

Middle School Technology Education

2016 Pilot

Acknowledgments

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Section 1: Introduction

Mission statement for New Brunswick Schools

To have each student develop the attributes needed to be a lifelong learner, to achieve personal fulfillment and to contribute to a productive, just and democratic society.

Middle School Technology Education is intended to cover the needs of grade 6 to 8 students with respect to practical skills in technology and creative project work. Rather than being tightly limited to computer usage operations, it gives the teacher a degree of flexibility in adjusting course work according to the strengths of their unique facility. Gaining a wide array of skills helps the individual prepare for life and the career choices required in a modern economy. This curriculum is designed so that students can experience a wide range of project types, and thereby, be introduced to a broader spectrum of life-long skills. There are three main subject areas in Middle School Technology:

1. Coding - Often known as programming, this study area is recognized as strengthening logical thinking and problem solving skills. Programming is often seen as the mysterious side of technology usage. However, modern platforms have made entry level programming user friendly and well adapted for the technology classroom.
2. Computer Operations - From the basic creation of folders and saving work to creating multimedia presentations and the operation of modern technologies, it is expected that the modern student should be able to use digital technologies with fluency. Although no schools have access to all the imaginable technology, we want our students to have an open mind when it comes to adopting new technologies.
3. Project Work – Essential to the development of any student is the process by which projects are proposed, designed, completed and assessed. Considering the facility differences in New Brunswick schools these projects can range from wood shop to culinary technology, from creating prototypes to working with fabric. The essential components of Middle School Technology projects is that students have the opportunity to design, create using their hands and basic tools, experience making mistakes with real materials, measure, problem solve, analyze mistakes, devise solutions, assess their work, and see connections to everyday life in a safe and creative setting.

Section 2: Essential Graduation Competencies (DRAFT)

Attitudes, skills, and knowledge that prepare learners to successfully participate in lifelong learning and life/work transitions

Citizenship

Learners are expected to contribute to the quality and sustainability of their environment, communities, and society. They analyze cultural, economic, environmental and social issues, make decisions, judgment, solve problems, and act as stewards in a local, national and global context.

Learners are expected to be able to:

- recognize the principles and actions of citizens in a just, pluralistic and democratic societies
- demonstrate the disposition and skills necessary for effective citizenship
- consider possible consequences of decisions, judgments, and solutions to problems
- participate in civic activities that support social and cultural diversity and cohesion
- promote and protect human rights and equity
- appreciate the complexity and interconnectedness of factors in analyzing issues
- demonstrate understanding of sustainable development

Personal-Career Development

Learners are expected to become self-aware and self-directed individuals who set and pursue goals. They understand and appreciate how culture contributes to work and personal life roles.

They make thoughtful decisions regarding health and wellness, and career pathways.

Learners are expected to be able to:

- connect learning to personal and career development
- demonstrate behaviors that contribute to the well-being of self and others
- build healthy personal and work relationships
- establish skills and habits to pursue physical, spiritual, mental and emotional well-being
- develop strategies to manage career balance and wellness
- create and implement a personal, education, career, and financial plan to support transitions and achievement of education and career goals

- demonstrate preparedness to learn and work in diverse, evolving environments

Communication

Learners are expected to interpret and express themselves effectively through a variety of media. They participate in critical dialogue, listen, read, view and create for information, enrichment and enjoyment.

Learners are expected to be able to:

- listen and interact purposefully and respectfully in formal and informal contexts
- engage in constructive and critical dialogue
- understand, interpret, and respond to thoughts, ideas and emotions presented through multiple media forms
- express ideas, information, learnings, perceptions and feelings through multiple media forms, considering purpose and audience
- assess the effectiveness of communication and critically reflect on intended purpose, audience, and choice of media
- analyze the impact of information communication technology on social equity
- demonstrate the provincially-defined level of proficiency in a second official language

Creativity and Innovation

Learners are expected to demonstrate openness to new experiences, engage in creative processes, to make unexpected connections, and to generate new and dynamic ideas, techniques and products. They value aesthetic expression and appreciate the creative and innovative work of others.

Learners are expected to be able to:

- gather information through all senses to imagine, create, and innovate
- develop and apply creative abilities to communicate ideas, perceptions and feelings
- take responsible risk, accept critical feedback, reflect and learn from trial and error
- think divergently, and embrace complexity and ambiguity
- recognize creative processes are vital to innovation
- use creation techniques to generate innovations
- collaborate to create and innovate

- critically reflect on creative and innovative works and processes
- value the contribution of creativity and innovation to social and economic well-being

Critical Thinking

Learners are expected to analyze and evaluate evidence, arguments and ideas using various types of reasoning and systems thinking to inquire, make decisions, and solve problems. They reflect critically on thinking processes.

Learners are expected to be able to:

- use critical thinking skills to inquire, make decisions and solve problems
- recognize critical thinking is purposeful
- demonstrate curiosity, inquisitiveness, creativity, flexibility, persistence, open and fair-mindedness, tolerance for ambiguity, and suspension of judgment
- ask powerful questions which support inquiry, decision-making, and problem solving
- acquire, interpret, and synthesize relevant and reliable information from a variety of sources
- analyze and evaluate evidence, arguments, and ideas
- work individually, cooperatively and collaboratively to use various types of reasoning and strategies, draw conclusions, make decisions, and solve problems based on evidence
- reflect critically on thinking processes used and acknowledge assumptions
- effectively communicate ideas, conclusions, decisions, and solutions
- value the ideas and contributions of others who hold diverse points of view

Technological Fluency

Learners are expected to use and apply technology to collaborate, communicate, create, innovate, and solve problems. They use technology in a legal, safe, and ethically responsible manner to support and enhance learning

Learners are expected to be able to:

- recognize technology encompasses a range of learning tools and contexts
- use and interact with technology to the create new knowledge

- apply digital technology to gather, filter, organize, evaluate, use, adapt, create, and share information
- select and use technology to create and innovate
- analyze how technology and society impact and advance one another
- adopt, adapt, and apply technology efficiently, effectively, and productively

Section 3: Approaches to Teaching (pedagogical principles)

Universal Design for Learning

Every student has the right to reach curriculum goals in a way that recognizes their diverse needs. *Universal Design for Learning* is a “framework for guiding educational practice that provides flexibility in the ways information is presented, in the ways students respond or demonstrate knowledge and skills, and in the ways students are engaged. It also “...reduces barriers in instruction, provides appropriate accommodations, supports, and challenges, and maintains high achievement expectations for all students, including students with disabilities and students who are limited English proficient.” (CAST, 2011)

The wide range of projects available within MSTE offers the educator an excellent opportunity to adapt materials and projects according to the diversity of the students. Strong skills learning can take place if the specifications for project work are adjusted to the students’ needs.

