**A *Reflection* on Experiences from ATWP 135**

***Taking a Deeper Look at my Relationship with Writing***

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**Reflective opening**

I’m unsure if this is the best English course I’ve ever taken or if it was the first one that I paid attention to. Either way, the value of this course has not escaped me. My [Personal Literacy Statement](#Personal_Literacy_Statement) was quite accurate in describing my love-hate relationship with writing. Although some of the elements of more artistic writing styles of writing might still escape me, my relationship with reading and writing has changed. Randy Lawrence’s ATWP 135 has reinforced the value which I see in proper grammar, spelling, word choice and structure. I also began to see value in other elements of writing which I had not mentioned in my [Personal Literacy Statement](#Personal_Literacy_Statement), such as rhetoric and revision.

Over the course of ATWP 135, I worked on some elements of structure. I remembered from high school English courses that I should have a topic sentence and concluding sentence for each paragraph and I made a conscious effort to have include those and keep my paragraph structure fairly clear. I consider APA to be an element of structure and I did my best to format my papers using APA style. Before this course, I had very little experience writing in APA which is reflected in my first assignment, Personal Literacy Statement. In this portfolio, I’ve omitted the title pages, however in my submission of the [Personal Literacy Statement](#Personal_Literacy_Statement), the lack of a title page indicated the use of MLA style. I used MLA for this assignment not knowing that APA or even IEEE was more appropriate for computer science writing. I then took the opportunity to practice my APA citation with the [Summary Practice](#Summary_Practice) task and further improved by adding a title page in the [Summary Assignment](#Summary).

Before this course I had done personal experiments to see if my English assignments’ grades would change depending on whether I revised my work. My preliminary results showed that it did not matter, so I always submitted the first draft and usually achieved a grade in the B range. Perhaps English was subjective but perhaps I did not understand how to revise properly. Now, when I reread my own work, I try to read from the perspective of somebody else. I will ask myself things like: *Is this sentence ambiguous in some way? When I refer to “it”, is it clear what I am referring to?* Regardless of the grade I receive (although this is the best I’ve ever done in an English course), I know that the piece I revised is better than when I wrote the first draft. Some parts of it could be improved, but for the first time I feel like my revisions are resulting in more clear and concise work.

Rhetoric was one of those elusive topics in English which I never really understood, but ATWP 135 made rhetoric easy to understand. The textbook (Ami et al., 2020) and lectures (Lawrence, 2021) helped me understand rhetoric and I really enjoyed “The Sixth Paragraph” (Lynch, 2011) which showed that there can be value to essays which do not have the strict five paragraph form. I did my very best to include a little flare to my [research essay](#Research_Paper) by adding an anecdote which was a direct application of “The Sixth Paragraph”(Lynch, 2020) (in case you were wondering, my research essay did, in fact, have six paragraphs without including the reflection). I also used the second person in my introduction and first person in my anecdote of my research paper to try to build pathos in the beginning of my essay. In the following paragraphs I did my best to provide clear, logical arguments so that the added untraditional structure in the beginning would not take away from my credibility. Although I did not have a statement which addressed who my audience was in my first paragraph as was suggested in lecture material (Humphrey, 2021), I thought of my audience as Canadian parents and more generally Canadians. In this way, I mention “Canadian” multiple times throughout the essay in an effort to reach my audience’s sense of national pride.

It is important to acknowledge that I ran into my fair share of bumps in the road during this course but still managed to enjoy it and learn from my mistakes. I started my research on quantum computers which I knew nothing about despite studying computer science as my major. I set out to inform a general audience that quantum computers were no longer science fiction and they will have limitations just as classical computers do today. Upon researching, I realized I had either a heck of a lot of work researching quantum computing to be confident in my ability to talk about the limitations of quantum computing or I had to switch my topic. After I had written most of my [outline](#Introduction_Draft_Practice), I decided to switch to my current topic to the need for a national education program in Canada. I was just as passionate about this topic and the research for it was much less intimidating. I found value in completely switching topics after having done a fair bit of research and receiving some feedback on my previous topic. Although I could not directly apply feedback from my previous topic, I did my best to apply what I had learned to my new paper. I rewrote my entire [outline](#Introduction_Draft_and_Peer_Review) and introductory paragraph. Once it was nearly complete, I proceeded to take a break from writing and play a game on my laptop called Runescape. Runescape crashed my computer and my unsaved work on my new outline was lost two hours before the submission deadline. I frantically rewrote my outline, most of which was fresh in my memory, and submitted just in time. I most definitely did not produce my best work in those last two hours, but I learned a very valuable lesson. SAVE YOUR WORK! Despite having to start over and then losing some of my work, it was worth it to switch topics. Sometimes it may be too late to change topics, but in this instance I was able to find more understandable research which I could use to form my arguments and I’m glad I decided to switch topics.

I think it is important to note one of my shortcomings in this course. When gathering information related to course engagement, I realized that I had not put forth a good enough effort in responding to other’s posts. When the course started, I was in the middle of end of term assignments for other courses and I attribute part of my lack of effort in discussion posts to the lack of time I was able to commit to the course. I understand that responding to other’s posts was an important part of the course. In an online setting feeling connection to other students can be difficult and responding to posts, especially in the beginning of the course is important. I found time to [post to discussion boards](#Best_Posts) and give [valuable peer feedback](#Best_Feedback_Given), but I should have spent more time responding to others’ posts in the beginning of the course. Nevertheless, the discussion boards were a great element of the course which encouraged student engagement.

