

**The Electronic Revolution: Assistive Learning Technologies in the Classroom in the
Twentieth Century**

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Historical Question

How has the evolution of technology affected education and student learning in Ontario from 1900-1999?

Thesis Statement

The continued evolution of technology has helped to foster innovative and interactive learning experiences for students in educational settings throughout the twentieth century. Despite varying degrees of success, as well as initial criticism and skepticism, the ultimate goal has remained the same – the assistance in and enrichment of student learning.

Overall Research Questions

What was going on in the world and Canada in particular, at different points during the twentieth century? What were the political, economic, social, and cultural variables that could have affected educational technology? What was the physical setup of the classroom like during different decades? What technologies emerged throughout these decades? What pieces of technology were popular in schools? Why did people find these technologies important or beneficial to education? What were the technological trends of each period in Ontario specifically?

Discussion and Analysis of Sources

Primary Sources

Our investigation of primary sources relied heavily on documents from the Ontario Ministry of Education; more specifically, the Annual Reports on Education were explored in great detail and allowed for a thorough understanding of the historical context of education in Ontario across a range of decades. For example, the Annual Reports provided us with enrollment

statistics, and the types of “equipment” and technological education systems in place over time, how well these were received, and how often changes were made. The Canadian Census was also useful, particularly from earlier decades in the assessment of changes in literacy among citizens in Ontario. An interview was also conducted with an Ontario citizen who attended school during the 1930s and the 1940s. This provided valuable insight into how technology was incorporated into rural and urban schools during this time period, as well as the contrast between one-room school houses and larger consolidated schools. Moreover, an examination of early technologies in the classroom at the Frontenac County School Museum provided a foundation from which to explore this topic and verified the existence of assistive classroom technologies as early as 1900. Many teacher manuals and instructional guides from the 1980s and 1990s were consulted as well.

Secondary Sources

A wide range of secondary sources, including monographs, historical overviews, scholarly articles, and web-based resources were used to enrich the research done for this project. In particular, books focusing on the development of technologies in Canada, as well as the development of education in Canada were quite useful. Moreover, articles focusing on specific technologies and their use in the classroom allowed for a more robust assessment of student learning and their role in it. Teaching manuals were also consulted, and revealed the degree to which technology, particularly in the latter half of the twentieth century, has been integrated into the curriculum. Interestingly, these secondary sources further revealed an increasing shift in teacher education on how to better implement new technologies in teaching and learning contexts.

Images and Media

An effort was made to diligently include a variety of images and multimedia throughout this report. Images were used to help make the report more tangible and engaging for readers. The images in this paper were found in both primary and secondary resources. Images and media help readers to visualize the technology and help the discussion become more meaningful. Given the rapid changes in technology, some of the technologies discussed may not be recognizable or understood without an image or a short video clip.

Introduction

The adoption of technology in the classroom cannot be ignored, especially in a scholarly analysis of the centennial impact of technology on the twentieth century classroom. It is, of course, important to establish what is meant by the term ‘technology.’ Classroom technology can be as simple as an inkwell and quill or as complex as a computer – it is any manipulation of materials in the environment used to perform a specific and desired function. Quite often the implementation of assistive technologies enriches the learning process for students. More specifically, the historian Rodney Earle, in discussing instructive technologies within schools, defines the term technology as a system or systems “concerned with improving the effectiveness and efficiency of learning in educational contexts...”¹ Therefore, anything within the classroom aimed at efficiently or effectively improving learning can be considered technology. While it is often easy to think of technology as electronically-based, Earle reminds readers that the term technology refers more accurately to those devices invented to assist learning in a more enriching and interactive way.

¹ Rodney Earle, “The Integration of Instructional Technology into Public Education: Promises and Challenges,” *Educational Technology* 42 (2002): 2.

The research methodology used for this project is slightly unorthodox in that it departs from the historical norm of systematically going through every year or decade to explain the significance of one technology, or perhaps several technologies in one year or decade. Instead, this project will discuss ‘snapshots’ of technological history throughout the twentieth century. One hundred years is a long time, and the amount of technological evolution that occurred in this period could not possibly be covered sufficiently within the constraints of this research assignment. While this research approach has its limitations, it can also be argued that the snapshot approach will be an effective way to emphasize the continuity and change of technological innovations within the twentieth century. Unfortunately, this methodology ignores some technologies and privileges others. However, these snapshots serve to demonstrate that while technology in the classroom evolved significantly – almost to the point of being unrecognizable to its predecessors one hundred years earlier – its function as a learning enhancement tool has largely remained the same.

This research report has been divided into the following eras: 1900-1929, 1930-1949, 1950-1969, and 1970-1999. Within each period, we are providing a brief introduction to the decades in question, some historical context as to what was happening nationally and internationally (in the context of education in Canada generally and in Ontario specifically), and finally, certain technologies that emerged in these respective eras and their impact on education and student learning. The response to technology in the classroom in the twentieth century ranged from distrust, ambivalence, indifference, fear, acceptance, and excitement. Whether regarded as an intruder that encroached on the traditional learning or as the solution to the monolithic, outdated structure of the physical classroom, the presence of technology in the classroom is a permanent and important fixture in the history of education in Ontario. Through

snapshots of technology in the decades that comprised the twentieth century, it is apparent that the goal of classroom technology remained the same, even though the technologies themselves evolved at a precipitous rate and were subject to condemnation.

The Use of Technology in Classrooms: 1900-1929

Introduction to Era

In his book *The Promise of Schooling: Education in Canada 1800-1914*, the historian Paul Axelrod describes the beginning of the twentieth century as a period of significant transformation in the arena of public education.² Another historian, Paul Saettler, describes this particular time period as the beginning of the marriage between technology and learning within school settings.³ “Instructional technology,” as it would come to be defined, allowed for industrial and scientific innovations to be applied in the classroom unlike they had ever been before. While many of the more advanced technologies that are observed in classrooms today were not introduced until after the Second World War, the emergence and implementation of assistive technologies in the classroom in Canada may be observed as early as the 1900s.⁴

Historical Context

In general, historiography on the subject suggests that the arrival and development of technology in the classroom, and certainly the evolution of technology in Canada in general, can be attributed largely to patterns of industrialization and urbanization which followed the British industrial revolution.⁵ Before exploring the evolution of technology within the classroom, it will first be important to gain an understanding of the Canadian climate out of which these

²Paul Axelrod. *The Promise of Schooling: Education in Canada, 1800-1914* (Toronto: University of Toronto Press, 1997): 1.

³Paul Saettler. *A History of Instructional Technology* (McGraw-Hill, 1967): 1.

⁴Rodney Earle. “The Integration of Instructional Technology into Public Education: Promises and Challenges,” *Educational Technology* 42 (2002): 13.

⁵Norman Penner. *From Protest to Power: Social Democracy in Canada 1900-Present* (James Lorimer & Company Limited, 1992):1.

technologies emerged. After all, similar to the education system, Canada as a whole was also in a period of transformation and transition at the beginning of the twentieth century.

In Canada in 1900, one third of the population was employed by farming and agricultural positions.⁶ Consequently, early twentieth century Canada could be described primarily as a rural nation.⁷ Only 34.9% of its population was living in urbanized areas such as Montreal, Toronto, and Vancouver.⁸ During this time, a large variation in wealth between Canadian citizens was also visible. In many areas, there was poor farming families living in sod huts and revolting against high tariffs imposed on agricultural workers.⁹ In other areas, beautiful Victorian houses adorned both countryside and cityscapes.¹⁰

The 1901 Census of Canada reported that a population of 5.4 million occupied Canada's territories, an expanse of over three million square miles.¹¹ Despite being widely distributed, Canada's citizens of the early twentieth century were connected in unprecedented ways. Movement between the vast expanses was achieved by way of the transcontinental railway, the canal system, or the St. Lawrence River.¹² In Ontario in particular, paved roads began to appear in 1914.¹³ Aside from transportation technologies, this time period also saw advances in refrigeration, the distribution of foods including white bread and canned goods, as well as gas and electric cooking.¹⁴ Perhaps the most immediate result of these new advancements in transport and lifestyle was an increased sense of national unity and connectivity.¹⁵ More people

⁶ Robert Bothwell, Ian Drummond, and John English. *Canada 1900-1945* (University of Toronto Press, 1987): 2.

⁷ Ibid.

⁸ Ibid.

⁹ Ibid., 1; Penner, 20

¹⁰ Bothwell, Drummond, and English, 1

¹¹ Ibid; "Indices to Canadian Censuses," Automated Genealogy, Accessed November 1, 2012, <<http://automatedgenealogy.com/census/>>.