New Brunswick curricula are created with universal design principles in mind. Outcomes are written so that students may access and represent their learning in a variety of ways, through a variety of modes. Three tenets of universal design inform the design of this curriculum. Teachers are encouraged to follow these principles as they plan and evaluate learning experiences for their students:

Multiple means of representation: provide diverse learners options for acquiring information and Knowledge

Multiple means of expression and action: provide learners options for demonstrating what they know

Multiple means of engagement: tap into learners' interests, offer appropriate challenges, and increase motivation

For further information on *Universal Design for Learning*, view online information at <http://www.cast.org/>

Assessment and Evaluation

Assessment is the systematic gathering of information about what students know and are able to do. Student performance is assessed using the information collected during the evaluation process. Teachers use their professional skills, insight, knowledge, and specific criteria that they establish to make judgments about student performance in relation to learning outcomes. Students are also encouraged to monitor their own progress through self-assessment strategies such as goal setting and rubrics.

Research indicates that students benefit most when assessment is regular and ongoing and is used in the promotion of learning (Stiggins, 2008). This is often referred to as formative assessment. Evaluation is less effective if it is simply used at the end of a period of learning to determine a mark (summative evaluation).

It is recognized that summative evaluation is usually required in the form of an overall mark for a course of study and rubrics are recommended for this task. Sample rubrics templates are referenced in this document, acknowledging teachers may have alternative measures they will apply to evaluate student progress.

Some examples of current assessment practices include:

- Questioning
- Observation
- Conferences
- Demonstrations
- Presentations
- Role plays
- Technology Applications
- Projects and Investigations
- Checklists/Rubrics
- Responses to texts/activities
- Reflective Journals
- Self and peer assessment
- Career Portfolios
- Projects and Investigations

For further reading in the area of assessment and evaluation, visit the Department of Education and Early Childhood Development's Assessment and Evaluation site at:

<https://portal.nbed.nb.ca/tr/AaE/Documents/,DanaInfo=portal.nbed.nb.ca,SSL+Assessment%20Framework.pdf>

Section 4: Subject Specific Considerations

Background and Rationale

We are teaching in the era of digital citizens. Most youth of today have grown up with a constant interaction with technology – these devices, from televisions, video games, smart phones, tablet computers, digital thermostats, gps locators, touch screens, and more, are changing the way students think and develop.

The importance of designing a MSTE curriculum with brain development in mind cannot be overstated. During the teenage brain development the neural connections “bloom”. “Based on usage, our brains “prune” what is not used. Up to 60% of these unused connections are pruned in the teenage years. After this... the brain is fundamentally wired for the rest of a person’s life, though some pliability is present into our twenties.” (Herman, pp36-37)

The broader the range of skills that a student acquires early in life, the more that individual will be prepared for life. Both their cognitive and practical abilities are strengthened in their adult years by experiences in their youth.

We need to balance the benefits of technology with its shortcomings (sedentary lifestyles, obesity, social alienation, economic change). We need to balance the student’s want of instant gratification thru technology with the mind’s deeper engagement in tasks of mental substance. (Herman, p.36)

MSTE offers an opportunity for skills acquisition, development, and application. The modern world expects individuals to practice a variety of technologically associated skills. Of course, everything we learn helps with our brain development. From the MSTE perspective, both the refining of fine motor skills and an expansion of practical computer usage abilities promote cognitive advantages.

According to psychologist Albert Bandura, in his social cognitive theory, an individual’s knowledge acquisition can be directly related to observing others within the context of social interaction, experiences, and by media influences. (Ives, p9) The Middle School Technology classroom can help to balance the over indulgence in digital media that is part of many of students’ lives. Instead of merely participating in online social interaction students can be directed to create digital content and to exercise logic through the exercises of coding.

Project Based Learning (PBL) is central to Middle School Technology. Those projects can be technology oriented and/or involve manual and machine tools skills. The five keys to rigorous PBL are:

1. Real World Connections
2. Core to Learning
3. Structured Collaboration

4. Student Driven
5. Multifaceted Assessment (source: <http://www.edutopia.org/video/five-keys-rigorous-project-based-learning>)

Section 5: Outcomes

The New Brunswick Curriculum is stated in terms of general curriculum outcomes, specific curriculum outcomes and achievement indicators.

General Curriculum Outcomes (GCO) are overarching statements about what students are expected to learn in each strand/sub-strand. The general curriculum outcome for each strand/sub-strand is the same throughout the grades.

Specific Curriculum Outcomes (SCO) are statements that identify specific concepts and related skills underpinned by the understanding and knowledge attained by students as required for a given grade.

Middle School Technology Education Curriculum Outcomes

GCO 1 – Students will understand technological operations and concepts.

Specific Outcomes	Concepts and content	“I Can” Statements
1.1 Students will use technological operations and concepts	<ul style="list-style-type: none">• File Management• Word processing• Computer Sketching• Basic Digital Operations	See Appendix J, Sections 1, 2, and 3
1.2 Students will be able to use tools and technology applications safely.	<ul style="list-style-type: none">• Hand tools• Workshop Protocol• Power Tools• Electronic Equipment•	See Appendix J, Section 5
1.3 Students will conceptualize, design, and create products respective of standards and specifications.	<ul style="list-style-type: none">• Measurement• Precision• Workmanship• Pride of Project	See Appendix J, Section 5

<p>1.4 Students will communicate information and ideas using a variety of multimedia.</p>	<ul style="list-style-type: none">• Video Production• Image Production• Audio Production• Presentations• Digital Literacy• Electronic Portfolio	<p>See Appendix J, Sections 1, 2, 3, and 4</p>
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GCO 2 – Students will practice critical thinking and problem solving skills.

Specific Outcomes	Concepts and content	“I Can” Statements
2.1 Students will investigate and solve technological problems.	<ul style="list-style-type: none"> • Help function • Troubleshooting • Research Skills • Critical Thinking 	See Appendix J, Sections 1, 2, and 3.
2.2 Students will examine data to draw conclusions and recommend solutions to improve performance.	<ul style="list-style-type: none"> • Spreadsheets • Coding • Prototypes • Product Evaluation 	See Appendix J, Sections 1, 2, 4, and 5
2.3 Students will work in teams to solve problems.	<ul style="list-style-type: none"> • Collaboration • Communication • Work Sharing 	See Appendix J, Section 5
2.4 Students will investigate and demonstrate the relationship between technology and society.	<ul style="list-style-type: none"> • Enterprise • Environmental Sustainability • Energy management • Ethics • Innovation 	See Appendix J, Section 5
2.5 Students will understand and demonstrate computer coding/programming concepts and terminology.	<ul style="list-style-type: none"> • App Development • Robotics • Game Development • Electronics 	See Appendix J, Sections 1, 2, 3, and 5

GCO 3 – Students will practice responsible citizenship.