The structure of ATWP 135 created impactful experiences which helped shape my reading and writing career. The assignments helped me work on things that I had learned in lectures (Lawrence, 2021) and in the textbook (Ami et al., 2020). Discussion posts helped me revise my work and think about how best to revise my own work. I found value in saving my work and switching topics late in the game. Lastly, reflecting on the course has shown where I could have improved and where I succeeded in the course expectations.

**Course Engagement**

**Best Posts**

***Summary Practice*** Fizza Kulvi, a PhD candidate in communications policy at McMaster University, wrote about how the Canadian social media platform Rumble influences the spread of misinformation and how that relates to new legislation in the online article “Meet Rumble, Canada’s new ‘free speech’ platform - and its impact on the fight against online misinformation”. The article, identifies challenges, specifically with Rumble, that regulators will encounter when addressing online hate speech. One perceived problem with Rumble, is that it spreads false information more than correct information. Rumble, however, advertises itself as a promoter of free speech, claiming it has fewer algorithms to recommend content as other comparable platforms. Kulvi claims platforms like Rumble, YouTube and Facebook must be clearer about how their algorithms promote content, since they could be held accountable for actively promoting harmful content through these algorithms.

***Introduction Draft and Peer Review Discussion Post*** If the mystical black box that is your personal computer can instantly perform every task which you assign to it, then why might companies like Google and International Business Machines Corporation [IBM] be spending so much money on building quantum computers? To answer this question, a little light needs to be shined on how that black box works. Many computer users probably reflect on pesky loading screens and know that computers do not perform tasks instantly. Instead, more computationally intensive tasks take more time. Stated another way, the more basic operations that your computer must perform to execute a task, the longer it will take. A basic operation could be adding two numbers together, retrieving or storing a value from the computers’ memory or comparing two values. The algorithms which a computer uses to perform that task directly correlate to how many operations will be done and how fast the task will be performed. These algorithms yield equations for how many operations will have to be done as the size of the input to the algorithm grows. These equations can take all forms, from an algorithm taking only a constant number of operations, to an algorithm growing proportionally to a factorial function. If you cannot imagine how quickly factorial functions can grow, just remember that 1 factorial equals 1 and 20 factorial equals over 240,000,000,000,000,000,000. Even if each operation only takes a fraction of a second, a large input for an inefficient algorithm can quickly become years’ worth of computing for the fastest of computers. This paper will cover the growth, in basic operations and therefore runtime, of types of algorithms named non-deterministic polynomial time [NP] algorithms and how these algorithms impact the total run time of a program. With that in mind, will quantum computers offer a viable solution to the problem of quickly growing run times for computers? If so, then there must be a fundamental difference that allows quantum computers to do something that a classical computer cannot. One such solution would be implementing an algorithm not possible for a classical computer that would reduce the growth rate of the run time. I argue that quantum computers can allow the implementation of faster algorithms which are not possible on a classical computer, but still face limitations which will not allow all problems to be solved in a practical amount of time, therefore, quantum computers will be able to solve a larger domain of problems than a classical computer in practice, but some problems, namely NP-complete problems, will remain out of reach for quantum computers.

1. Background
2. Algorithms
   * 1. Define algorithm
     2. Describe the relationship between algorithms and programs
     3. Describe the relationship between input size and run time.
     4. Limitations of current algorithms. -*cite some csc textbooks I have for algorithm run time.*
     5. NP- complete problems. -*need to find a good source for NP problems still*
   1. Introduce what a quantum computer is, and how it differs from a classical computer.
      1. Introduce a “clock cycle” as the fundamental unit which drives computation in classical computers.
      2. A constant number of instructions can be executed per clock cycle. Therefore, even large inputs for polynomial time algorithms can take a long time to compute.
   2. Current limitations of classical computers.
      1. Transistor as the heart of computation.
      2. Size of transistors and relation to speed.
         1. Transistors are closer, therefore the time taken for computation is less, clock cycle rate can be increased.
3. Current limitations of quantum computers.
   1. Describe superposition, and why it has the potential to be faster. Using much of *commercial applications of quantum computing* for this section (Bova, Goldfarb, Melko, 2021). Also, *Digital fluency: Understanding the basics of artificial intelligence, blockchain technology, quantum computing, and their applications for digital transformation* will help me further understand the benefits of quantum computing (Lang, 2021).
   2. Drawbacks of quantum computing such as interference and reading data.
4. To solve exponential problems, a quantum computer’s power will have to be able to scale exponentially or execute an algorithm which is impossible for a classical computer. Furthermore, that algorithm must show P=NP for a quantum computer. This section is where I draw on background information from the previous sections of the paper and make my arguments. Although I don’t have much in these sections now, they will contain a large portion of the paper. I need more research to be able to fill out this part of the outline still.
   1. Regarding the former, I need to do more research here, but I believe quantum computers can scale exponentially as their size increases. This implies that the size of a quantum computer is essential to taking on larger inputs to exponential algorithms (Lang, 2021).
   2. Regarding the latter, quantum computers will not be able to solve NP-complete problems, therefore some problems will remain out of reach for quantum computers (Aaronson, 2008).
5. conclusion

Special Notes:

1. I need to address in the introduction that I will not be addressing the memory space requirements of computers for the sake of simplicity. This is an unfair assessment of computational speed overall because memory is essential to the speed of computation.
2. I also have much more research to do before my final submission. I feel most confident in the background information on the subject, but my claims need to be supported by more evidence. I may end up altering my argument based on my findings.
3. My goal with this paper is to reach a broad audience, so I will need a fair bit of background information. I imagine much of my time will be spent condensing background information in order to talk more about my arguments and research.