¹² Penner, 1

¹³ Bothwell, Drummond, and English, 7

¹⁴ Ibid., 5-6

¹⁵ Ibid., 6

were gaining access to new places and new products, all the while increasing their ability to communicate and interact with others. Some scholars have described this period of time as the “Great Boom of 1900-1913.”¹⁶ In addition to transportation and material goods, Canada also saw an influx of immigrant workers for the farming industry, the establishment of new mines, paper mills, and ports, as well as an increase in industrial development and urbanization.¹⁷

Context of Education in Canada

As a result, a great deal of both continuity and change may be observed within the Canadian schooling system between the years of 1900 and 1930. During this time period, more Canadians were becoming increasingly literate. By 1901, 82.8% of Canadians aged five years and older were reported as being able to read and write.¹⁸ The one-room school house of the early nineteenth century remained much the same.¹⁹ A key difference however, as outlined by the 1920 Annual Report from Ontario’s Minister of Education, was that newer, larger schools were in the process of being built, while smaller schools were beginning to be consolidated.²⁰

Despite several advancements in technology, however, the rural nature of Canada made it difficult for all children across the vast expanses of Canadian territory to access the same level of education. In Ontario in particular, steps were taken to improve this situation. Reports from the Minister of Education speak of “schools on wheels” which were exactly that, classrooms built into train cars which were intended to travel to and from children living in extremely rural areas accessible only by railway.²¹ In this way, technology was not only making subject material in the

¹⁶ Ibid.,55

¹⁷ Ibid.

¹⁸ Ibid.,8

¹⁹ “Oxford Township,” The One-Room School House, Accessed October 15, 2012, <<http://www.oneroomschoolhouses.ca/oxford-township.html>>.

²⁰ Ontario Department of Education. Report Of the Minister of Education, Province of Ontario for the year 1920. Clarkson W. James, printer to the King’s most excellent Majesty, 1920, p. 7

²¹ Ontario Department of Education. Report Of the Minister of Education, Province of Ontario for the year 1928. Clarkson W. James, printer to the King’s most excellent Majesty, 1928, p. ix

early twentieth century more accessible, it was also helping to make the classrooms themselves more accessible. As a result, this ensured an enriching education, at least in Ontario, for nearly all of its young citizens. The topic of “schools on wheels” will be discussed in greater detail in the section which follows.

While in the nineteenth century students often had to pay a small tuition or gain sponsorship, elementary schools of the early twentieth century in Canada were free, publicly funded, and attendance by law was necessary.²² In addition, the twentieth century was host to a number of changes in education itself. The urbanization and industrialization of Canadian spaces, as described above, was a key player in this change in education.²³ One major result was the implementation of new teaching technologies in the classroom.

Technologies that Emerged During this Era

Larry Cuban, the writer of *Teachers and Machines: The Classroom Use of Technology Since 1920* identifies textbooks and chalk as technologies in addition to radios and televisions.²⁴ Chalk and text books, despite having been around since the nineteenth century, undoubtedly improved the effectiveness and efficiency of learning to those who employed their use. In particular, their role as a “visual aid applied to teacher talk” supplemented the knowledge a teacher would otherwise transmit verbally.²⁵

Other classroom technologies employed in the classroom in the late nineteenth century were books, pictures, and slate boards.²⁶ On the eve of the twentieth century, pencils for writing and chalk boards were also introduced.²⁷ Many of these were likely very useful considering the

²² Axelrod, 1

²³ Bothwell, Drummond, and English, 187

²⁴ Cuban, 3

²⁵ Ibid.

²⁶ Ibid.

²⁷ “Oxford Township,” The One-Room School House, Accessed October 15, 2012, <<http://www.oneroomschoolhouses.ca/oxford-township.html>>.

individual level at which many of them could be used to enrich learning. More often than not, children would have access to their own pencil, or slate, or chalk, allowing them to personally interact with the subject material. In 1900, the classroom technologies which inspired the most “promise, controversy, and hype” were the magic lantern and the stereoscope.²⁸ Magic lanterns functioned as early image projectors, using light to illuminate a series of slides which could be viewed by an entire class.²⁹ Stereoscopes employed the use of lenses and photo screens to generate multi-dimensional images.³⁰ Overall, early twentieth century education in Ontario, and certainly in Canada as a whole, became largely preoccupied with the use of visual teaching tools.



A stereoscope from 1905.³¹

²⁸ Earle, 13

²⁹ John Plunkett, “Moving Books/Moving Images: Optical Recreations and Children’s Publishing 1800-1900,” *Verbal and Visual Interactions in Nineteenth Century Print Culture* No. 5 (2007): 1.

³⁰ Plunkett, 2

³¹ “Oxford Township,” *The One-Room School House*, Accessed October 15, 2012, <<http://www.oneroomschoolhouses.ca/oxford-township.html>>.



*A “Magic Lantern” and slides similar to those implemented in North American school systems.*³²

The emphasis on the importance of visuals, while experiencing resurgence in popularity in the twentieth century, was not a new concept. Visual aids made their way into the educational arena as a result of positive responses by the general public to picture shows and moving images.³³ The turn of the century was preceded by an era during which optical shows and devices played a key role in popular culture.³⁴ After all, it was in the nineteenth century that devices such as magic lanterns, peep shows, stereoscopes, panoramas, and dioramas initially became advertised and widespread.³⁵ By the late nineteenth century, the value of images in the context of learning for children was being realized.³⁶ In addition to providing a novel approach to understanding subject material, it was believed that the combination of visual and verbal cues

³² Photo taken from Jeff Dunn, “The Evolution of Classroom Technology,” <http://edudemic.com/2011/04/classroom-technology/>

³³ Plunkett, 1

³⁴ Ibid.

³⁵ Ibid.

³⁶ Ibid., 2

made classroom settings more interactive.³⁷ For example, in the latter half of the nineteenth century, it became a trend among book publishing companies to invest in the development of visual-based stories and books with moving images.³⁸ Overall, educating through the use of audio-visual techniques allowed children at the turn of the century to explore a world beyond their own in new and exciting ways.³⁹ The increased use of visual aids in classrooms during this period was likely a result of the increase in war propaganda. During this period, the Canadian government went to great lengths to provide communities with propaganda posters and advertisements to visually remind them of the importance of the war. Moreover, propaganda was used to increase enlistment rates and to promote the general war effort at home.



An example of a visual aid used for anatomy studies from the early twentieth century - housed at the Frontenac County School Museum, Kingston, Ontario.⁴⁰

By the 1920s, the popularity of audio-visual presentations were reaching new heights. In Canada, this was largely a result of the emergence of Hollywood movies in the western United

³⁷ Ibid.

³⁸ Plunkett, 19

³⁹ Ibid., 4

⁴⁰ Visual Aid for Anatomy, Frontenac County School Museum, Photo taken September, 2012.

States.⁴¹ Across the continent, movie theatres had become the major form of recreation and leisure for many citizens. By 1930, Ontario had two theatres devoted exclusively to cinema.⁴² 1920s North America also saw an increase in experimentation with regards to integrating existing technologies into the student learning process. One radical example comes from Los Angeles in 1927, where an aerial classroom was constructed so that students, learning from an airplane, could observe physical geography firsthand.⁴³ In general, this time period also saw an increase in teacher training, and increased numbers of pupils attending schools for longer periods of time.⁴⁴ In Ontario specifically, 1919 saw the emergence of the Industrial Education Act, which with the assistance of significant federal funding, introduced technical education programs into Ontario schools and evening programs.⁴⁵

Context of Education in Ontario

Ontario statistics recorded in the Canadian Census of 1921 indicate that literacy had increased dramatically during this time period. In 1901, 89.78 percent of the adult population could read and write.⁴⁶ In 1911, this number increased to 93.11 percent, and in 1921 hovered at 92.99 percent.⁴⁷ Essentially, something was being done well in terms of education, and this is indeed reflected in the increased literacy of Ontario's citizenry. In general, the expansion of technological applications appears to have been a prevalent theme in early twentieth century Canada. As this section has discussed, educational practice appeared to have followed suit. Even in 1900, most classrooms housed a host of assistive technologies, whose goals as a general trend were to marry the written and the visual as a means of improving learning. This was especially

⁴¹ Bothwell, Drummond, and English, 192

⁴² Ibid.

⁴³ Cuban, 1

⁴⁴ Bothwell, Drummond, and English, 195

⁴⁵ Ibid; Annual Reports 1928

⁴⁶ Bothwell, Drummond, and English, 189

⁴⁷ Ibid.

important since an increasing population meant more people needed to be educated, and therefore schooling systems needed to find the most efficient and effective way of educating the masses. While technology was certainly not the only factor affecting and improving student learning in the early twentieth century, it cannot be denied that visual devices like the magic lantern, the chalkboard, and even chalk played a significant role in doing so.

The Use of Technology in Classrooms: 1930-1949

Introduction to Era

A visit to the Frontenac County School Museum in Kingston, Ontario, was useful in providing significant insight into what it was like to attend school in the early twentieth century. Although the one room school house had some similarities to classrooms today, there were also some fundamental and very obvious differences. One of the most noteworthy differences was that there were no Smart boards, projectors, laptops, Elmos or flat screen televisions. The physical set up of a classroom since the era of the one-room school house has been shaped by the development of technology. For example, a stark contrast may be observed between the use of slate and chalk to answer questions as opposed to computer track-pads, clickers, and iPads. It is clear that the use of technology in classrooms has come a long way and that there have been a countless number of technological innovations that have revolutionized the classroom. For the purposes of this section, the focus will be on how technology was used in the classroom during the 1930s and 40s and how it affected student learning.