Specific Outcomes	Concepts and content	“I Can” Statements
3.1 Students will demonstrate an awareness of human, cultural, and societal issues related to technology.	<ul style="list-style-type: none"> • Digital Access • Digital Etiquette • Communication 	See Appendix J, Sections 2, 3, and 5
3.2 Students will practice safe, legal, and ethical use of technology.	<ul style="list-style-type: none"> • Digital Security • Legal Issues • Policy 311 	See Appendix J, Section 3
3.3 Students will explore the educational and career pathways that exist in technology.	<ul style="list-style-type: none"> • Career Exposure • Online courses 	See Appendix J, Section 5
3.4 Students will interact, collaborate, and publish using technology respective of copyright.	<ul style="list-style-type: none"> • Responsible Publishing • Referencing 	See Appendix J, Section 1, 2, 3, and 5
3.5 Students will understand the concept of, and demonstrate appropriate decision making with regards to, “Digital Footprint”	<ul style="list-style-type: none"> • Privacy • Social Responsibility • Legal Issues • Security • Cyber bullying • Rights versus responsibilities • Digital finances • Internet Safety • Phishing • Malware 	See Appendix J, Sections 2 and 3.

Bibliography

Web sources: <http://www.edutopia.org/video/five-keys-rigorous-project-based-learning>

Herman, Jana Morgan. "Creating Balance in the New Age of Technology." *Montessori Life* 24.3 (2012): 36-43. *Education Research Complete*. Web. 28 Jan. 2015.

Ives, Eugenia A. "iGeneration: The Social Cognitive Effects of Digital Technology on Teenagers." Online Submission (2012). ERIC. Web. 5 Feb. 2015.

VARLAS, LAURA. "Teaching To the Teenage Brain." *Education Update* 56.9 (2014): 1-5. *Education Research Complete*. Web. 6 Feb. 2015

Mulholland, Rita. "Woodshop, Technology, and Reading!" *Teaching Exceptional Children* 37.3 (2005): 16-19. *Education Research Complete*. Web. 6 Feb. 2015

Appendix A – Rubrics Aligned to Curriculum Outcomes

GCO 1. Students will understand technological operations and concepts.					
GCO	SCO	Exceeding	Meeting	Approaching	Below
1.	1.1	Students will use technological systems.			
		Consistently and independently demonstrates effective use of technological systems	Usually determines effective and appropriate uses of technology systems	Sometimes and with help grasps concepts and marginally achieves success when learning systems	Rarely engages in assigned activities, and is unsuccessful when using systems
1.	1.2	Students will be able to use tools and technology applications safely.			
		Always uses the specified procedures and tools to perform tasks safely	Usually demonstrates the ability to use appropriate tools and procedures safely	Occasionally uses appropriate tools and applications safely	Not able to select appropriate tools and demonstrate safe behaviours
1	1.3	Students will conceptualize, design, and create products respective of standards and specifications.			
		Skillfully generates ideas that lead to the development of a sophisticated project/product	Often comes up with ideas that lead to development of a project/product	Generates incomplete ideas that may lead to partial development of a project/product	Rarely exhibits idea generation skills or the development of a project/product
1	1.4	Students will communicate information and ideas using a variety of multimedia.			
		Precisely or persuasively communicates information and ideas using a variety of multimedia	Reliably communicates information and ideas using a variety of multimedia	Communicates limited information and ideas using a variety of multimedia	Unable to communicate ideas and information with multimedia, or does so with extreme difficulty

GCO 2. Students will practice critical thinking and problem solving skills.					
GCO	SCO	Exceeding	Meeting	Approaching	Below
2	2.1	Students will investigate and solve technological problems.			
		Consistently integrates scientific knowledge into technological solutions	Routinely integrates scientific knowledge into technological solutions	Sometimes integrates scientific knowledge into technological solutions	Unable to integrate scientific knowledge into technological solutions
2	2.2	Students will examine data to draw conclusions and recommend solutions to improve performance.			
		Always examine data to draw conclusions and recommend solutions to improve performance	Often examine data to draw conclusions and recommend solutions to improve performance	With some help, examine data to draw conclusions and recommend solutions to improve performance	Hardly ever able to examine data to draw conclusions and recommend solutions to improve performance
2	2.3	Students will work in teams to solve problems.			
		Works in teams with success to solve problems in all situations	In most cases, work well in teams to solve problems	In some situations, works moderately well in teams to solve problems	Not able to work with peers to solve problems
2	2.4	Students will investigate and demonstrate the relationship between technology and society.			
		Insightfully demonstrates an understanding of the relationship between technology and society	Demonstrates an understanding of the relationship between technology and society	Demonstrates a limited understanding of the relationship between technology and society	Does not appear to understand the relationship between technology and society
2	2.5	Students will understand and demonstrate computer coding/programming concepts and terminology.			
		Design, develop, and code their own project. Code their own project to produced desired effect	Demonstrates functional coding with some difficulty applying concepts	Practices limited coding but projects often have problems	Does not appear to understand the fundamentals of coding

GCO 3. Students will practice responsible citizenship					
GCO	SCO	Exceeding	Meeting	Approaching	Below
3	3.1	Students will demonstrate an awareness of human, cultural, and societal issues related to technology			
		Independently investigates and demonstrates an understanding of human, cultural, and societal issues related to technology	Demonstrates an understanding of human, cultural, and societal issues related to technology	With some difficulty demonstrates an understanding of human, cultural, and societal issues related to technology	Rarely demonstrates an understanding of human, cultural, and societal issues related to technology
3	3.2	Students will practice safe, legal, and ethical use of technology			
		Always practices safe, legal, and ethical use of technology	Routinely practices safe, legal, and ethical use of technology	Practices safe, legal, and ethical use of technology when prompted	Shows disregard for the safe, legal, and ethical use of technology
3	3.3	Students will explore the educational and career pathways that exist in technology			
		Creatively explores career pathways in technology with independence	Investigates and explores educational and career pathways in technology	Sometimes explores the educational and career pathways in technology	Rarely examines the educational and career pathways in technology
3	3.4	Students will interact, collaborate, and publish using technology respective of copyright			
		Skilfully interacts, collaborates, and publishes exemplary content using technology	Routinely and proficiently interacts, collaborates, and publishes using technology	With support interacts, collaborates, and publishes using technology	Not able to use technology to interact, collaborate, and publish
3	3.5	Students will understand the concept of appropriate decision making with regards to their "Digital Footprint"			
		Always demonstrates appropriate decision making processes with regard to "Digital Footprint"	Consistently demonstrates appropriate decision making processes with regard to "Digital Footprint"	Rarely demonstrates appropriate decision making processes with regard to "Digital Footprint"	Does not demonstrate appropriate decision making processes with regard to "Digital Footprint"

Appendix B – Conceptual Framework Divisions for Grades 6 to 8

Middle School Technology can include the following:

Digital Technology Skills Exposure

- File Management
- Office
 - Word Processing
 - Spreadsheets
 - Presentations, etc.
- Coding/Programming
- Computer Aided Drafting/Design
- Image Production
- Video Production
- Audio Production
- Storyboarding
- Web Design
- Social Networking
- Digital Citizenship
- Internet Safety
- 3D Design
- Game Design
- Multimedia Editing

Manual /Project/Practical Skills Exposure

- Measurement
- Small Hand Tools
- Cutting
- Sanding
- Sewing/Fashion Technology
- Culinary Skills
- Light Machine Tools
- Finishing
- Circuits
- Robotics
- Claymation
- Prototype Design
- Model Building
- Bridge Building
- Small Engines
- Manual Drafting
- 3D Comprehension
- Alternate Energy
- Aerodynamics
- Safety Knowledge

*This section is facility dependent. Different schools have different equipment and capabilities.