**Best feedback given**

Hi Gillian,

I like that the first sentence of your introduction is relevant to your thesis.  I might suggest using the active voice to grab your readers' attention a bit more but overall it is good.  In my interpretation, it sounds like you're going to focus more on how the addiction to social media increases isolation for individuals in the real world.  How might this be different from say a video game or other app which uses user data  to increase app usage?  It might be good to keep the distinction between the effects of social media on isolation and the effects of the social media itself (comparison to other people, likes etc) clear, although I think both are important.

I think acknowledging potential sources of bias (although a solid movie, I'm thinking about The Social Dilemma) at some point could strengthen your paper.

I like the structure of your introduction so far.  Discussing how social media companies make money is relevant and adds to your introduction in my opinion.

Good luck writing and revising and let me know if you have any questions!

Nick

Hi Nick, thank you very much for your feedback!

I see your point about potential bias with the movie a social dilemma...would you suggest I should choose a different source to backup the statement that this concern is very apparent today? (or perhaps just leave out a source entirely?) Please let me know what you think :) also,

I was aiming to focus both on how addiction to social media increases isolation as well as decreases self-esteem through comparisons, as being the two biggest factors that contribute to decrease in the mental wellbeing of users.  But maybe that is too much for one essay or not specific enough for the reader to follow? Please let me know if it is!

And finally, in answer to your question of how social media is different from say a video game or other app that uses user data to increase app usage (and thus increases isolation), I was hoping to argue that point that social media plays into an individual's basic psychology to want to see what others are up to (to avoid "FOMO") , and creates a social media “community” which most people want to be a part of and often feel excluded if they are not a part of it. But that this sense of community and belonging is not actually real (perhaps giving examples of catfishing or "friends" on facebook etc.), which ultimately makes people more lonely since they are putting less effort into their real life relationships.

Do you think that is a good counterpoint? Again, I appreciate any and all feedback! (Clackdoyle, 2021)

Hi Gillian,

Thanks for your response I hope my feedback was helpful in some way.

In my opinion I think you could still use The Social Dilemma if you acknowledge that there could be potential bias there.  I think there are some good points in the movie, but parts of it might be dramatized.

I think you could probably argue both of your points about the isolation social media can cause as well as some negative effects of using social media.  I think it would be important to make sure those two ideas are distinct in some way because they're both great points, but I wasn't sure at first if you would argue both or one.  Maybe in your thesis you could say something along the lines of "because of insert point about isolation and insert point about addiction I argue.." and then use structure in your paper to keep them separate? I think it could work well if both arguments could be made though!

I really like your counter argument, it made the difference between other apps and some social media platforms really clear in my mind!

Let me know if you have any more questions, or would like some more feedback and I'll do my best to get back to you promptly :)

**Personal Literacy Statement**

I have a love-hate relationship with writing. I’ve always liked math and science because they felt concrete to me. In math, there are rules to follow and formulas to remember and it just makes sense. Sciences can seem a bit less concrete, but still, it makes sense. English on the other hand is subjective and has all sorts of rules that contradict each other and may or may not be rooted in a method or formula. Maybe the guy who came up with the word “weird” forgot about the “i before e” rule, but who cares, it stuck! As time progresses, I enjoy writing more than I used to though. Perhaps because (for the most part) the writing I do is either some sort of lab report, or I’m only writing for myself.

I used to despise English class. As a middle schooler, you never have anything unique or particularly insightful to write about. Even the idea of writing a piece that was self-aware, cutting edge or meta would have gone right over my head. I think part of my lack of interest in writing stemmed from my incredibly boring life, and dull imagination.

In high school, I found labs and research papers to be fairly interesting. I liked that there was a set structure to them, and that it didn’t matter as much how they were written, as long as they contained the appropriate content. My teachers also started to introduce ideas like theme, motif and symbol. I could never seem to recognize when a color was just a color, or when it was really an underlying motif.

Now I can at least appreciate some of those silly grammatical rules, and maybe even a touch of symbolism in a piece. I think proper grammar, which is probably hard to find these days, holds value in its ability to create unambiguous meaning. Spelling, word choice and structure are equally important in my eyes. Then there are the more subtle things, that sometimes escape me. Niche cultural and historical references along with those dreaded motifs can be hard to identify, and even harder to come up with. At times I even feel as though the author used a thesaurus to use abstruse words which are only meant to befuddle and obfuscate the meaning of an already labyrinthine sentence. Despite the challenges that English poses to me personally, I hope that I can gain more appreciation for it and become a better reader and writer in the process.