Historical Context

Before one can explore the use of technology in classrooms during the 1930s and 40s, it is crucial to understand what was happening in Canada and around the world during this time period. Perhaps the two most significant events that shaped society during this period were the

Great Depression and the Second World War. On October 29th, 1929, the New York Stock Market crashed and triggered a worldwide depression. The Great Depression reached Canada in 1929 and lasted for a decade. During the depression, unemployment rates rose significantly, many businesses were forced to close, and thousands of Canadians could not afford the basic necessities of life such as food, shelter and clothing.⁴⁸ With the rising costs of food and goods, many Canadians were forced to live through very tough and undesirable conditions. Many people lost all of their life savings and were forced to leave their homes and move to urban centers in search of employment. The Canadian Broadcasting Corporation created a series of television episodes entitled *A People's History*, which depicts life in Canada throughout the twentieth century. Episode 13, entitled "Hard Times," focused on life in Canada from 1929 until 1940. The episode uses primary sources, such as images and videos from the era, to show viewers how the Great Depression affected people living in Canada.⁴⁹ The depression affected almost every aspect of life in Canada, including education. The following link provides more information about *A People's History*: <http://www.cbc.ca/history/EPISHOMEEP13LE.html>.

In addition to dealing with the consequences of the Great Depression, Canada became involved in the Second World War at the end of the decade. On September 9th, 1939, Canada declared war on Germany and soon became involved in the fighting overseas. Moreover, Canadians at home also assisted with the war effort by making ammunitions, supplies and vehicles. This placed an emotional, economic, and psychological toll on the world during the

⁴⁸ Canadian Broadcasting Corporation, *Canadians Suffer: Desperate times settle over Canada during the Great Depressioin*. <http://www.cbc.ca/history/SECTIONSE1EP13CH1LE.html>

⁴⁹ Ibid.

1930s and 40s. As a result, the depression and the war had a tremendous impact on education in Canada.⁵⁰

Context of Education in Canada and Ontario

Given the challenging economic times in the 1930s and 40s, many school boards in Canada were forced to cut costs and reduce spending. In order to save money, many school boards throughout Canada merged or consolidated existing schools together.⁵¹ School boards also delayed or put an end to the construction of new schools, increased class sizes, and were forced to lay off teachers. The Annual Report from Ontario's Minister of Education in 1940 explains how the number of qualified teachers available for schools decreased during the time of the war. The decrease in teachers occurred because many of the male teachers became enlisted in the army. Moreover, many women were not available to be teachers because they were getting married, helping with the war effort, or were taking on office jobs.⁵² As a result, 38 rural public schools with low enrolment rates were forced to close.⁵³

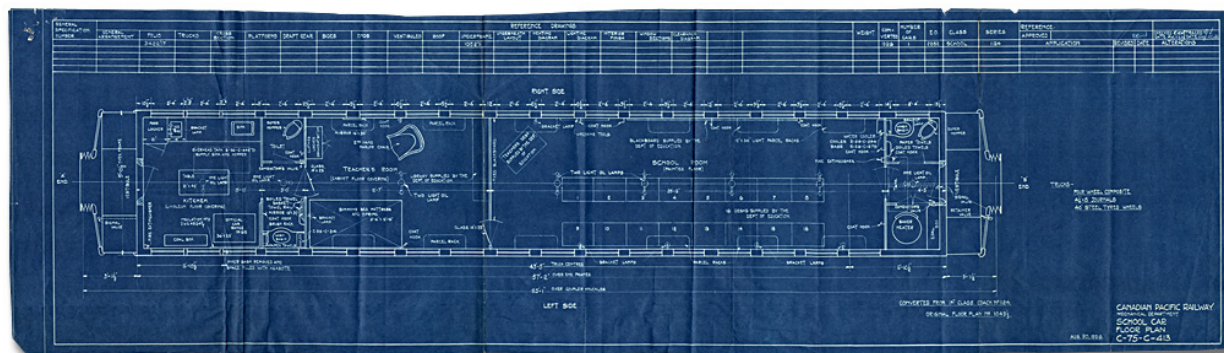
As mentioned in the previous section, railway cars that were converted into classrooms emerged in the 1920s. Below is a floor plan of how a railway car would be transformed into a school car.

⁵⁰ Veterans Affairs Canada, *Canada and the Second World War 1939-1945*, <http://www.veterans.gc.ca/eng/history/secondwar/canada2/warbeg>

⁵¹ Ontario Department of Education. Report Of the Minister of Education, Province of Ontario for the year 1928. Clarkson W. James, printer to the King's most excellent Majesty, 1928, p. ix

⁵² Ontario Department of Education. Report Of the Minister of Education, Province of Ontario for the year 1940. T. E Bowman, printer to the King's most excellent Majesty, 1940, p.2

⁵³ Ibid., 2-3.



Archives of Ontario, August 20, 1926.⁵⁴

Teachers would have living quarters in the car and would travel from community to community. The school car would stay in a community for a few days at a time while teachers instructed students.



An image from the Archives of Ontario that show a teacher and his students standing out front of the school car.⁵⁵

The Minister of Education's annual report on education in 1930 and 1940 makes it clear that these railway school cars were of great importance. For the first time, the education system was working to bring educational instruction to students that would have been denied access to it

⁵⁴ Archives of Ontario, Canadian Pacific Railway school car floor plan, August 20, 1926, http://www.archives.gov.on.ca/english/on-line-exhibits/education/big/big_037_cpr_school_plan.aspx

⁵⁵ Archives of Ontario, *Railway School Students Posing with their teacher*, [ca. 1930.] Ministry of Education, http://www.archives.gov.on.ca/english/on-line-exhibits/education/big/big_036_railway_students.aspx

simply because they lived too far from a school. The annual report of 1940 claims these school cars were efficient because eighteen pupils were taking secondary work and seven more were added to the list as high school entrance graduates.⁵⁶ Thus, it is clear that these moving school cars were helping to foster student learning.

When one explores the physical conditions of classrooms and schools in the 1930s and 40s, they recognize that they were very primitive compared to today's educational facilities. In rural communities, there was often a one room school house that would serve several different grades, and classes would be instructed by the same teacher.⁵⁷ During the 30s, most of the rural schools in Canada did not have running water that was drinkable. Thus, the teacher or students would be responsible for bringing water into the classroom from a neighboring well. Moreover, these school houses did not have modern day furnaces and they relied on wood stoves as a source of heat during the colder months. The photograph below shows children working in a school garden in Bridgenorth, Ontario.



*Archives of Ontario, ca. 1920.*⁵⁸

⁵⁶ Ontario Department of Education. Report Of the Minister of Education, Province of Ontario for the year 1940. T. E Bowman, printer to the King's most excellent Majesty, 1940, p.13.

⁵⁷ Archives of Ontario, *The One Room Schoolhouse*, <http://www.archives.gov.on.ca/english/on-line-exhibits/education/one-room-schoolhouse.aspx>

⁵⁸ Archives of Ontario, *Children working in school garden, Bridgenorth Elementary, Peterborough County, [ca. 1920]*, http://www.archives.gov.on.ca/english/on-line-exhibits/education/big/big_032_school_garden.aspx

The photo is especially interesting because the students are learning about agriculture by tending to the school garden. As a result of having no indoor plumbing, schools often used outhouses as bathrooms. One unique characteristic of schools in the 1930s and 40s was that the teacher and students had to be the janitor and look after the upkeep and maintenance of the school.

Our group conducted an interview with a relative who went through the education system in the 1930s and 40s. Brigid Rooney, a grandmother of one of our group members, recalled growing up in the rural community of Norwood, near Peterborough, Ontario.⁵⁹ She shared her stories of going to a one-room school house when she was in the sixth grade. Brigid said she recalls being in the same class as her younger brother who was in the third grade and her older sister who was in the ninth grade. As a sixth grader, she said it was the girls' responsibility to come in before school and clean Mrs. Murphy's blackboards. The grade 8 boys were responsible for bringing fire wood inside for the stove. Rooney recalls that her classroom had few books or teaching resources, and as a result, students shared their books or copied out the questions that would be for homework. When Rooney was asked if she remembers any of the teaching styles that were used during this period, she laughed and said "memorize, memorize, memorize." Rooney said she recalls having to write out spelling words on the blackboard several times and mental math was drilled into her head by constant memorization.⁶⁰

According to the Minister of Education's annual report on Education in 1930, Ontario had 7,706 schools, roughly 20,000 teachers and the number of students enrolled in Ontario schools was over 747,000 pupils.⁶¹ While these numbers may be considered low by today's

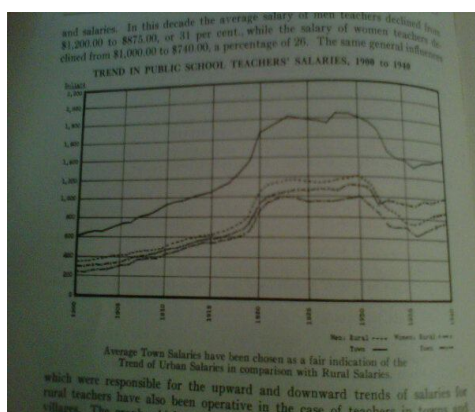
⁵⁹ Brigid Rooney (Grandmother of group member) in discussion with the authors, November, 10, 2012, Peterborough ON.