* A safety orientation is mandatory before any project work begins.

- ❖ A minimum of 10% of each year must be spent on coding.
- ❖ A minimum of 30% of each year must be spent on Manual /Project/Practical Skills.
- ❖ Schools must work out the scope and sequence of their 3 year MSTE schedule.

Appendix C - MSTE Teaching Strategies for Coding

1. **Become Familiar with the Resources**: The number of coding resources can be overwhelming. No single individual can hope to become fluent in the variety of programming platforms available. However, it is possible to familiarize yourself with the entry-level platforms offered by different coding organizations. Two resources have been prepared by New Brunswick teachers to facilitate familiarization: New Brunswick Coding Tree (Appendix D) and Coding K-12 Existing Resources and Policies from around the World (Appendix E) **Please note that Coding Resources are developed weekly and no list could be comprehensive. These organizations support Coding Education; visit their websites for an expanding collection of resources:**

www.Code.org

www.codecademy.com/

www.khanacademy.org/

hourofcode.com/ca

www.edutopia.org
2. **Encourage Students to Collaborate**: Students appreciate the chance to share what they know with classmates. Such opportunities to be a leader can strengthen the identity of those students. As some students use coding to supplement their spare time activities, these students can become your class experts in particular programming languages. Also, there is the added advantage that students speak student language naturally and can often understand gaps in understanding from the student level.
3. **Allow Students to Advance at their Own Pace**: There is no need to rush the learning of programming. In fact, expecting students to all maintain the same pace can lead to gaps in learning. Learning Coding is similar to learning a language; individuals learn at different speeds and it is necessary to have a solid foundation before moving onto more complex programs.
4. **Permit Students to Use Novelty Platforms**: Twenty years ago Coding was all about learning complex programming languages. The introduction of user-friendly platforms has democratized coding; everyone is able to find a platform or system in which they can work. In some cases, complex lines of code are now represented by labeled icons that allow the user to avoid learning detailed, syntax dependent formats. This has added ease of use and speed to the coding process allowing users a shorter project timeline with rapid feedback from their efforts. If students become more interested in coding they will naturally gravitate towards the more complex programming languages.
5. **Promote Coding at Home**: With the advent of novelty platforms starting coding at home is not difficult. By utilizing the entry-level block coding methods with instructional videos almost anyone can learn coding at home. For the self-motivated student at-home learning will allow that individual to specialize on more complex programming languages. Despite the broad

selection of coding platforms significant time is still needed if individuals are to move beyond rudimentary operations. There is simply not enough time within the school day for anyone to advance vastly in coding. Remember Coding is part of the subject area we know as Computer Science.

6. **Assess on Participation and Understanding**: As different students will be at different places in their coding abilities decide and announce early how the assessment will be framed. Base your assessment on several of these factors:
 - a. Is there evidence that the student is learning?
 - b. Can the student explain what their coding is doing?
 - c. Is the student being creative with the coding platform? Or are they merely following a prepared module?

Sources or Research Basis:

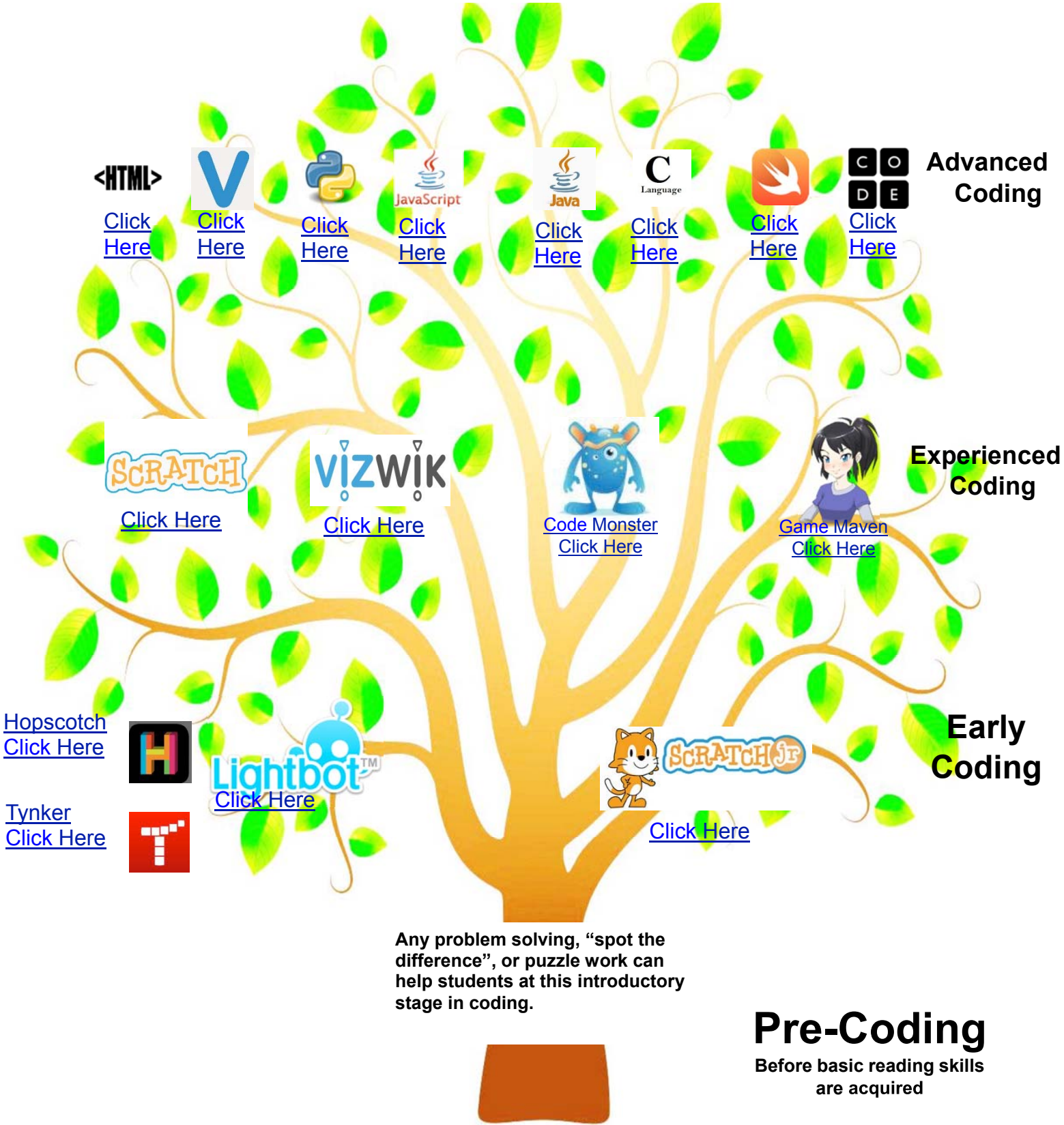
Add Coding to Your Elementary Curriculum. . . Right Now (March 17, 2015) :http://www.edutopia.org/blog/add-coding-elementary-curriculum-now-matt-harrell?utm_source=SilverpopMailing&utm_medium=email&utm_campaign=032515%20enews-A%20coding%20ngm&utm_content=&utm_term=feature1hed&spMailingID=10973545&spUserID=MjcyODEyMDk0NTES1&spJobID=501773575&spReportId=NTAxNzczNTc1S0

15+ Ways of Teaching Every Student to Code (Even Without a Computer) (December 4, 2013):
<http://www.edutopia.org/blog/15-ways-teaching-students-coding-vicki-davis>

Teaching Kids to Code – A Comparison of 50+ Coding Tools: <https://www.edsurge.com/guide/teaching-kids-to-code#A-Comparison-of-50-Coding-Tools>

Appendix D – New Brunswick Coding Tree

Suggested Coding Resources based on experience of individual students. These SCRs can be used to differentiate and enrich classroom coding efforts and show students a natural progression as their skills develop.