**Persuading Skeptics**

**Summary**

Assistant professor in plant biology and urban ecology, Karen K. Christensen-Dalsgaard of MacEwan University, describes the impacts of urban gardens in her persuasive article, “How Urban Gardens Can Boost Biodiversity and Make Cities More Sustainable”. The article states that cities can be inhospitable environments for life, due largely to pollution and the composition of the ground. Considerable populations of Canadian cities mean urban areas significantly affect the environment. The relatively new field of urban ecology studies how greenspace in these cities impacts “the livability and sustainability of urban areas” (Christensen-Dalsgaard, 2021, paras. 7). Urban ecology has found that plants in cities reduce temperature, pollution, noise and flooding. Most plants are more ecologically beneficial than sealed surfaces like asphalt or concrete, but how much plants influence these attributes depends on which plants are chosen. Both the chemical and physical structure of plants help shape its surroundings, but generally, more diverse greenspaces better address ecological problems in cities than homogeneous ones. Although the findings of urban ecology are applied by many urban planners, large portions of greenspace in urban areas are privately owned, so it is the owner’s responsibility to manage their greenspace effectively. Christensen-Dalsgaard’s article explains why gardens in cities are important and how the types of plants chosen can impact biodiversity and the sustainability of cities.

**Response**

Karen K. Christensen-Dalsgaard’s article *How Urban Gardens Can Boost Biodiversity and Make Cities More Sustainable* (2008) provides reasons why homeowners or renters should make their greenspaces more sustainable. The article also gives key background information on urban ecology and gives the audience tips on how to implement more environmentally friendly gardens (Christensen-Dalsgaard, 2008). Perhaps a reader of Christensen-Dalsgaard’s article is still unconvinced that they should restructure their gardens to incorporate more diverse plants. After all, what’s in it for them? Or maybe they didn’t quite follow how the gardens will address the issues of sustainability which the article outlined. I argue that by alternating between factual statements and emotionally relevant subjects, Christensen-Dalsgaard’s article persuades readers that biodiverse gardens are a good way to make their cities more sustainable.

The article begins by introducing sustainability problems that many cities experience and relating the populations of cities to the importance of addressing these problems (Christensen-Dalsgaard, 2008). One such problem is heat. According to Christensen-Dalsgaard’s article, “temperatures in cities are typically 2 C to 3 C warmer than those of the surrounding landscape” (2008). Although climate change may not be accepted as factual by all readers, most audiences would be selfishly interested in living in a cooler city. One logical solution to such a problem is vegetation which “lowers the temperature of a city by 1 C to 9 C” (Christensen-Dalsgaard, 2008). The next problem which unsustainable cities cause for its inhabitants is a demographically disproportionate level of comfort (Christensen-Dalsgaard, 2008). Neighborhoods with more people of colour are likely to have less greenspace than neighborhoods with more Caucasian people and are less comfortable to live in (Christensen-Dalsgaard, 2008). Here, the article is appealing to an audience’s sense of socio-economic justice. Lastly, the article becomes even more relevant for those readers who own greenspace since private gardens can make up “between 16 and 40 per cent of total urban land cover” (Christensen-Dalsgaard, 2008). Before finding out how biodiverse gardens can help solve some of the issues of unstainable cities, the reader learned how a lack of greenspace can impact themselves and those around them.

Now that the article has provided readers with reasons to care about the topic, Christensen-Dalsgaard flexes her credibility as an assistant professor in plant biology and urban ecology. Although there is little data involved in the last few paragraphs of the article, it is expected that the audience believes Christensen-Dalsgaard as she makes claims like “surface temperatures, measured using infrared thermal imaging, were higher in plots with less plant volume” (Christensen-Dalsgaard, 2008). Christensen-Dalsgaard’s well framed argument and accredited status allow her to make claims about how urban gardens can tackle the issue unsustainable cities. In her concluding paragraph she reiterates that it is the responsibility of those who own lawns and gardens to make the most of their space (Christensen-Dalsgaard, 2008).

Dalsgaard’s article *How Urban Gardens Can Boost Biodiversity and Make Cities more Sustainable* first appeals to an audience’s self-interests in cool temperatures and sense of racial and economic equity. While appealing to these emotions, Christensen-Dalsgaard builds her credibility by informing the audience on key issues and creating a logical basis for an argument. It is then brought to the reader’s attention the relevance of the article. Assuming the reader has an area which they can garden, the reader can have an impact on the problems previously outlined. Before reiterating the importance that the article has for a reader with a garden, Christensen-Dalsgaard outlines some elements of a beneficial urban garden. Christensen-Dalsgaard’s’ reputability and strong application of rhetoric create a strong argument for the average urban gardener.

Naysayer Description

All the founding partners of *The Conversation* are universities which should mean that articles on the website are unbiased. That said, some of the non-profits that fund *The Conversation* support social causes which could introduce some liberal bias. The naysayer who immediately comes to mind is a person who does not believe in climate change, but I think most people reading articles from *The Conversation* would generally be less conservative. With this in mind, I think a typical skeptic would be one who believes in climate change but doesn’t believe that gardens are an effective way to combat environmental issues in cities. They most likely have not studied biology and are hesitant to restructure their garden before knowing that it will make a difference.