⁶⁰ Ibid.

⁶¹ Ontario Department of Education. Report Of the Minister of Education, Province of Ontario for the year 1930. Herbert H. Ball, Printer to the King's most excellent Majesty, 1930, p.vi.

standards, they serve as an important reminder that education was a desirable but not always attainable dream for young Canadians.

If one wants to get an accurate representation of what was happening in Ontario schools during the 1930s and 40s, they should also consider the trends in salaries of elementary school teachers. As aforementioned, there was a severe economic depression that hit Canada in the early 30s. The repercussions were plenty, and teachers' salaries dropping significantly was an unfortunate outcome. The average male teachers' salary dropped by 38 percent, and women's salaries dropped 55 percent.⁶² The Second World War brought improved economic conditions and as a result, teacher salaries began to increase between 1936 and 1940. The following graph shows the trends in public school teachers' salaries, 1900-1940.



Graph from Annual report- Department of Education 1940⁶³

This graph depicts the depression and the war as having a significant impact on the education system.

Technologies that Emerged During this Era

After exploring what was happening in Canada and the world during the 1930s and 40s, and looking at what education was like in Ontario and Canada during this era, we can now

⁶² Ontario Department of Education. Report Of the Minister of Education, Province of Ontario for the year 1940. T. E Bowman, printer to the King's most excellent Majesty, 1940, p.15.

⁶³ Ibid., p.16.

explore how technology was used in the classroom during the 30s and 40s. It is important to note that several of the technologies that were introduced at the beginning of the century were still being used. Therefore, items like the blackboards, pencils, stereoscopes, and magic lanterns were being used in the classroom. After consulting primary and secondary resources it was found that the two pieces of technology that were used the most during this time were radio and film. Brigid Rooney said she recalls from a very early age the use of radios in schools.



Rooney explained that her teacher used to gather students around the radio and listen to different public address announcements. Rooney also recalled there being educational programs that teachers would have a schedule for and would tune in when the show aired. According to the Annual Report from the Department of Education in 1946, the Department of Education presented a programme of 75 different education broadcasts to elementary and secondary schools in the province. A survey suggested that 40% of schools were using the broadcasts and that several of the other schools were planning on implementing the use of radio broadcasts.⁶⁵ Larry Cuban's *Teachers and Machines: The Classroom Use of Technology Since 1920* explores the use of the radio in the classroom during the 1930s. Cuban explains that, "The central and dominant

⁶⁴ Photo taken from Jeff Dunn, "The Evolution of Classroom Technology," <http://edudemic.com/2011/04/classroom-technology/>

⁶⁵ Ontario Department of Education. Report Of the Minister of Education, Province of Ontario for the year 1946. Baptist Johnston, Printer to the King's most excellent Majesty, 1946, p.63.

aim of education by radio is to bring the world to the classroom, to make universally available the services of the finest teachers, the inspiration of the greatest leaders...”⁶⁶ Rooney echoed this statement and said that the radio brought the events of the Second World War into the classroom. Although the radio was invented in the mid-1920s, it really emerged as a popular piece of technology in the classroom by the late 1930s. The radio was seen as an important teaching tool because it was a new way for teachers to present students with information. Moreover, they could hear what was happening in the world from different perspectives. Thus, radios went a long way in the assistance and enrichment of student learning.

In addition to the emergence of radios in the classroom, the 1930s and 40s also saw the increased use of film. In 1922, Thomas Edison stated his position on the use of motion pictures in the classroom:

I believe that the motion picture is destined to revolutionize our educational system and that in a few years it will supplant largely, if not entirely, the use of textbooks.... The education of the future, as I see it, will be conducted through the medium of the motion picture... where it should be possible to obtain one hundred percent efficiency.

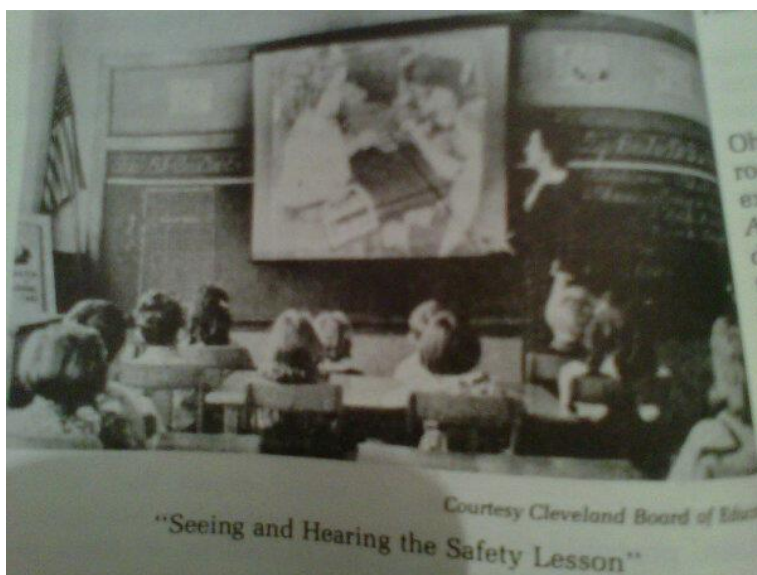
This quote affirms that from a very early period people recognized the value of motion pictures being used in the classroom. Brigid Rooney was asked if she remembers the use of film during her schooling. She pointed out that she grew up in a rural community and that they did not have access or funding to new pieces of technology like projectors to show films. Rooney did say that when she moved to Toronto in 1945, she remembers her teacher showing filmstrips that did not have audio.⁶⁷ According to the Annual Report on Education in 1946, the use of educational films during 1946 increased from the previous year. Sound and silent films were shown to a total

⁶⁶ Cuban, 9-11.

⁶⁷ Brigid Rooney (Grandmother of group member) in discussion with the authors, November, 10, 2012, Peterborough ON.

⁶⁷ Ibid.

audience of 3,726,124 students. In addition, more than 150 schools had reported purchasing a sound projector during the year.⁶⁸ The schools that could afford projectors would have been more urbanized schools and would have been schools that had access to more funding. The 1946 report also explained that teachers could receive training on the use of audio-visual aids. It also claimed the focus was on using films for enriching educational experiences and minimizing the entertainment value.



The picture above shows an American classroom during the 1930s watching a safety film.⁶⁹

Although this image is from an American source, it is safe to say that Canadian schools with projectors would have looked very similar. The utilization of films in the classroom became more common in the late 1930s and 1940s. Films were a piece of technology that led to the assistance in and enrichment of student learning. Although there were other forms of technology that emerged in classrooms during this era, radios and films were arguably the most popular forms of technology that were found in classrooms during this period. Film and radio have

⁶⁸ Ontario Department of Education. Report Of the Minister of Education, Province of Ontario for the year 1946. Baptist Johnston, Printer to the King's most excellent Majesty, 1946, p.63.

⁶⁹ Cuban, 18.

continued to be an important part of education and some would argue that there has been a re-emergence of films in the classroom with the creation of online video search engines such as YouTube and Project Free TV.

The Use of Technology in Classrooms: 1950-1969

Introduction to Era

The use of media was a key turning point in the world of education, from the creation of radio and film projectors in the 1920s, to the use of television and videotapes as noted in the article "Evolution of Classroom Technology" by Jeff Dunn.⁷⁰ In today's world, this evolution of media has further spread its wings into the world of social media. However, it cannot be ignored that technology played a key role in enhancing student learning in the 1950s and 60s.

Historical Context

During the 1950s and 60s, there were major changes throughout the world and in Canada. The war was over, wrongs were being righted, retribution was to be paid, and towns, countries, and continents were trying to rebuild themselves physically, economically, and socially. This era saw much hype around new technology and the rush to have or be creating the best in the industry. Television shows like *The Jetsons* or movies like *Star Trek* were popular and focused on a romanticized technological future. Given the context of the Cold War, where two of the world's leading powers, the United States and the Soviet Union, were competing in an arms race for military advancement and technological superiority. Moreover, civil rights movements were starting to gain publicity in the United States, such as the work of Martin Luther King Jr. and the actions of Rosa Parks. The framework of standing up for social injustice created movements across Canada as well.

⁷⁰ Jeff Dunn, "The Evolution of Classroom Technology," Edudemic - Education Technology, Apps, Product Reviews, and Social Media, Accessed October 30th, 2012, <http://edudemic.com/2011/04/classroom-technology/>.