Appendix E - Coding K-12 Existing Resources and Policies From Around the World

Coding K-12

Existing Resources & Policies from Around the World (and right here at home!)

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Prepared for:

Department of Education and Early Childhood
Development, Province of New Brunswick

Research Dates: July/August 2014

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All of the information contained in this document was first posted to <http://bbtnb.ca> under the course called “Broad Based Technology 10” and under the section called “K-12 Coding”.

If there are any broken links in this document, updated links may be found at <http://bbtnb.ca>.

Executive Summary

This document lists as many active coding resources as could be found in July/August 2014.

Top recommendations for teachers looking for the best and most engaging coding tools, the recommendations are:

- Kindergarten – Grade 2:
 - Scratch Jr for the iPad (<http://www.scratchjr.org>)
 - Code.org (always being updated, awesome new courses!) (<http://learn.code.org>)
 - Rapid Router (new from the UK) (<https://www.codeforlife.education>)
- Grades 3-7:
 - Scratch (preferably installed, but can also use the online version: <http://scratch.mit.edu>)
 - Code.org (Entry Level: <http://learn.code.org> or see the Full List: <http://code.org/learn>)
- Grades 8-10:
 - Scratch (for new coders. Official Scratch Ed Site: <http://scratch.ed.gse.harvard.edu> or try the Frogger Game: <http://www.witty.ca/scratch-2-coding.html>)
 - Vizwik (requires Google Chrome and is only available online: <http://vizwik.com>)

For teachers looking for curriculum resources and unit plans, there are a number listed below, but these will also be updated frequently on the new BBT 10 curriculum ideas web site (<http://bbtnb.ca>).

Background

Coding is the newest term for “Computer Programming” and “Software Development” and even “Software Engineering”. Yet, whatever term you use, graduates of public high schools around the world often lack even a basic understanding of how computers can be programmed to assist with a range of tasks.

This document is a snapshot of existing Coding policy documents and resources currently available. Wherever possible, no new resources were created.

This document also springboards off the activities of the Broad Based Technology 10 (BBT 10) curriculum committee, especially from Ben Kelly and Graham Rich who had both been using Scratch (<http://scratch.mit.edu>) to teach Block Coding for a number of years.

This document also attempts to answer the question, “What’s next?”

- for what are we preparing our students? What is our goal?
- If Scratch units, developed for BBT 10, are being borrowed by MSTE teachers for use in lower grades, then what will BBT 10 teachers use?
- after students have used Scratch, what tools/languages should students use next?
- what tools are enticing to students in the general population, not just those who are already drawn to working with computers and coding?

Some teachers in New Brunswick have been using Visual Basic for a number of years, sometimes for all students and sometimes as an enrichment activity. Visual Basic is an excellent entry-point into the coding tools provided by Microsoft, with tie-ins to text-based coding with C# and SQL Server. These are certainly a viable answer to the question and, if already in use, are to be encouraged!

However, a recognizable shift has been happening in New Brunswick for the past number of years:

Many BBT teachers (in either grade 9 or 10) do not have a strong background in technology, do not have much time to develop these technical skills, and often do not foresee teaching BBT longterm.

While this shift has been happening, our society has become much more technologically savvy and our students have higher expectations of their learning:

- for the technology used (Is this something new?)
- for the personal relevance and interest (Do I think this is a cool project?)
- for immediate results (Can I make something work right away?)
- for the “Wow” factor (Can I show this off to my friends and they will think it is cool?)

The combined effect of all of this means that text-based coding and also Visual Basic are often too complex for the new or part-time BBT teacher and are too uninteresting or difficult for the average student.

So, after Scratch, what comes next?

There are precious few options, with the best answer to-date being Vizwik (<http://vizwik.com>), a block coding tool for phone apps that is being developed right here in Moncton by AgoraMobile. However, Vizwik has only gone public in September, so resources are scarce, but both Vizwik staff and New Brunswick teachers are developing text, graphical and video-based tutorials to help students and teachers. To date, Vizwik is a free online resource that only requires Google Chrome (with nothing to

install). As such, it is by far the best resource for general population students who aren't yet sure if coding or computer programming are for them.

What about text-based coding?

Vizwik is actually just a visual representation of Javascript. Once students master how to manipulate the code blocks, scripts, views and data, then there is a direct mental mapping to text-based coding with Javascript.

If students don't get that jump right away, then there are a variety of tutorials for Javascript, including the amazing Codecademy (<http://www.codecademy.com>) or the equally amazing Khan Academy (<https://www.khanacademy.org/computing/computer-programming>).

In addition, New Brunswick has a number of strong Computer Science programs in grades 11 and 12. These typically use Java and/or Visual Basic/C# as their primary resources. With this in mind, the new BBT 10 curriculum team actively avoided using Java, Visual Basic or C# in their recommended curriculum. This does not mean Java/VB/C# are not allowed; far from it! These are to be encouraged where schools already have a workflow for students through their course offerings. However, for schools that do not already have such a workflow, then we recommend using Scratch and Vizwik in lower grades and allowing the grade 11 and 12 courses to remain as-is. (These course curricula may someday be updated, but that is a topic for another document at another time.)

Overviews, Discussion Points & Suggested Reading

- [DRAFT / DISCUSSION POINTS: K-12 Coding Curriculum Standards - Version 01](#)
- [DISCUSSION POINTS: Coding vs Information Technology vs Digital Literacy](#)



- [BBC Schools - Computing](#)
Resources for both Elementary (Primary) and Secondary.



- [About the new "BBC Schools - Computing" News article about the new "BBC Schools - Computing" web site.](#)



Existing Coding Tools & Resources

VISUAL CODING (Great for Beginners)

Visual coding, by dragging code blocks into patterns, has been experimented with for years. The original Lego Mindstorms programming language was visual and was well received by both teachers and students. Unfortunately, when the Mindstorms NXT came out, the visual language was entirely new and not as well received.

However, in the aftermath, a number of alternatives sprang into existence! Here is a list of those available in Summer 2014.

