Patterns of the Use of Technology in Transition from High School to University Mathematics

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**Introduction**

The purpose of this paper is to look at the differences in technology use in mathematics instruction between secondary school and university, in order to better understand problems students face in the transition to university. I will look at the use and prevalence of technology at the secondary level and compare it to the use and prevalence at the tertiary level. My analysis will include educators’ perspectives (both secondary school teachers and university professors), and I will investigate the differences in educator’s technique, implementation and opinion on the effectiveness of the use of technology. I will also include students’ perspectives (both secondary school students and university students) and will contrast their opinions on the use and effectiveness of technology in the mathematics classroom.

Technology is becoming an important part of our society. With over 78% of teenagers owning a cell phone, 95% using the internet, and 93% having a computer or access to one, the way in which we are able to engage students to learn is, and must be changing (Madden, Lenhart, Duggan, Cortesi, Gasser, 2013). Students are reported to spend over 10 hours a day using technology, whether it is their cell phone, computer or iPod (HMH Fuse Algebra I, 2011). Teachers and professors need to respond to the increased use of technology by using it in the classroom.

Education needs to be part of this technological evolution. The U.S. Department of Education suggests that the inclusion of technology in schools must have a purpose, a plan of what technology will be integrated, and how that technology will be utilized in the classroom (HMH Fuse Algebra I, 2011). Technology is used in the mathematics classroom for computations and representation and researchers have found that the technology can support learning when integrated effectively (SRI International, 2007). This paper will look at the degree to which technology is used in both secondary school and university.

Technology allows students and teachers to focus on what is really important: how to solve problems and think logically—namely, the mathematical concepts. For example, instead of a student spending five minutes to copy out a question to be answered, they are able to use that time to work on and solve the problem. Another
example, more applicable to higher-level math, as Bergqvist states: "In the past, students studied advanced mathematics (calculus) to learn how to draw graphs. Now, computer-generated graphs can be used to study important mathematical concepts" (Bergqvist, Homquist & Lingefjard, n.d.). Teachers must set a framework for themselves, which will help them to think about proper ways of technology integration in the classroom, in order to have successful integration. Technology can be looked at as a “cultural artifact” in that the use of technology is dependent on the teacher’s past experiences, and social settings (Srisurichan, 2012). This paper will look at the educator’s teaching background and experience used for instruction to see if there is a correlation with their use of technology.

In the context of this paper, technology will be defined as any piece of equipment used for teaching that includes an electronic hardware component. This includes: laptops, Internet, SMART boards, projectors, programming software, and more. There are many research papers on the effectiveness of technology in education (though many of them conclude that it is not possible to test effectiveness); however there are not many references on the prevalence and the comparison between secondary and tertiary level mathematics.

To conclude, Thomas et al. wrote, “high school teachers and university lecturers seem to be using the same technology, although there is a perception among teachers that technology is used more at the tertiary level than in secondary. It appears that technology use at both levels is somewhat ad hoc, lacking clear coordination and direction”. We know that technology is used in both secondary school and in university. The aim of this report will be to find the degree to which it is used, and how, at both levels.


**Literature Review**

Since I am looking at the use of technology in transition years from high school to university, my literature review will consist of the research on the use of technology at the high school level and the research on the use of technology for math education at the university level. In addition, since technology is constantly changing and evolving, I have used sources available from only the last ten years because these look at specific technologies used presently in the classroom.

**Technology Use in High School Mathematics Education**

Over the past decade, the use of technology in math education has become increasingly popular in elementary and secondary schools (Li & Ma, 2008). Most schools have access to computers and Internet, and have invested in educational technology such as interactive whiteboards (Cheung & Slavin, 2013). There has also been an increase in educational games (Cheung & Slavin, 2013). The National Council of Teachers of Mathematics stated that “technology is essential in teaching and learning mathematics; it influences the mathematics that is taught and enhances student learning” (Li & Ma, 2008).

The types of technologies that are being used in secondary schools include: computer programs developed for the curriculum such as Geometer's SketchPad, Maple, Mathematica, Excel spreadsheets, internet, Maple, and virtual manipulatives (Li & Ma, 2008). The main uses of computers in high school mathematics education are for investigations, demonstrations, and skill building (Thomas et al., 2007). Five other uses for math technology at the secondary school level include: independent learning, group learning, instructional management, communication, and administration (Niess, 2005).