This was the era of the baby boomers. After the Second World War, families were starting to have children again and the economy was picking itself back up. As a result, there was a significant rise in population because families were having more children. This rise is directly correlated to the increase in schools being built during this period. A growing population had to be accommodated.

Context of Education in Canada and Ontario

As alluded to by James D. Finn in his compilation, *Extended Education Through Technology*, the 1950s held a unique mark in the world of technology and teaching; it has been described as the “pre-automation period.”⁷¹ This period was at the turning point of when technology went from being a small component in classroom instruction to becoming more available and ingrained in the daily workings of a classroom.⁷² Finn notes that due to the two world wars that preluded this period, there was a rise in technology; however, this rise in technological advancement was not reflected in the classroom until the 1950s.⁷³ This was a great turning point in education. Schools were able to use the technology that society had created for the purposes of education, and this was a healthy start to continuous growth in student learning. Students would be able to learn how to use and apply the knowledge they had gained about technology in the classroom to their daily lives outside of school. This also served to make students tech-savvy for their future jobs, and prepared them for the real world after school. Though it should be noted that *Extending Education Through Technology* was written in the

⁷¹ James D. Finn and Ronald J. MacBeath, *Extending Education Through Technology: Selected Writings by James D. Finn on Instructional Technology* (Connecticut: Information Age Publishing, 2004), 148.

⁷² Finn and MacBeath, *Extending Education Through Technology*, 148.

⁷³ Ibid.

United States, it is prevalent to what was happening in Canada – especially given the effects of the world wars.

Finn alludes to how students were more receptive to the use of film in the classroom due to the Second World War.⁷⁴ Students were more knowledgeable about the purposes of film and were interested in learning through use of this media. It is noted by Finn that the use of media in classrooms as a tool for teaching was beginning to gain momentum with the use of the television. He also claims that social psychology played a role in this new world of instruction, especially the efforts of B.F. Skinner.⁷⁵ Both educational television and the work of Skinner will be examined later in this paper as technologies which emerged in this era.

In secondary schools during the 1950s, it was noted in the Ontario Department of Education's *Report of the Minister 1950* that there was a focus on expanding schools to offer different specialized courses as well as providing accommodations to students.⁷⁶ At this time, the Ontario Ministry report from 1950 showed that the use of railway cars as physical schooling establishments for students in far-reaching stretches of the province were still in practice.⁷⁷ When the history curriculum class attended the Frontenac County School Museum in September, one of the books entitled *School on Wheels: Reaching and Teaching the Isolated Children of the North* by Karl and Mary Schuessler discussed stories of those children and families who were a part of this learning experience which continued into the late 1960s.⁷⁸ The 'school on wheels' provides yet another example of the way teachers and schools tried to reach all students and enhance the

⁷⁴ Ibid., 148-149.

⁷⁵ Ibid., 149.

⁷⁶ Ontario Department of Education, *Report of the Minister 1950*, Dana Porter. (Toronto: Order of the Legislative Assembly of Ontario, 1952). (Session Paper No. 11). 11.

⁷⁷ *Report of the Minister 1950*, 1952, 10.

⁷⁸ Karl Schuessler and Mary Schuessler, *School on wheels: reaching and teaching the isolated children of the North* (Ontario: Boston Mills Press, 1986).

schooling opportunity for those who would not have been able to get to a physical school otherwise.

In the 1950s, the Ontario Ministry Report made reference to the construction of over “424 new schools, 368 additions, and 17 temporary buildings.”⁷⁹ In comparison to Ontario’s education system, this number seems quite extraordinary because it is rare that one hears of many new schools being built, but rather old schools being torn down due to low enrollment numbers. This increase in the building of schools has a direct correlation with the baby boom. In terms of technology, the Ontario Ministry documents from 1950 to 1960 reflect increased attention to training teachers in the use of audio-visual technologies. It is noted in the Ministry Report from 1960 that there were a couple of summer courses offered for teachers to learn more about how to use the video-audio technology available to them.⁸⁰ The report goes on to state that “[a] total of 294 teachers enrolled in these courses, an increase of 81 over the previous year.” This reflects a growing trend toward understanding the world of technology and its practical uses in the classroom to further improve student learning.

Technologies that Emerged During this Era

The 1950s and 1960s saw a rise in use of technology which was very integrated in educational videos as a means of expanding lessons taught in class. As well, it was a means of instruction which was embedded in psychological theory, especially that of B.F. Skinner. The major technological pieces that will be examined include the introduction of educational television and the Skinner teaching machine. Both of these technologies worked to enhance student learning.

⁷⁹ Ontario Department of Education, *Report of the Minister 1950*, Dana Porter. (Toronto: Order of the Legislative Assembly of Ontario, 1952). (Session Paper No. 11). 10.

⁸⁰ Ontario Department of Education, *Report of the Minister 1960*, John P. Robarts. (Toronto: Order of the Legislative Assembly of Ontario, 1961). (Session Paper No. 7). 10.

B.F. Skinner, a prevalent behaviour psychologist, believed that the field of education was not being efficient and that as the population grew there were more effective means to teach a large amount of students.⁸¹ Skinner believed in the principles of John Dewey and progressive education; he believed students should not learn through being physically punished when they do not get the information correct, but should be learning through experience and through doing.⁸² Following this belief system, Skinner created what is called a 'teaching machine.' These machines were "... a device which create[d] vastly improved conditions for effective study."⁸³ Skinner explains,

With the machine ... the student sees a bit of text or other printed material in a window. This may be a sentence or two, or an equation in arithmetic. Some small part is missing and the student must supply it by writing on an exposed strip of paper. His response may be the answer to a question or the solution to a problem, but generally it is simply a symbol or word which completes the material he has just read. As soon as a student has written his response, he operates the machine and learns immediately whether he is right or wrong. This is a great improvement over the system in which papers are graded by the teacher where the student must wait perhaps till another day to learn whether or not what he had written is right.⁸⁴



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Watch Skinner explain his teaching machine: <http://www.youtube.com/watch?v=EXR9Ft8rzhk>

⁸¹ B.F. Skinner, "Teaching Machines," *Science* 128, 3330 (1958): 969, DOI: [10.1126/science.128.3330.969](https://doi.org/10.1126/science.128.3330.969).

⁸² Skinner, "Teaching Machines," 977.

⁸³ "Skinner and Teaching Machine," April 2, 2007, video clip, accessed October 20, 2012, YouTube, <http://www.youtube.com/watch?v=EXR9Ft8rzhk>.

⁸⁴ "Skinner and Teaching Machine," YouTube.

⁸⁵ "Skinner and Teaching Machine," YouTube.



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Skinner Teaching Machine

With the invention of this teaching machine, Skinner believed that since students would immediately be informed if their answers were right or wrong, this would lead “rapidly to the formation of correct behaviour.”⁸⁷ Students would have the answers right in front of them and know quickly how to change their answer. Moreover, Skinner notes that students would be excited and enthusiastic to learn more because they would not have the anxiety of having to write a test and therefore would be able to concentrate better as well. Students could take their time with the activities, and this therefore enabled the slower learners to learn at their own pace while still allowing for the higher functioning learners to be challenged.⁸⁸

Skinner’s teaching machine had all students follow “a carefully constructed program” which took the student from beginner to expert on the subject through the technique of

⁸⁶ Photo taken from Jeff Dunn, “The Evolution of Classroom Technology,” <http://edudemic.com/2011/04/classroom-technology/>

⁸⁷ “Skinner and Teaching Machine,” YouTube.

⁸⁸ Ibid.

scaffolding.⁸⁹ The invention and use of Skinner's teaching machine not only aided in efficiency in the classroom, but also embodied many instructional strategies emphasized in today's world of education. These include scaffolding, assistive technology, differentiated learning, facilitating meaningful learning to students at all levels, and enhancing student learning through use of technology. It is important to remember that of all the technologies presented in this project, only Skinner's teaching machine has been debunked as a defective teaching aid.

Skinner also discusses in his article the significant use of videos in instruction.⁹⁰ *New York Times* online magazine notes that "[b]y the early 1960s there were more than 50 channels that included educational programming on the air across the world."⁹¹ This growth struck at a time when more homes and educational settings had access to televisions. This was because during the first and second world wars, production of television sets was held off while Canada was using their factories to produce what was needed for the war effort. In Robert A. Levin and Maurie Moses Hines's article "Educational Television, Fred Rogers, and the History of Education," published in *History of Education Quarterly*, they explain that it was in the post-war years that television sets were being manufactured again and were becoming re-established as a need of society.⁹² This social need soon developed into an educational need.

⁸⁹ Ibid.

⁹⁰ Skinner, "Teaching Machines," 969.

⁹¹ Charles Wilson, Marvin Orellana, and Miki Meek, "The Evolution of Classroom Technology –Interactive Feature - NYTimes.com," *The New York Times - Breaking News, World News & Multimedia*, Last modified September 15th, 2010, Accessed November 7th, 2012, <http://www.nytimes.com/interactive/2010/09/19/magazine/classroom-technology.html>.