Visual Coding (with Code Blocks) - Free Tutorials

These are free resources with drag-and-drop blocks, especially for kids and new coders.

- [Learn.Code.org \(especially for kids & first-time coders\)](#)

K-8 Intro Course
(15-25 hours)

[And new courses
uploaded regularly]



Activities can be:

- Unplugged for small groups
- Unplugged for the whole class
- Online "Blockly" coding (drag & drop blocks) - no installation as it is all online
- Video or text instructions

- [Scratch \(especially for kids & first-time coders\)](#)

The absolute best tool for starting coding.

- [Online version \(no download necessary\).](#)
- [Download version \(recommended but requires install\).](#)
- Great [help page](#) and [online community & resources!](#)



Online and download/installed versions are identical. Online is great but can lag if the Internet connection is slow (due to the whole class doing online activities.)

[ScratchED is a great resource for teachers.](#)



- [ScratchJr \(for the iPad and ages 5-8\)](#)

WOW! Now a Scratch for even younger students (K-3)!

Download it from the Apple App Store. (Requires an iPad.)
Teaching resources on the site!



- [CS-First \(Scratch Tutorials from Google. Especially for kids & first-time coders\)](#)

Workshops created for summer camps. Uses Scratch.

Topics:

- [Scratch Game Design \(8 days\)](#)
- [Scratch Music & Sound \(8 days\)](#)



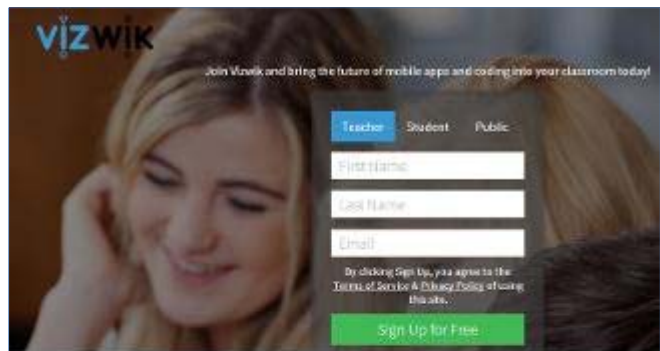
- [VizWik by AgoraMobile - Make Apps for Any Device!](#)

Visual coding tool, simple enough for teens, professional enough for business.

Develop an App and have it automatically work on any Android or Apple phone.

AgoraMobile is based in Moncton, NB. Their product, VizWik, has just been open to the public since Sept 2014.

Currently, students can only develop the code using Google Chrome.



- [VizWik Overview Presentation \(larger images\)](#)



- [App Inventor - Make Apps for Android \(Phones & Tablets\)](#)

[Recommend you follow a tutorial, as there are important tricks to learn.](#)
[Can use an emulator, so phone or tablet is not required.](#)



- [Alice - 3D Programming](#)

[Using an innovative programming environment to support the creation of 3D animations, the Alice Project provides tools and materials for teaching and learning computational thinking, problem solving, and computer programming across a spectrum of ages and grade levels.](#)



- [Blockly \(also used in Learn.Code.org\)](#)

[Drag-and-drop block to build your code.](#)

[Use the Code.org tutorials](#)

... [or try these ones.](#)



Used in the UK by "Rapid Router" to teach coding to younger students. Blockly is actually a software tool made by Google so you can customize any grid-based action.

- ["Rapid Router" & "Code for Life" by Ocado](#)

Rapid Router is a coding curriculum for young students (K-4). (Uses Blockly.)

"Code for Life" is a coding curriculum for older students (Gr. 5-12). (Uses Python.)

[Created by the British company "Ocado" that is actually an online grocery store & delivery service.](#)



Visual Coding (with Coding Blocks) - Commercial Tutorials (\$\$\$)

- [Tynker \(Some free activities, \\$50 courses or \\$5 mobile app\)](#)
- [Lightbot \(kids game - move robot and light blue squares\)](#)

TEXT CODING

Coding using text is what both university courses and businesses expect. Therefore, any schools looking to prepare students for to move on with computer programming should expect their students to learn text-based coding.

However, text-based coding requires a high degree of rigour. In other words, one small spelling or syntax error will mean that either the code won't run at all, or it will run with strange side effects. As such, text-based coding is suggested for those students who want to pursue computer programming as a career or study option (at college or university).

Text Coding - Free Tutorials

- [Codecademy.com](https://www.codecademy.com)

[Learn to code interactively, for free!](https://www.codecademy.com)
(no videos)

Type your code right into the site. It will confirm your code or offer hints.

Topics include:

- HTML & CSS
- JavaScript & jQuery
- PHP
- Python
- Ruby



AMAZING RESOURCE! Students follow prompts and learn the spelling and syntax for coding.

- [Crunchzilla - Code Monster](https://www.crunchzilla.com)

Learn Javascript. Similar to Codecademy, but much more flexible, allowing students to move ahead even if they don't get the syntax perfect. (This can be both good and bad.)

- [Invent Your Own Computer Games with PYTHON](https://inventwithpython.com)

[3 FREE eBooks!](https://inventwithpython.com)

1. [Invent Your Own Computer Games with Python](https://inventwithpython.com)
2. [Making Games with Python & Pygame](https://inventwithpython.com)
3. [Hacking Secret Ciphers with Python](https://inventwithpython.com)



- [Khan Academy - Computer Programming \(JavaScript\)](#)

[Online video-based teaching, targeting grade 4-12](#)
<https://www.khanacademy.org/computing/cs>



[Canadian review of Khan Academy's computer programming](#)

- [W3Schools](#)

[Free instruction & activities \(no videos\)](#)

[Currently, courses in:](#)

1. [HTML & CSS](#)
2. [JavaScript & jQuery](#)
3. [SQL](#)
4. [PHP](#)



- [Bootstrap - Algebraic Videogame Programming](#)

[Build on student's math knowledge. Being used all over the USA.](#)

[Teacher resources are here.](#)



["Unlike Python, Scratch or Javascript, functions and variables behave exactly the same way in Bootstrap that they do in your child's math book. Bootstrap focuses on order of operations, the Cartesian plane, function composition and definition, solving word problems and more."](#) (Uses [WeScheme](#) and [Racket](#) languages)

- [Pluralsight for Kids](#)

[Free Video-based Courses:](#)

1. ["Teaching kids to program"](#)
2. [Scratch](#)
3. [App Inventor](#)
4. [Kodu Kingdom Defense](#)
5. [HTML](#)



Text Coding - Commercial Tutorials (\$\$\$)

(Most offer a small selection of courses for free.)

- [Pluralsight](#)

[Video-based Courses:](#)

Started with Microsoft languages (VB, C#, ASP, ...)

Now has the widest library of language choices, and all with video learning!



Starts at \$29/month but also has a "Try It Free" option.

<http://pluralsight.com>

- [CodeSchool.com](#)

[Online Coding + Video-based Courses:](#)

Languages / "Paths":

1. Ruby
2. JavaScript
3. iOS (iPad/iPhone)
4. HTML/CSS

Watch a video and then type your code right into the site. It will confirm your code or offer hints.