**Research Paper Drafts and Outlines**

**Research Consultation Summary**

I chose to research the limitations of quantum computing and how that will impact the possible applications for quantum computing. With my background knowledge and information from Scott Aaronson’s, *The Limits of Quantum* (2008), I’ve come up with a working thesis that quantum computing will be more powerful than classical computing, which will allow some problems that would take years on the most powerful supercomputer to be solved quickly, but that quantum computing will not open any new domains of problems which in theory cannot be solved by a classical computer. Aaronson, an assistant professor of electrical and computer engineering at MIT, describes the limits of quantum in the context of NP problems (2008). Grouping problems as P, NP hard, or NP complete is way of grouping problems based on how they scale computationally when the size of the problem is increased. For P problems, or polynomial problems, as the size of your input variable N grows, the number of calculations the computer needs to do is bounded by some polynomial with respect to N. For example, with an input of size N, there is some polynomial CNK where C and K are constants is an upper bound for some other polynomial, say (C-1)NK-1. Aaronson’s article claims that Quantum computers may be able to solve a larger realm of polynomial-time time problems with relative ease, however problems that grow exponentially with respect to the size of their input will quickly get too large for even quantum computers to handle (2008). To understand the limits of quantum computing, I will likely have to research more about how quantum computers work (which I know very little of right now) and more about what types of computational problems exist. Then I will need to find sources which relate the performance of quantum computers to possible applications in the future.

**Introduction Draft and Peer Review**

I ended up changing my topic from quantum computing to k-12 education of computer science anyways. I felt I was having a tough time pulling together enough sources and reaching the appropriate audience with quantum computing and I’m passionate about computer science education.

Introduction

Nine of Ten Canadians think it is important to learn computer science [CS] in school, yet only seven out of thirteen provinces include CS in their curricula. Ask yourself, if you had to, could you navigate to and open a file on your computer using only command line? For many Canadians the answer is no. Although some might say using command line is unnecessary, sometimes a basic knowledge of file systems and commands can help get you out of a bind with problematic software. More generally, CS education is beneficial to Canadian in multiple ways. Firstly, CS education helps improve problem-solving and critical thinking skills. Secondly, CS education is a rapidly growing and essential sector in Canada and therefore worth investing in. Lastly, CS education can help improve social equity in Canada. CS education teaches essential skills and valuable socially and economically in Canada, therefore the Canadian federal government needs to implement a national CS education program.

Anecdote about helping a “computer literate” friend configure a text editor to suit their current needs. This has to do with using command line to get a program running properly (referenced in introduction).

1. Improving Problem solving skills.
   1. A study of 1st grade students showed coding exercises were associated with improving two executive functions: planning and response inhibition (Arfé et al., 2020)
   2. A study conducted by Stanford undergrads (concern for credibility here, but study appeared to be conducted well) also associated computer science courses in undergrads with increased problem-solving ability. Here they related improved problem decomposition and comprehensive data collection to computer science majors. Results improved for higher year students. This is in contrast to other STEM majors who did not score as high in these areas, or improve as higher year students (Salehi et al., 2020)
   3. Executive functions are associated with greater success in STEM.
2. Economically strong sector which is growing rapidly.
   1. Innovation, science and economic development [ICT] sector accounts for a significant portion of Canada’s GDP (5.1% in 2020) (Innovation, Science and Economic Development Canada, 2021).
   2. The average salary in this sector is 46% higher than the average Canadian (Innovation, Science and Economic Development Canada, 2021).
   3. The sector is also growing rapidly, with compound annual growth rate [CAGR] of 4.2% from 2015-2020 compared to .7% CAGR for the whole economy during the same period. The sector accounted for 27.2% of GDP growth in Canada (Innovation, Science and Economic Development Canada, 2021).
   4. During 2020 the sector saw 2.9% increase in GDP compared to a contraction of 5.1% by the whole economy. This shows that technology related fields are resilient to some economic turbulence (Innovation, Science and Economic Development Canada, 2021).
3. Can help improve equity for underrepresented groups.
   1. For this argument to be valid, we must assume equal access computers and internet even though some computer science teaching can be done without a computer.
   2. That said, steps have been made to improve equity in technology related fields
   3. Programs have been put in place increase the number of women studying computer science (source needed still).
   4. Efforts have also been made to include methods of learning that are more appropriate to indigenous groups (source needed still).
   5. If reasonable effort is made to connect rural communities and give proper funding to the computer science program, then the benefits of computer science education will be seen in many groups. Improved problem-solving skills as mentioned previously being one of the benefits. Other benefits include improved efficiency in everyday use of technology
4. Conclusion

**Research Paper**

Nine out of ten Canadians think that it is important to learn computer science [CS] in school, yet only seven out of thirteen provinces include CS in their curricula (Sariffodeen, 2018). Many Canadians interact with technology daily and it plays a vital role in our economy. Despite its large impact, could you navigate to and open a file on your computer using only command line? For most Canadians the answer is probably no. Although some might say using command line is unnecessary, sometimes a basic knowledge of file systems and commands can help get you out of a bind with problematic software. Other than the specific use of the command line interface, CS education is beneficial in at least three ways. Firstly, CS education helps improve problem solving and critical thinking skills. Secondly, CS related industries make up a large portion of the Canadian economy and are growing quickly, therefore investing in CS education will help the economy prosper. Lastly, social and economic equity in Canada can be improved by providing equal opportunities for CS education. CS education teaches essential critical thinking skills and is valuable socially and economically in Canada, therefore the Canadian federal government needs to implement a national CS education program.