⁹² Ibid., 263-264.



⁹³ *A classroom using educational television to enhance student learning*

Robert A. Levin and Maurie Moses Hines describe this growing trend by noting that “[t]he rapid increase in classroom television, due largely to favorable [sic] responses from teachers, pupils, and parents, leaves no doubt to the effectiveness of this new medium as a teaching device.”⁹⁴ With the introduction of educational television into the classroom, teachers were able to enhance student learning by giving both auditory and visual learners a way of learning that would fit their needs. The use of television programming allowed for teachers to have collections of resources all in one easy format, as well as allowing student learning to be both extended and enriched. An example of such programming is “Mister Rogers’ Neighborhood” which came out during this time period.⁹⁵ Through different activities and stories, the programming was able to convey educational information while at the same time being fun and interactive with its viewers. As supported in the Ontario Minister of Education reports of both 1950 and 1960, Robert A. Levin

⁹³ Ibid., 268.

⁹⁴ Ibid., 264.

⁹⁵ Ibid., 265.

and Maurie Moses Hines note that teachers completed summer training for the use of educational television in schools.⁹⁶ Teachers were being properly trained because the use of this technology was seen as valued and important to enrich student learning.

The Use of Technology in the Classroom: 1970-1999

Introduction to the Era

The technological evolution that occurred in the last three decades of the twentieth century informed what is now known today as the Information Age. Of all the advancements made in technology during the 70s, 80s, and 90s, the computer eclipses them all. It revolutionized schools in ways that would have been unfathomable to the previous decade – where the only computers in existence were goliaths that did not have educational purposes. Computers changed word processing and could process information in ways vastly superior to the human mind. As computer technology advanced, so did the cultural appetite for electronics. With the creation of the Internet, the Information Highway provided access to information previously available only in books and archives. It changed how people could search for and access information.

As these technologies percolated into the classroom, the classroom itself accommodated whether it wanted to or not; computers were now a visible presence in classrooms, and even entire rooms were reserved for the purpose of storing computers. The creation of the computer lab – a physical change that most schools underwent – suggests an embracement of this technology, an understanding that the sociocultural need for computers would not losing its urgency in the future. In increasingly younger and younger grades, elementary school children were learning how to type. Educators witnessed the world around them become more and more automated, and knew their students would have to survive and thrive in the technological jungle.

⁹⁶ Ibid., 264.

As predicted, computer literacy became as crucial a skill as basic reading and writing proficiency, and those with limited computer knowledge risked alienation from certain opportunities and privileges in life. From the handheld calculator to the internet, the last thirty years of the twentieth century were an unprecedented leap forward in technological revolutions.

Historical Context

The Cold War continued through the 70s and 80s, and so did the subsequent technological arms race between the United States and the Soviet Union; this continued until the dissolution of the Soviet Union in 1991. Although the war continued, the Red Scare and the general promotion of fear had subsided, as the threat of mutually assured destruction pricked the collective international conscience. It was an unpalatable reminder to the world that humans really were – through their unnecessary hatred and fear of one another – capable of producing technology and weapons of mass destruction capable of wiping out the human population in seconds. While the threat of nuclear World War Three had loomed large in the decades before, the threat became less and less imminent with the prospect of a nuclear holocaust slowing down the production and testing of nuclear weaponry. This explains a rising interest in speculative fiction that focused on nuclear apocalypses, dystopian futures, and the breakdown of human civilization.

As interest in nuclear technology waned, interests in other technologies increased. There still existed a strong competition between the United States and Soviet Union, and technologies in space exploration and computers continued to capture and hold the imagination of people all over the world. It is in this era that technologies such as the handheld calculator and the PLATO computer changed the way students learned, wrote tests, and conveyed information. This was also a time of widespread fear that technologies no longer enriched education, but instead

promoted laziness that hindered cognitive processing, studying, and learning. Despite the criticism, these new technologies gained a strong foothold in the classroom, and never left it again. By the end of 1999, the classroom that was venturing forward into the twentieth-century was completely unrecognizable to its hundred-year-old ancestor.

Technologies that Emerged During this Era and Final Conclusion

This was the era of automation in classroom technology. The first significant technology that emerged during this period was the handheld calculator in 1970.⁹⁷



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The first handheld calculator, a convenient predecessor to the popular TI-83

The handheld calculator became the new standard for classroom calculators, and paved the road for the ones used today.⁹⁹ Its function was to provide quick solutions to basic math problems in a portable, lightweight device. In an era of room-size computers, the size of this

⁹⁷ Jeff Dunn, "The Evolution of Classroom Technology"

⁹⁸ Photo taken from Jeff Dunn, "The Evolution of Classroom Technology," <http://edudemic.com/2011/04/classroom-technology/>

⁹⁹ Jeff Dunn, "The Evolution of Classroom Technology"

device was highly desirable. This desirability, however, was eclipsed by larger concerns that the handheld calculator was more detrimental than beneficial to student learning. Educators were hesitant to adopt these calculators into their classrooms because they feared that the technology only served to undermine basic learning skills.¹⁰⁰ Provided students know the steps to carry out basic mathematical problems, the required numbers can be typed in and the answer will show itself to students without the students themselves conducting any problem-solving of their own. Nevertheless, handheld calculators became a permanent fixture in the classroom, and because of their cheaper price and portable size, were much more likely than computers to be found in classrooms around the world. The handheld calculator in 1970 is the predecessor of the still-popular TI-83 graphing calculator, though the graphing calculator aids in mathematical functions – long equations, plotting – that most human minds could not carry out unassisted.¹⁰¹

The entirety of this historical project could focus on the invention, adoption, and evolution of computers in the classroom. For the purposes of this assignment, this project will narrow this focus considerably by examining the PLATO computer in 1980, one of the earliest computers “to gain a foothold in the education market.”¹⁰²

¹⁰⁰ Ibid.

¹⁰¹ Ibid.

¹⁰² Ibid.



The PLATO computer, one of the first computers to be adopted into the classroom

This was certainly not the first computer, but it was the beginning of an educational trend to include computer technology in the learning process. Dubbed a microcomputer (laughable by today's standards), the PLATO signified that portable, cheaper computers were on the rise. Many educators were forced to admit, however, that they were quite clueless about how to use computers to benefit student learning. During the 80s and 90s, many teaching manuals were dedicated to instructing teachers on how to use them to not only enrich student learning, but just simply how to use them. The ubiquitous presence of computers in an era becoming known as the digital revolution led to the adoption of computers in many classrooms and schools.

It seemed as though everyone was confused by the rate at which computers were changing the social landscape, and teachers were equally uncertain about the role of this technological bombardment in their classrooms. Literature during this period reflected a rhetoric of confusion, fear, and even Darwinian sentiment with titles such as *Computer Consciousness: Surviving the Automated 80s*, the OSSTF's *Computers Don't Byte: A Starting Point for Teachers Using Computers* and *Coping with Computers in the Elementary and Middle Schools*. Educators

¹⁰³ Photo taken from Jeff Dunn, "The Evolution of Classroom Technology," <http://edudemic.com/2011/04/classroom-technology/>

could not ignore the growing presence of computers; they were increasingly discussed in educational discourse and their presence was becoming more common in schools and classrooms. There was a growing desire to keep up with computer technology, and this technological “survival of the fittest” was related to both a dramatic increase in the amount of computers that were in schools and the constant evolution of such technologies. This almost-Darwinian sentiment not only suggested that teachers understood that computers were becoming an increasingly important component of the classroom, and that they would have to “keep up with the times” if they wanted to survive and thrive in their educational territories. By the 90s, the literature surrounding computer use was mostly instructional, and some examples include *How to Use Technology to Improve Student Learning*, *Using a Microcomputer in the Classroom*, and *Computers and Teaching*. Computers could no longer be avoided in an increasingly automated world, and teachers in Ontario felt this urgency and understood that the classroom was becoming a digital environment. While most of these manuals and texts were published in the United States, they are still pertinent to the context of education in Canadian generally and in Ontario specifically.

Lockard, Abrams, and Many’s 1987 *Microcomputers for Educators* offered a how-to guide not only for computer-assisted instruction and computer-assisted learning, but on how to use them – there were still many teachers who were quite unfamiliar with the technology that was slowly percolating into the schools where they worked. Referring to basic computer knowledge as “survival skills,” Lockard, Abrams, and Many state:

There are many skills that students must possess if they are to work effectively on the computer. For example, it is important that students know how to properly handle disks, how to insert and remove a disk from the disk drive, how to “boot up” a program, and how to use the keyboard appropriately. Certainly, these basic skills are important for all students who want to use the computer. Perhaps they are analogous to inserting the key

into the ignition, turning the key, and properly placing the gear shift into reverse before backing the car out of a garage. They are low-level skills, but they are important ones.¹⁰⁴

Coining these basic skills as necessary for survival suggests that teachers felt an onus of responsibility to educate and prepare students for the information age. The authors admit that “as an agent of the society it represents, education has a responsibility to produce citizens capable of successfully living and working in this new technological age,” and affirms that “The need for intelligent consumers of the computer cannot go unanswered.”¹⁰⁵ Over time, these “survival skills” necessary for success in the automated age became easier in some ways (the invention of the CD-ROM drive) and perhaps more difficult in other ways (the advent of the internet.)