Starts at \$29/month but also has some FREE courses.

<http://www.codeschool.com>

- [Team Treehouse](#)

[Video-based Courses](#) and [Pioneers of the learning tracks, so your courses build towards a career.](#) Tracks include:

1. [Web & Front-End](#)
2. [Ruby on Rails](#)
3. [iOS \(iPhone & iPad\)](#)
4. [Android](#)
5. [PHP](#)
6. [WordPress](#)
7. ["Starting a Business"](#)



Starts at \$25/month but also has a "Try It Free" option.

<http://teamtreehouse.com/>

- [CodeHS](#)

First unit is free (JavaScript).
Full course is \$25/month.

[CodeHS](#) offers TUTORSI!!!
\$400/month.

Based at Stanford University.



- [Udemy.com](#)

Are you interested in:

1. [only the free courses on Udemy.com?](#)
2. [or all coding courses offered on Udemy.com \(+\\$\)](#)



- [Minecraft Education](#)

Discounted licenses for education.
Includes class management tools.

\$18/student +
\$41/server



- [RobotsLab.com](#) - "The Box"

Teacher uses \$4000 Robot "Box" in her Calculus class! Watch her video on YouTube!



Suggestions

(Things to keep in mind, or alternative approaches)

- Making Your Own Videos? Keep this in mind!
- Smart List: 20 Coding & CS, Assessment & Data Resources

[SMART LISTS / August 13, 2013.
Coding, computer science and data resources](#)

- Exploring Computer Science

[Contains their own Computer Science curriculum \(v5\)](#)

1. [Human Computer Interaction \(4 weeks\)](#)
2. [Problem Solving \(4 weeks\)](#)
3. [Web Design \(5 weeks\)](#)
4. [Introduction to Programming \(6 weeks\)](#)
5. [Computing and Data Analysis \(6 weeks\)](#)
6. [Robotics \(7 weeks\)](#)

Policy Resources (for Admin, District & Department Staff):

United Kingdom

- [Official UK Coding Curriculum](#)
- [Guide for Primary Teachers - Computing in the National Curriculum \(UK\) File 6.1MB](#)
- [Provided by Computing At School \(original is here\)](#)
- [Guide for Secondary Teachers - Computing in the National Curriculum \(UK\) File 1.9MB](#)
- [Provided by Computing At School \(original is here\)](#)
- [UK Coding Curriculum - Sampler from Private Sector File 1.3MB](#)
- [Easy-to-understand sampler from UK company.](#)

- [Codecademy's Curriculum & Teacher Resources \(for UK\)](#)

United States

- [CSTA - Computer Science Teachers Association \(USA\)](#)
 1. [CSTA Standards - Computational Thinking - Scaffold Page](#)
 2. [CSTA Standards - Collaboration - Scaffold Page](#)
 3. [CSTA Standards - Computer Practice and Programming - Scaffold Page](#)
 4. [CSTA Standards - Computer and Communication Devices - Scaffold Page](#)
 5. [CSTA Standards - Community, Global and Ethical Impacts - Scaffold Page](#)
 6. [CSTA Reports](#)

[Includes "Why is K-12 CS Education Fading as Digital Economy Grows?" and also "Addressing Core Equity Issues in K-12 CS Education: Identifying Barriers and Sharing Strategies"](#)

- [Khan Academy](#)
 1. [Khan Academy - Flow of Curriculum](#)
Using JavaScript to code Basic Shapes, Complex Shapes, Colors, Text, Transforms, Mouse, Keyboard, Math, Trig, Date/Time, Debugging.
 2. [Khan Academy - Curriculum to Become a Better Programmer](#)
Topics: Power of Docs, Pseudo-Code, Comments, Readable Code, What's Next.

- [AMSA Charter School - Massachusetts school with mandatory Computer Science 6-11](#)
 1. [About Computer Science at AMSA](#)
 2. [A YouTube Documentary about AMSA](#)

Canada

- ["How Alberta Got CS" \(June 2011\)](#)

[Best quote for how to attract high school students to coding: "Don't worry too much about the content of the K-12 CS curriculum. We still have no clue about what CS is or how to teach it."](#)

1. [HowAlbertaGotCS File 60.4KB PDF document](#)

Appendix F – MSTE Teaching Strategies for Project Work

The types of projects that can be done in Middle School Technology vary significantly according to school facilities and educator expertise. The determining factor with the greatest significance is the safety of students and staff. Do not attempt projects in your school that cannot be safely done with the equipment and space available. Also, when selecting projects for students be mindful of the cognitive and physical abilities of not only each age group, but also individuals within each class. Not all students have comparable levels of strength, muscle control, agility, perseverance, courage, and ambition.

A larger framework for the progression of projects is included in Appendix 7 – MSTE Project Pathway. The points below represent pedagogical and managerial operations that will help to make your class more successful.

- Choose or recommend projects according to the make-up and age of the class
- Enrich project explanations with the “Science” behind the project
 - Example 1: The principles of aerodynamics for Rockets, CO2 Cars, Wind Turbine Generators, etc.
 - Example 2: The chemistry behind a culinary project.
 - Example 3: The nature of wood fibres for a wood project.
 - Example 4: The nature of electricity for a project using electrical components.
- Stress the absolute adherence to safety at all times, with special attention to Personal Protective Equipment.
- Structure your classes so that they start with a group meeting where rules are reinforced, expectations established and demonstrations performed. Effectively demonstrating a certain operation can pre-empt problems. Provide exemplars of both good and bad projects with detailed explanations of qualities and deficits.
- Do not be afraid to use technical language. Use the proper names for tools, techniques, and operations.
- Have a system for organizing student projects between classes to ensure damage is not done to student work.
- Expect students to become familiar with measurements and measuring devices. Stress that an adherence to precision is a class expectation.
- Establish consistent guidelines for clean-up at the end of work time.
- Encourage students to cooperate. If a certain operation is stressful for one student it is fine if another student assists them. However, the owner of the project must always be with their project even if the teacher or another student is performing a certain operation.

- No student can be “forced” or “heavily persuaded” to perform actions with power tools for which they are not entirely comfortable. Monitor the social atmosphere of student groups closely to ensure that peer pressure does influence anyone so that the workspace becomes unsafe or uncomfortable.
- Ask students to calculate the cost of projects taking into consideration the materials used and the time consumed. Set a nominal value as the rate for an hour of work.
- Circulate continuously and make observations of student work habits and techniques. Students cannot be left alone with any types of tools. Glue guns, food mixers, utility knives, screw drivers, pliers, sewing machines, paint brushes, hand saws – all tools – have the potential for creating significant injury.
- Make sure students are familiar with ALL EMERGENCY PROCEDURES. Everyone should be able to explain the procedure to follow in any event – from a fire drill to getting a splinter to a lock-down. This develops a culture of safety.
- Discourage the wasting of any materials.
- Create and provide rubrics that are aligned to the outcomes and the specific project. Use this as a teaching tool at the beginning of the project.
- Assist students in learning to use measuring instruments and expect them to be able to talk about dimensions.
- Have conversations with students about the quality of their work. Share mistakes you have personally made while working on projects.
- Always model safe working habits.