I’d like to a share a short anecdote about using the command line interface in case the relevance of the previous reference of it escaped you. Last week I was helping my friend start coding. He is quite computer literate as he does plenty of research before buying electronics, plays video games and I remember him telling me about taking apart his PlayStation 5 controller to fix it not too long ago. We had installed a simple text editor for him to write code on, but we wanted to set some customized settings to maximize efficiency. To make these changes, we needed to edit the configuration file for the text editor. We found the preexisting configuration file and opened it; however, the file would not allow us to edit it. My friend was stuck. Having a background in CS I imagined a few options to solve this problem. We could have changed the permissions associated with the file, edited the file as an administrator or created a new configuration file for the text editor. After having tried a few things and reading documentation online, it appeared the easiest option was to create another configuration file which contained extra instructions when the program was booted up. Although the task we had set out to complete was CS related, the problem was quite ordinary; we wanted to customize the default settings for a program on opening. The only reason I had insight into the problem and my technologically savvy friend did not, was due to formal CS education. Without knowledge of file systems and the command line interface the problem might have seemed intimidating, but these are common topics taught in CS. A foundational education in CS would grant every Canadian the ability to troubleshoot many everyday technology related problems.

In addition to anecdotal evidence, more formal studies have shown CS education improves problem solving skills. Undergraduate students at Stanford University conducted a “black box” experiment to analyze undergraduate student’s problem solving skills based on major (Salehi et al., 2020). The experiment involved participants making guesses about the structure of a virtual electrical circuit (Salehi et al., 2020). The circuit was obscured by a black box, but several wire leads connecting to the circuit protruded from the edges of the box (Salehi et al., 2020). Students were allowed to connect their own circuits to these leads to gather information about the circuit (Salehi et al., 2020). The three groups of majors studied were CS, quantitative natural science/engineering and all other majors (Salehi et al., 2020). The results of the experiment showed computer science majors excelled in two areas of problem solving when compared to the other two groups (Salehi et al., 2020). Firstly, CS majors showed better comprehensive data collection skills (Salehi et al., 2020). Secondly, CS majors showed increased ability in problem decomposition (Salehi et al., 2020). Another noteworthy result was that CS majors were the only group which showed improvement for upper-year students compared to first-year students (Salehi et al., 2020). This suggests that CS courses improve problem solving skills. One may mistakenly attribute the improvement in understanding circuits to course work, however, the study highlighted that the upper-year quantitative natural science/engineering majors had similar exposure to electrical circuits as upper-year CS majors (Salehi et al., 2020). Although this study provides promising evidence that CS courses improve problem solving skills, the participants were not K-12 students and the study’s sample size was small (Salehi et al., 2020). Despite the shortcomings of the Stanford study, more relevant evidence was provided in Arfé et al.’s (2020) study which focused on the effects of coding exercises on two executive functions in first graders: planning and response inhibition. The study is important because executive functions are “abilities that support individual’s cognitive control, goal-directed behavior and problem solving” (Hongwanishkul, Happaney, Lee & Zelazo, 2005; Zelazo, Muller, Frye & Marcovitch, 2003, as cited in Arfé et al., 2020, p. 2) and are “foundational to children’s school achievements”(Masten et al., 2012; Purpura, Schmitt & Ganley, 2017; Roebers, Rothlisberger, Cimeli, Michel & Neuenschwander, 2011; Vandenbroucke, Verscheuren & Baeyens, 2017, as cited in Arfé et al., 2020, p. 2). Arfé et al. (2020) found that first graders who participated in coding exercises for a total of eight hours had greater improvements in planning and response inhibition when compared to a control group which participated in eight hours of science, technology, engineering and math [STEM] related coursework. The study involves participants whose age is relevant to this paper and uses a larger sample size than the experiment conducted by Salehi et al. (2020) (Arfé et al., 2020). These two studies are important because problem solving skills are not only essential for K-12 students who go into STEM related fields but also in everyday life (Wing, 2006). The problem solving skills that CS education promotes are foundational skills for a successful education system.

Technology is essential to the Canadian economy, accounts for much of the growth of the economy and offers annual salaries which are above the national average. These three factors show that investing in CS education is a worthwhile endeavor for Canadians. The information and communications technology [ICT] sector accounts for many of the CS related jobs in Canada and therefore is a good indicator of the influence that technology has on the economy. Innovation, Science and Economic Development Canada (2021) reported that in 2020 the ICT sector accounted for 5.1% of Canada’s gross domestic product [GDP]. The sector is also growing rapidly, with a compound annual growth rate of 4.2% from 2015-2020 compared to .7% for the whole economy during the same period (Innovation, Science and Economic Development Canada, 2021). Furthermore, the sector has accounted for 27% of GDP growth in Canada from 2015-2020 (Innovation, Science and Economic Development Canada, 2021). These figures show that the sector is a vital part of the economy and is also one of the fastest growing sectors in Canada. The ICT sector also boasts salaries 46% higher than the average Canadian, demonstrating its value to the individual, not just the nation as a whole (Innovation, Science and Economic Development Canada, 2021). Lastly, the sector has proven to be a resilient part of the economy. For example, in 2020 Canada’s GDP fell by 5.1%, but the ICT sector saw growth of 2.9% (Innovation, Science and Economic Development Canada, 2021). Covid-19 may have negatively affected the ICT sector less than others, however the resiliency of the sector should not be ignored. Given the economic powerhouse that the sector has become, it would be worthwhile for the Canadian government to invest in education which promotes the sector’s growth.