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The CD-ROM, originally designed for an external drive that came into usage around 1985. The CD-ROM proved to be vastly superior to the floppy disc, as it was able to store an entire encyclopedia plus audio and visual material.

¹⁰⁴ James Lockard, Peter D. Abrams, and Wesley A. Many, *Microcomputers for Educators* (Toronto: Little, Brown and Company, 1987): 321.

¹⁰⁵ *Ibid.*, 320.

¹⁰⁶ Photo taken from Jeff Dunn, “The Evolution of Classroom Technology,” <http://edudemic.com/2011/04/classroom-technology/>

Yet in the specific context of student learning, both researchers and teachers alike were baffled about the place of computers in the classroom. Computers had no doubt revolutionized the social, cultural, political, and economic landscape, and education seemed to be the inevitable last frontier. Research that lauded computers, such as Vockell and Schwartz's *The Computer in the Classroom* concluded that "computerized tutorials can enhance academic learning time by permitting students to proceed at their own pace, focusing their attention, and placing at their fingertips information they need when they need it."¹⁰⁷ This acknowledges that computers provided students with the opportunity to be active participants in learning as opposed to just passive recipients.

Computers also shifted the role of teaching, making teachers no longer the centers of attention in their classrooms. They became facilitators aided by technological help, and no longer the sole dispensers of knowledge and information. Not that teachers were complaining, necessarily, because the learning benefits of computers seemed almost infinite: they allowed students to learn and develop at different rates because it could individualize instruction, they fostered an increase in the quantity and quality of students' thinking and writing, they nurtured artistic expression, and they created opportunities to be globally aware – to name a few.¹⁰⁸ While anxieties existed about how to teach and how to learn with computer technology, another common fear was that – since computer literacy was an increasingly important skill to teach the next generation – computer instruction would take time away from mathematics, English, and the sciences.¹⁰⁹ However, many teachers and researchers thought this could be remedied by computer-assisted instruction, which were computer tasks that taught students in an array of

¹⁰⁷ Edward Vockell and Eileen Schwartz, *The Computer in the Classroom* (Santa Cruz: Mitchell Publishing, Inc., 1988): 9.

¹⁰⁸ Michael Milone, *How to Use Technology to Improve Student Learning: Problems and Solutions* (Washington, D.C.: American Association of School Administrators, 1996): 13.

¹⁰⁹ Gregg Brownell, *Computers and Teaching* (

subjects – from math problems to grammar questions, computers soon become more and more interdisciplinary. Drill and practice software was effective in the aid of vocabulary and typing development,¹¹⁰ tutorials were excellent for concept development,¹¹¹ simulation games and activities allowed for students to make and be affected by their decisions,¹¹² problem-solving software required logical strategy and input,¹¹³ and computer-assisted learning provided tailored instruction for students with special needs or learning disabilities.¹¹⁴

Other criticisms associated with computer use predicted a “digital divide” and that, because of many cultural, economic, and social variables, certain groups would be alienated from the information age. Prominent educational scholar, Jonathon Kozol, noted that those likely to be banished to the fringes of the information age would be those disadvantaged by low socioeconomic status. He was not as concerned with individual poverty as he was with the dichotomous use of computers in poor and affluent schools. He notes that structural inequality would manifest in the ways that technology was used in schools, claiming that poor schools “teach computers” whereas affluent schools “use computers”.¹¹⁵ Despite these criticisms, which still exist in some capacity, schools continued to embrace or at least tolerate computers as they evolved from microcomputers to personal computers – they became smaller, cheaper, and less of a luxury item and more of an everyday necessity in the classroom.

The external CD-ROM drive was only a minor computer facelift; the advent of the internet changed both the purpose and the function of computers. Many welcomed the internet and believed it would be a great equalizer, an opportunity to bridge structural inequalities

¹¹⁰ Gary G. Bitter, Ruth A. Camuse, and Vicki L. Durbin, *Using a Microcomputer in the Classroom* (Needham Heights, MA: Simon & Schuster, Inc., 1993): 62

¹¹¹ *Ibid.*, 64.

¹¹² *Ibid.*, 70.

¹¹³ *Ibid.*, 77.

¹¹⁴ *Ibid.*, 83.

¹¹⁵ Jonathon Kozol, “Rich Child, Poor Child,” *Electronic Learning: Special Edition* 10, no. 5 (1991): 56

between rural and urban schools. Historically, rural schools were viewed as disadvantaged, and many assumed they provided students with an inferior education – to some degree this is true. In metropolitan areas, the tax base supports many opportunities not available to rural schools, there is an abundance of nearby cultural and social opportunities, and the close proximity of major universities provides many resources.¹¹⁶ The internet, creating a global community, allows anyone or any school willing to invest in the technology the opportunity to connect with what was once inaccessible – people and affiliations, infinite amounts of information, and the published work of others. The internet provided an alternative to research – it was perhaps less tactile than searching through books in libraries, but it provided search options that cut down the time invested in walking through aisles and flipping through pages – and it was certainly much easier. While computers and internet provided as many solutions as they did problems in the context of learning and education, many educational prophets saw the direction that the twenty-first century classroom was heading in. In the *World Yearbook of Education 1982/83: Computers and Education*, Jacquetta Megarry promotes electronic learning, and makes a doomsday prediction for the teachers who choose to avoid it:

Against these apocalyptic forecasts must be set a powerful political pressure which will be exerted by the teaching work-force to preserve their jobs and institutions. They will argue [...] that significant sociological and psychological processes can only take place where teachers and pupils are gathered in a social unit. [...] There is, I believe, an important future for schools as places which encourage inventive learning, social mixing, and physical opportunities which no home is likely to emulate. However, to maintain any appeal they will have to adapt themselves to the twenty-first century, to the needs of the information generation and to the demand for greater flexibility in their curriculum, methodology and organization. If the teaching profession is to survive, it must develop and capitalize on those skills which are not easily replaced by microelectronic devices. To this end, the teacher education sector requires a massive increase in its level of

¹¹⁶ Michael Milone, 126.

microelectronic awareness and skills. Otherwise tomorrow's teachers will be as handicapped as yesterday's illiterates.¹¹⁷

Megarry speaks for an opinion that was often expressed in the twentieth century, one that became more pertinent as the prospect of the new millennium conjured notions of fear and wonder about the technological future.

From stereoscopes to “magic lanterns” to “teaching machines” to computers, the goal of educational technology in the twentieth century was always to enrich learning in ways that were meaningful and efficient. Some were more effective than others, and all of them invited a fair share of criticism. It would be impossible to describe the invention and evolution of every single educational technology that emerged in the twentieth century. Not only do the parameters of this assignment not allow it, but it would be a lofty endeavour that would lack coherence. Through snapshots of technology in the decades that comprised the twentieth century, it can be observed that the educational goal remained the same despite the constant and rapid evolution of those technologies involved in the process. There was a benevolent undercurrent in what appeared to be a sea of criticism and skepticism. This argument is, admittedly, at odds with what has occurred and what is occurring in the twenty-first century. There are many contemporary educational technologies that do not enrich learning, and even students abuse technology in ways that is detrimental to their learning. The fingerprint-scan payment method at Fredericton's Centre Communautaire Sainte-Anne school cafeteria comes to mind, as does the trend for students to take pictures of lecture notes on the chalkboard/SmartBoard with their smartphones. In regard to the former, one questions the necessity of the practice and likely dismisses it as superfluous and

¹¹⁷ Jacquetta Megarry, “Thinking, Learning, and Educating: The Role of the Computer,” in *World Yearbook of Education 1982/83: Computers and Education*, edited by Jacquetta Megarry, David R.F. Walker, Stanley Nisbet, and Eric Hoyle (New York: Nichols Publishing Company, 1983) 27.

possibly horrifying; with regard to the latter, one marvels if – by using the phone as a technological extension of the eyes and brain – the student has succeeded in bypassing cognitive retention during the note-taking process altogether.

While even more incredible technologies such as the SmartBoard and iPad have inspired a new century of disapproval, debate, and support, what is happening now in the twenty-first century cannot be compared to what happened in the twentieth. It is tempting to criticize the educational technology of the twentieth century because of the current technology that fuels both our suspicions and appraisal. From 1900-1999, exciting and unprecedented technological innovations occurred, ones that completely revolutionized how we teach and how we learn. The snapshots suggest that these particular technologies survived condemnation and were eventually commended as innovative tools of learning enrichment. The classroom stepped out of the twentieth century with a different appearance and pedagogical approach than its predecessor a hundred years earlier. But just like the pen became a quicker writing tool than the quill, and the keyboard a faster typing alternative to the typewriter, the goal of technological education was always to build upon successful technologies and improve them for the sake of efficient and effective student learning.