Goos discusses four interesting metaphors that describe technology's role in teaching and learning. Technology is a ‘master’ if the teacher and students have little knowledge about its use. Technology is a ‘servant’ if it is used by teachers and students as a replacement of by-hand calculations. Technology is a ‘partner’ when it allows the user to have new ways of approaching tasks and develop the user’s
understanding. Technology is an ‘extension of self’ when it is fully integrated into the math classroom (Goos et al., 2003).

To date, there is no agreement on how to effectively integrate the technology to be a meaningful medium in the math classroom (Srisurichan, 2012). Research suggests that in order for the integration of technology in the math classroom to be successful, technology should be used to:

1) Provide multiple representations of concepts and the relationships between them;

2) Facilitate mathematics development through intuitive reflective thinking and learning;

3) Provide opportunities for social collaboration and constructive learning;

4) Use the knowledge from technology and apply it to mathematical concepts;

5) Link the acquired concepts to real-world situations (Srisurichan, 2012).

In order for teachers to be successful in the integration of technology in the classroom, they must first set a proper definition for themselves about how they think technology integration in the classroom should be used. Technology can be looked at as a “cultural artifact” in that the use of technology is dependent on the teacher’s past experiences, and social settings (Srisurichan, 2012).

There have been many studies completed at the elementary and secondary level that have tested the effectiveness of technology in the classroom, and that hint at the fact that it is very present at these levels. In general, it was found that technology has a positive (but modest) effect on achievement in mathematics at the secondary level (Cheung & Slavin, 2013).

Technology Use in University Mathematics Education

According to Zsolt Lavicza at the University of Cambridge, technology is becoming more frequent in university math lectures (Lavicza, 2008). He states that there are only several studies that have examined the use of technology. The past two decades have resulted in drastic changes that have an effect on how math is taught at the university level (Lavicza, 2008). For years people have always been
looking for some sort of way to make time-consuming work easier (Bergqvist, Homquist & Lingefjard, n.d.). Using technology for mathematics at the university level was seen as a way to revitalize teaching and to help students understand concepts in different ways (Lavicza, 2008). The use of technology leads to different demands of the students. It is not the availability of technology that is the issue today; it is the opinions of the user (Bergqvist, Homquist & Lingefjard, n.d.).

The reasons computers are used in university math courses include: pedagogical, looking for information, and gaining computer knowledge. Reasons computers are not used in university math courses are: lack of resources, ineffectiveness, or tradition (Bergqvist, Homquist & Lingefjard, n.d.).

Lavicza states there is still little known about the use of technology and the practices with technological use at the university level, so he conducted a study to find what the uses are. According to Lavicza’s study, 55% of university math instructors use technology for teaching on an occasional basis (Lavicza, 2008). This use is about 40% higher than the use of technology in schools. It is indicated that mathematicians view technology positively in their math curriculum.

In the past two decades, researchers have entirely shifted their focus from technology use in math at the university level to the secondary level (Lavicza, 2008). This is clearly evident from the number of studies completed to test the effectiveness of technology at the secondary school level. If technology is not integrated into the teaching, students might only use it for simple calculations which has a negative impact on their learning (Bergqvist, Homquist & Lingefjard, n.d.). In a study that compared a control group to a group that had access to computer programs that enhanced the concepts of functions, the test group had significantly higher results on conceptual understanding and program solving tasks (Bergqvist, Homquist & Lingefjard, n.d.).
Methodology

Organization

The main mode of research for this thesis was based on surveys (see appendix for surveys). Four surveys created with similar questions, with different wording depending on school level and whether it was an instructor survey or student survey. The surveys were created to examine students’ and instructors’ attitudes and beliefs on the use of technology in math education. It was used to find potential differences in the secondary and tertiary mathematics levels that could possibly relate to reasons for difficulties in transition.

Participants

The surveys were given to high school math students, university math students, high school math teachers, and university math professors. There were 148 participants in total. There were 69 high school students from St. Mary's Catholic Secondary School (Hamilton, ON) from Grade 9, 10, and 12, 60 students from Dr. Lovric’s first year Math 1X03 class at McMaster University, 8 high school math teachers from the Hamilton-Wentworth Catholic District School Board, and 11 math professors from McMaster University who completed the survey.