Computer science education also has the potential to improve social equity within Canada. This argument hinges on the underlying condition that all Canadian schools have equal access to internet and computers. Internet accessibility rates in Canada have been increasing in the last decade and as of 2018 only 6% of Canadians did not have internet access at home (Statistics Canada, 2019). Furthermore only 8% of those who did not have internet access reported internet service could not be installed, meaning less than 1% of Canadians are unable to have internet access (Statistics Canada, 2019). Even with a low proportion of people unable to get internet at home, Canada is making efforts to improve connectivity. For example, in 2021 Canada invested $1.44 billion in Telestat to connect rural areas to internet via satellite (The Canadian Press, 2021). Assuming efforts will be made to ensure all schools have equal access to internet and computers, the favorable outcomes of CS education such as improved problem solving skills and increased opportunities to high paying jobs can help improve social and economic equity in Canada. British Columbia is one province which has implemented CS education in the curriculum and made efforts to ensure female and Indigenous students have equal opportunity to CS education (Fowler et al., 2021). If these efforts can be matched when creating a federal-level CS education program, then schools will further promote social and economic equity.

Creating a federal CS education program is a worthwhile investment in Canadians and the nation. The program would increase computer literacy, general problem solving skills, economic productivity and social and economic equity for Canadians. As the production and development of technology accelerates, the importance of having an education in computer science will only increase. The investment made by the Canadian government will fuel the growth of the ICT sector and propel the economy forward. Canadians want computer science to be taught in schools, and most homes already have access to Internet, therefore there has never been a better time to implement a Canada-wide computer science education program.

Grading Reflection

I believe I deserve about a B+ on this paper. As someone who has typically struggled a little with writing, I’m fairly happy with how this paper turned out. I worked on understanding and implementing many things which previously had escaped me as a writer including using the active voice, proper tense and clear sentence structure throughout my paper. I also tried to incorporate elements from class, specifically Paul Lynch’s (2011) work The Sixth Paragraph: A Revision of the Essay. I included my anecdote on pages 2 and 3 and wrote in the first person and second person in the introduction and anecdote because I thought it would add relatability for my readers. I know that these are not typical elements of a research paper, but I thought they related to Lynches writings. I tried to make much of the body of my paper logical, so that the structure of my essay still built credibility as well. If I had spent more time refining my paper, I would have had more time to ask about in-text citations, since I got a little lost on one of them on page 4. I also would have appreciated asking someone knowledgeable about any issues with APA in my paper since I’m not the best with formatting.

**References**

Aaronson S. (2008). The Limits of Quantum. *Scientific American 298*(3),62-69. <https://www.cs.virginia.edu/~robins/The_Limits_of_Quantum_Computers.pdf>

Arfé, B., Vardanega, T., & Ronconi, L. (2020). The effects of coding on children's planning and inhibition skills.*Computers and Education, 148*, 103807. <https://doi.org/10.1016/j.compedu.2020.103807>.

Blums, A., Belsky, J., Grimm, K., & Chen, Z. (2017). Building links between early socioeconomic status, cognitive ability, and math and science achievement.*Journal of Cognition and Development, 18*(1), 16-40. <https://doi.org/10.1080/15248372.2016.1228652>.

Bova, F., Goldfarb A. & Melko R. G. (2021) Commercial applications of quantum computing. *EPJ Quantum Technology, 8*(2). <https://doi.org/10.1140/epjqt/s40507-021-00091-1>

Brown E. & Brown, R. (2020) The effect of advanced placement computer science courses taking on college enrollment. West Coast Analytics. <http://www.westcoastanalytics.com/uploads/6/9/6/7/69675515/longitudinal_study_-_combined_report_final_3_10_20__jgq_.pdf>.

Christensen-Dalsgaard, K. K. (2021, June 8) *How Urban Gardens Can Boost Biodiversity and Make Cities More Sustainable. The Conversation.* [*https://theconversation.com/how-urban-gardens-can-boost-biodiversity-and-make-cities-more-sustainable-162810*](https://theconversation.com/how-urban-gardens-can-boost-biodiversity-and-make-cities-more-sustainable-162810)

Clackdoyle, G. (2021, August 7) *(Social media & mental health) – draft/outline!* [Discussion Post]. University of Victoria. <https://bright.uvic.ca/d2l/le/133783/discussions/threads/318638/View>

Fowler, B. Nessen, Y. & Vegas, E. (2021) How British Columbia implemented its computer science education program. *Brookings Institution.* Retrieved August 13, 2021, from <https://www.brookings.edu/wp-content/uploads/2021/04/British-Columbia-CS-education-program-FINAL-041621.pdf>.