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Skinner, B.F. “Teaching Machines.” *Science* 128, 3330 (1958): 969-977. Accessed November 5th. DOI: [10.1126/science.128.3330.969](https://doi.org/10.1126/science.128.3330.969).

Vockell, Edward, and Eileen Schwartz. *The Computer in the Classroom*. Santa Cruz: Mitchell Publishing, Inc., 1988.

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Annotated Bibliography

Axelrod, Paul. *The Promise of Schooling: Education in Canada, 1800-1914*. University of Toronto Press, 1997.

In this short monograph, Paul Axelrod surveys the social, political, and economic climate of Canada at the turn of the nineteenth and twentieth century. It is of particular interest to this study since Axelrod discusses some of the major events and changes in Canadian schooling during this time period and ending at the First World War. Alexrod's analysis is especially interesting because it explores the reasons behind campaigns such as publicly-funded education, and the ways in which industrialization and urbanization caused both the structure and the subject materials taught in schools to change.

Bothwell, Robert, Drummond, Ian, and John English. *Canada 1900-1945*. University of Toronto Press, 1987.

This book contains a general but comprehensive survey of Canada between the twentieth century and the end of the First World War. It is an enlightening source in the sense that it identifies key events in Canadian history during this time period chronologically, while at the same time discussing general continuities and changes in Canada during this era. The section on "The Great Boom of 1900-1913" was of particular use to this paper. It described and analyzed the effects that population expansion, increased immigration, and industrialization had on Canadians at the beginning of the twentieth century, with specific references to Ontario. Technological innovations of this time period were also discussed at length in various sections, including the integration of the railway system and how it transformed communication, trade, and travel.

Cuban, Larry. *Teachers and Machines: The Classroom Use of Technology Since 1920*. Teacher's College Press, 1986.

This book was an excellent resource for the purposes of this paper as it is first and foremost a history of technology since the 1920s. Within, Larry Cuban discusses the emergence, acceptance, and usefulness of a variety of classroom technologies. In addition, he emphasizes how an increased integration of technology into the classroom was not observed until the 1920s, following a boom in the popularity of visual media such as Hollywood films. Cuban also enters into an enlightening discussion about the different types of technologies which were available during this time period, and whether or not they were actually implemented within schools and classrooms based on factors such as funding, location, and teacher preference. Overall, this book provided a great survey of the evolution of the relationship between teaching and technology.

Dunn, Jeff. "The Evolution of Classroom Technology." Edudemic - Education Technology, Apps, Product Reviews, and Social Media. Accessed October 30th, 2012.
<http://edudemic.com/2011/04/classroom-technology/>.

This online resource provides a quick survey of the evolution of classroom assistive technologies from the early twentieth century to the present. The value of this source is increased by the numerous pictures utilized to illustrate this evolution. It has many visuals and a YouTube link as well which will be used for the media component of the paper.

Earle, Rodney. "The Integration of Instructional Technology into Public Education: Promises and Challenges," *Educational Technology* 42 (2002): 5-13.

Rodney Earle's article is insightful in the sense that it provides examples of early twentieth century technologies and why certain ones were integrated into public education spheres. For example, he discusses the popularity of the stereoscope and magic lantern in schools, and how they were used to make visual connections which would hopefully enrich student learning. He also mentions that instruments like this were at times controversial, bringing to light, as other historians have, the ever-transforming relationship between technology and teaching.

Finn, James D., and Ronald J. McBeath. *Extending Education Through Technology: Selected Writings by James D. Finn on Instructional Technology*. Connecticut: Information Age Publishing Inc., 2004.

This book is a compilation of James D. Finn's work and includes a discussion of the shifts in technology in the classroom in the 1950s. It gives a historical context of what was going on in education and in the United States which directly relates to Canada, given both countries involvement in the wars. Furthermore, it discusses the use of educational television and the Skinner teaching machine in schools. This will be helpful in multiple sections of this paper.

"Indices to Canadian Censuses," *Automated Genealogy*, Accessed November 1, 2012, <<http://automatedgenealogy.com/census/>>.

This web resource provides researchers with quick access to information from Canadian census conducted in the first half of the twentieth century. The limitation of this resource is that it does not offer access to the full primary documents associated with the information presented.

Nevertheless it is accessible and relevant with regards to literacy rates in the early 1900s.

Levin, Robert A. and Laurie Moses Hines. "Educational Television, Fred Rogers, and the History of Education." *History of Education Quarterly* 43, 2 (2003): 262-275. Accessed November 7th, 2012. <http://www.jstor.org/stable/3218313>.

This journal article discusses the growing use educational television and its effectiveness in the classroom. Having this background will be useful in giving the context of the rise of this technology and will help structure the argument.

Ontario Department of Education. *Report of the Minister 1950*, Dana Porter. Toronto: Order of the Legislative Assembly of Ontario, 1952. (Session Paper No. 11).

Ontario Department of Education. *Report of the Minister 1960*, John P. Robarts. Toronto: Order of the Legislative Assembly of Ontario, 1961. (Session Paper No. 7).

The reports of the Minister of Education serve as primary sources which give context of what was going on in Ontario education during the periods being researched and show what initiatives were beginning or were in progress. These documents are significant in providing social, cultural, and intellectual context as well as the data-driven context of education during that time. They include discussions of specific trends, opinions, procedures, programs, and changes in education in Ontario. The information was especially useful in outlining the importance of technological programs and the types of equipment used to assist student learning during these time periods.

“Oxford Township,” *The One-Room School House*, Accessed October 15, 2012, <<http://www.oneroomschoolhouses.ca/oxford-township.html>>.

A website devoted to the cataloguing of one room school houses in the counties of southern Ontario. Where available, images and descriptions of school houses are included for counties in what was originally Upper Canada.

Penner, Norman. *From Protest to Power: Social Democracy in Canada 1900-Present*. James Lorimer & Company Limited, 1992.

Norman Penner’s monograph is particularly enlightening because it helps readers to gain a better understanding of the social and political atmosphere of Canada throughout the twentieth century and how it has evolved. While this resource was not particularly useful in terms of technology in the classroom, it revealed what could be argued as the political motivations behind certain educational movements such as an increased focus on technological education. Due to an increase in industrialization, technologically-educated individuals would become useful for the economy.

Plunkett, John. “Moving Books/Moving Images: Optical Recreations and Children’s Publishing 1800-1900,” *Verbal and Visual Interactions in Nineteenth Century Print Culture* No. 5 (2007): 1-27.

This article explores the relationship between the popularity of moving images, and the types of children's books created by publishers of the nineteenth and early twentieth century. Overall, the take home message from this article is that visual media was becoming more popular during this time period. Even in the nineteenth century many people were starting to recognize the value of adding a visual element to learning as a means of supplementing teacher talk. One of the main ways this was achieved was through the sale of stereoscopes and magic lanterns, devices which would eventually be incorporated into the classroom due to their novel and educational qualities. Saettler, Paul. *A History of Instructional Technology*. McGraw-Hill, 1967.

This source provided a good survey of the history of instructional technology. Despite being very general, it was useful in identifying different types of classroom technologies, and changes which have occurred over time.

Schuessler, Karl, and Mary Schuessler. *School on wheels: reaching and teaching the isolated children of the North*. Ontario: Boston Mills Press, 1986.

This book illustrates stories of children and families who were using the train as an educational setting since they did not have means of going to school in their remote areas. These stories serve as an example of how educators were continuously working to reach all students and to enhance student learning.

"Skinner and Teaching Machine." April 2, 2007. Video clip. Accessed October 20, 2012. YouTube. [www.Youtube.com, http://www.youtube.com/watch?v=EXR9Ft8rzhk](http://www.youtube.com/watch?v=EXR9Ft8rzhk).

This YouTube video involves behavioural psychologist B.F. Skinner explaining how his teaching machine works and how it enhances student learning. This is a great resource to explain the teaching machine and its effectiveness as it is the creator himself describing his apparatus.

Skinner, B.F. "Teaching Machines." *Science* 128, 3330 (1958): 969-977. Accessed November 5th. DOI:[10.1126/science.128.3330.969](https://doi.org/10.1126/science.128.3330.969).

B.F. Skinner explains his technology as well as other technologies which could be classified under the same umbrella and it argues the effectiveness of those technologies in the classroom. This source was helpful in explaining how Skinner's teaching machine enhanced student learning.

Wilson, Charles, Marvin Orellana, and Miki Meek. "The Evolution of Classroom Technology – Interactive Feature - NYTimes.com." *The New York Times - Breaking News, World News & Multimedia*. Last modified September 15th, 2010. Accessed November 7th, 2012. <http://www.nytimes.com/interactive/2010/09/19/magazine/classroom-technology.html>.

This website was a source referenced in Jeff Dunn's "The Evolution of Classroom Technology" and serves as a timeline of technology introduced into the classroom from 1600 to today. This source was helpful in tracking when other classroom technologies were established.