Appendix G- MSTE PROJECT PATHWAY

CONCEPT



INITIAL



RESEARCH



DESIGN



PRODUCTION



PROJECT REVIEW



STEP 1: INTRODUCE PROJECT CONCEPT

- Define the need.
- What must you produce?
- What must you design?
- Do you have a project idea? (Maybe something totally new)
- What is the project?
- Is this an annual project? Something new to this setting? Or a prototype?

STEP 2: INITIAL

- What prior knowledge do you have about this type of project?
- Create a needs list.
- Initial analysis of problems.
 - Perceived difficulties/ Possible solutions.
 - What I know/ What I do not know.
 - I need these materials/ I do not know what materials I need.
 - I have these skills/ I do not have these skills.
- How do you think the problem might be solved?
- What types of careers are related to this project?
- Create initial designs – rough sketches- no or few measurements.

STEP 3: RESEARCH STAGE

- Search all the sources available
- Consider existing designs.
- Ask questions.
- Get an understanding of Dimensions
- Understand the related science.
- Investigate the materials that you want to use.
- What safety issues will there be?

STEP 4: DESIGN STAGE

- Is the project pre-designed?
- Create paper or computer based designs. (Rough)
- Draw plans. (Higher Quality)
- Include measurements for everything.
- Write the specifications.
- Compare drawings to needs list.
- Check measurements for practicality.
- Ensure tools are capable of task.
- Consider non-traditional materials.
- Consider the “style” of your design. Create beauty when possible.

STEP 5: PRODUCTION

- Do not start until safety has been considered.
- Source materials.
- Measure repeatedly and compare to design.
- Follow logical steps.
- Pay attention to aspects of precision – careful measuring, marking, cutting, finishing, etc.
- Be prepared to make alterations during this stage – problems sometimes arise.
- Look for efficiencies. Can multiple pieces be manufactured at the same time?
- Exercise caution with materials usage – waste nothing.

STEP 6: PROJECT REVIEW

- Comparison with original design.
- Comparison with cohorts' projects.
- Testing.
- Error Analysis
- Recommendation of improvements in design or production.
- Recommendation of change of materials.
- Presentation/ Defense of design.
- Cost analysis
- Publishing
- Were there safety issues?
- Final Assessment Level

Appendix H- Project Key Words for MSTE

- Measurement
- Precision
- Workmanship
- Specifications
- Syntax
- Careers
- Prototype
- Pattern
- Revision
- Innovation
- Cost Analysis
- Logic
- Citizenship
- Engineering
- Program
- Enterprise
- Estimating
- Digital Footprint
- File Management
- Scale
- Fine Tune
- Editing
- Formal Process
- Design
- Efficiency
- Environmental Impact
- Model

Appendix J – MSTE “I Can” Statements

1. Computer Operations:

- Sign into my computer account
- Create an effective password
- Find the different drives in a computer
- Create a folder in my student account
- Effectively name projects and folders
- Create and name subfolders in my student account
- Identify hardware components of a computer
- Start an application (program) and create a new project
- Save a project in the appropriate folder
- Retrieve a project from the appropriate folder
- Understand the difference between “Save” and “Save As”
- Use the print view to view a document before printing
- Print a project
- Use keyboard shortcuts
 - CTRL+C (Copy)
 - CTRL+X (Cut)
 - CTRL+V (Paste)
 - CTRL+Z (Undo)
 - CTRL+N (Open a new document/project)
 - CTRL+S (Save the open project)
 - CTRL+M (Add a new slide)
 - CTRL+W (Open a new window)
 - CTRL+P (Print the current page or active pane)
 - CTRL+B (Bold)
 - CTRL+U (Underline)
 - CTRL+I (Italics)
 - CTRL+A (Select All)
 - CTRL+O (Open)
 - CTRL+Enter (New Page)
 - ALT+Tab (Switching between open programs)
 - ALT+Print Screen (Screen capture to clip board on a desktop)
 - Function+Print Screen (Screen capture to clip board on a laptop)

2. Program Operations:

- Connect peripherals

- Use the dropdown menus in programs to find the tools I need
- Change the size and style of fonts
- Use cut, copy and paste
- Automatically center
- Adjust margins
- Change the orientation of a page
- Change the size of paper used in a project
- Use a spell checker
- Change page margins
- Use the “Undo” command
- Select different text sizes
- Add a table
- Create a graph
- Insert a graph in a project
- Select objects with a selection tool
- Delete or move objects
- Crop, resize, or modify images
- Understand image size
- Layer objects
- Combine objects
- Use line properties and adjust the characteristics of lines
- Use a digital camera to create a graphics file
- Add sounds, images, or a video to a project
- Insert hyperlinks in a project.

3. Internet Operations

- Understand and adhere to Policy 311 (Information and Communication Technologies Use)
- Understand what a browser is
- Recognize the differences between different browsers
- Create bookmarks
- Effectively use my student email

- Use and understand the features of a browser (back, forward, stop, search, refresh, history, and home buttons)
- Properly cite internet references
- Determine whether internet information is current, accurate, and reliable
- Effectively use search engines
- Understand the general structure of an email address and a URL
- Compose and send emails that follow standard rules of protocol
- Attach a file to an email
- Use the address features of an email: To, CC, Subject, and Signature
- Explain the fundamentals of cloud computing
- Research using scholarly articles

4. Spreadsheet Operations

- Understand the layout and purpose of a spreadsheet
- Understand the terminology that deals with spreadsheets
- Adjust the height and width of columns
- Change the fill colour in cells
- Adjust decimal places
- Write formulas that allow for mathematical operations
 - Calculate sum and differences.
 - Multiply and divide.
 - Determine an average
- Create graphs using a spreadsheet
- Insert images into a spreadsheet
- Create cells that are designated as currency, date, or number.

5. Project Operations

- Envision a project that I want to create.
- Design a project according to standards and specifications
- Roughly sketch a design that falls into the project criteria
- Accurately draw a set of plans for my project.
- Understand the concept of scale and proportion
- Understand that there are different measuring systems

- Accurately make and mark measurements
- Use tools safely
- Avoid wasting materials
- Maintain a tidy work space.
- Cooperate with classmates to safely share work space and responsibilities
- Follow a design that has been created or approved by the instructor
- List the order of procedure for completing my project
- Appropriately use Personal Protective Equipment
- Understand the principles of producing quality work.
- Finish my project according to the project expectations
- Complete my project within the precision guidelines established by the instructor
- Demonstrate safe operations of tools
- Assist classmates who need help
- Recognize dangerous situations in the workplace
- Remain focused throughout the duration of the project
- Accept positive comments and constructive criticism about my project made by the instructor
- Analyze errors and faults in my project
- Recommend ways to improve the project in the future
- Recognize health and safety concerns and how they affect myself and others
- Responsibly handle and dispose of waste materials
- Comprehend the energy consumption of my project
- Do a post-analysis of my project
- Start and finish a project

End of document