Hongwanishkul, D., Happaney, K. R., Lee, W. S. C., & Zelazo, P. D. (2005). Assessment of hot and cool executive function in young children: Age-related changes and individual differences. *Developmental Neuropsychology, 28*(2), 617–644. <https://doi.org/10.1207/s15326942dn2802_4>.

Humphreys, S. (2021) *How to write an introduction* [Narrated PowerPoint]. University of Victoria. <https://bright.uvic.ca/content/enforced/133783-202105ATWP135A07(33187)CO/How%20to%20Write%20an%20Introduction.pptx?_&d2lSessionVal=rX5oSenQvOiql6SMdrnTlp0Yn>

Innovation, Science and Economic Development Canada (2021) *2020 Canadian ICT sector profile* [Annual Report]. Retrieved August 13, 2021, from Innovation, Science and Economic development Canada’s Website: <https://www.ic.gc.ca/eic/site/ict-tic.nsf/eng/h_it07229.html>.

Kulvi, F. (2021, July 8). *Meet Rumble, Canada’s new ‘free speech’ platform - and its impact on the fight against online misinformation*. The conversation. <https://theconversation.com/meet-rumble-canadas-new-free-speech-platform-and-its-impact-on-the-fight-against-ne-misinformation-163343>

Lang, V. (2021). *Digital fluency: Understanding the basics of artificial intelligence, blockchain technology, quantum computing, and their applications for digital transformation*. Apress. <https://doi-org.ezproxy.library.uvic.ca/10.1007/978-1-4842-6774-5>

Lawrence, R. (2021) *ATWP 135: Introduction to academic reading and writing* [Online Course]. BrightSpace. <https://bright.uvic.ca/d2l/home/133783>

Lynch, P. (2011) The sixth paragraph: A revision of the essay, *Writing Spaces: Readings on Writings*(Vol# 2). pp 286-301

Masten, A. S., Herbers, J. E., Desjardins, C. D., Cutuli, J. J., McCormick, C. M., Sapienza, J. K., et al. (2012). Executive function skills and school success in young children experiencing homelessness. *Educational Researcher, 41*(9), 375–384. <https://doi.org/10.3102/0013189x12459883>.

Purpura, D. J., Schmitt, S. A., & Ganley, C. M. (2017). Foundations of mathematics and literacy: The role of executive functioning components. *Journal of Experimental Child Psychology, 153*, 15–34. <https://doi.org/10.1016/j.jecp.2016.08.010>.

Roebers, C. M., Rothlisberger, M., Cimeli, P., Michel, E., & Neuenschwander, R. (2011). School enrolment and executive functioning: A longitudinal perspective on developmental changes, the influence of learning context, and the prediction of pre-academic skills. *European Journal of Developmental Psychology, 8*(5), 526–540. <https://doi.org/10.1080/17405629.2011.571841>.

Salehi, S. Toorawa, R. Wang, K. & Wieman, C. (2020) Can majoring in computer science improve general problem solving skills? SIGCSE 2020 51st ACM technical Symposium on Computer Science Education, Portland, Oregon, USA. <https://dl.acm.org/doi/10.1145/3328778.3366808>.

Sariffodeen, M. (2018). Learning for the digital world: A Pan-Canadian K-12 computer Science education framework [PowerPoint slides] Canada Learning Code. <https://k12csframework.ca/wp-content/uploads/Learning-for-the-Digital-Future_Framework_Final.pdf>.

Statistics Canada. (2019).  Component of Statistics Canada catalogue no. 11-001-X Canadian internet use survey [report]. Innovation, Science and Economic Development Canada <https://www150.statcan.gc.ca/n1/daily-quotidien/191029/dq191029a-eng.html>.

The Canadian Press. (2021, August 12). Ottawa investing $1.44 billion in Telestat to help improve rural and remote internet access. *Times Colonist.* <https://www.timescolonist.com/business/ottawa-investing-1-44b-in-telesat-to-help-improve-rural-and-remote-internet-access-1.24350556>.

Vandenbroucke, L., Verschueren, K., & Baeyens, D. (2017). The development of executive functioning across the transition to first grade and its predictive value for academic achievement. *Learning and Instruction, 49*, 103–112. <https://doi.org/10.1016/j.learninstruc.2016.12.008>.

Wing, J. (2006). Computational thinking. *Communications of the ACM, 49*(3), 33–35. <https://doi.org/10.1145/1118178.1118215>.

Zelazo, P. D., Muller, U., Frye, D., & Marcovitch, S. (2003). The development of executive function. *Monographs of the Society for Research in Child Development, 68*(3), 11–27. [https://doi.org/10.1111/j.0037-976X.2003.00261.x, 68(3)](https://doi.org/10.1111/j.0037-976X.2003.00261.x,%2068(3)).

Ami, N., Boldt, N., Humphreys, S., 1968, Kelly, E. E. 1., Bedi, S., Llewellyn, J., & Conners, M. (2020). Why write?: A guide for students in Canada (First 2020. ed.). The Academic Writing Program, University of Victoria.