevancy of other subject matter to their lives, thereby preparing them for a lifetime of learning.

11. Provides non-academic areas for demonstration of skills and pursuit of excellence.

12. Provides a non-contrived opportunity for engagement of multiple intelligences.

13. Provides an opportunity to engage physically and actively in learning exercises.

14. Provides an opportunity for engagement and success even for those disinclined for academic involvement.

15. Helps students gain confidence as real world problem solvers.

16. Helps students gain confidence in tools use and learn safety considerations required for a career, lifetime of general home maintenance or a life-long hobby.

17. Offers an appreciation for the values inherent in physical labor and the work contributions of others.

18. Connects students to thousands of years of human creative endeavor. 19. Provides a much-needed break from oppressive classroom routine.

20. Helps students to better understand the sources and process of technological change, placing human development in historical context.

21. Is a class that students enjoy!