The Survey

The survey was divided into five different sections to evaluate the use of technology in the different areas in the classroom. The first looks at the use of technology to present lectures. This could mean the presentation of lectures on a SMART board, PowerPoint, or any other modes of presentation technology. The second section looks at the use of technology for showing examples, illustrations, or graphs that would otherwise be difficult to be represented by hand. The technologies in this category include programs like: Geometer’s SketchPad, Programming Software such as Matlab, or Maple or even demonstrations that could be completed using the SMART board. The third part of the survey looks at the use of technology in lectures and how that has an effect on student engagement. The
fourth section of the survey looks at technology use for assessment of homework and assignments. This could include: online assignments, programming assignments, or other. The fifth section of the survey looks at student and instructor opinions on the use of technology and understanding. It questions if the participants believe that technology is essential for teaching mathematics.

Questions on the Survey by Section Discussed

Question 1-4: Presentation of Lectures

1-How often are your math lessons presented using technology? (student survey)
1-Do you use technology for presenting your lectures? (instructor survey)

This question assesses how often technology is used to present material to the students. This mainly consists of content—how is the information being delivered to the students? This question was included to see possible changes that could be made at either level.

4- I believe I get more out of the lesson when technology is used. (student survey)
4- I believe that students get more out of my lecture when technology is used. (instructor survey)

This question looks at the outcome of the use of technology for the presentation of lectures. Is the student learning more?

Questions 5-7: Showing examples, illustrations, graphs, simulations

5- Do you use technology (such as programming, PowerPoint, Maple, internet) during the lecture to show examples (ie. demonstrate ideas that would be difficult with a blackboard)? (instructor survey)

5- Does your teacher use technology (such as programming, PowerPoint, Maple internet) during the lesson to illustrate concepts, run simulations, graph, etc.? (student survey)

7- I believe that using technology to complement lectures helps the students to better understand the content and concepts presented. (instructor survey)
7- I believe that using technology to show examples, illustrates concepts, etc. helps me better understand the content and concepts presented. (student survey)

This section was included in the case that the instructor presented the lesson without the use of technology, however wanted to show examples to the class using technology. The section looks at the use of graphs and simulations to better students’ understanding of material.

Question 8-9: Engagement
8- How engaged do you feel during a lesson taught with technology? (student survey)

I included this question for students to assess whether or not technology makes them feel more engaged in the lesson or less.

8- How engaged are your students during your typical lectures? (instructor survey)

I included this question for the professors for them to reflect on the differences on their students’ engagement level without technology before they reflect on their engagement with technology.

9- By using technology I participate more in class and feel like I am learning more. (student survey)

9- By using technology, my students participate more in class and I feel that they are learning more. (instructor survey)

This question, almost identical for students and professors, looks at the amount of learning and participation taking place in a class with technology.

Question 10-12: Assessment
10- Does your teacher use technology for assessment? (student survey)

10- Do you use technology to assess students? (instructor survey)

12- I believe that using technology for assessment helps me better understand the material being presented. (student survey)

12- By using technology, my students participate more in class and I feel that they are learning more. (instructor survey)

This section was included to see if technology is being used in the assessment of students. Technology could include: online website such as: Edmodo, FirstClass,
WileyPlus, or assignments using programming software such as Matlab, Maple, or R. This section was included to see the differences in the use of technology for assessment in high school and university and also the differences in the types of software and technology used.

**Question 13-18: Technology and Understanding**

13- I have a better understanding of the material when technology is used in some degree in the classroom. (student survey)

13- Students have a better understanding of the material when there is some form of technology used in the classroom. (instructor survey)

This question I believe to be the most important of the survey. It deals with a student’s direct understanding of the material and it’s relation to technology. It determines if technology does in fact have an impact on the student’s ability to learn and understand material.

14- I believe that the use of technology is essential for learning (teaching for the teachers’ survey) mathematics at the secondary school level. (for secondary school students and teachers)

14- I believe that the use of technology is essential for learning/teaching (for the professors) mathematics at the university level. (for university students and professors).

This question was included because it can be compared and analyzed in several different ways. It can be used to see the disparity in thought between university students and professors, to see if one prefers technology more than the other. In addition, it can be looked at for differences between high school teachers and university professors. For example, if one group of instructors prefers it over the other there will be obvious difficulties in transition. It also can look at a comparison between high school students and professors.

15- How long have you been teaching? (instructor survey)

16- What type of learner are you? (student and instructor surveys)

These questions for the instructors were included to see if there is any correlation between years teaching and the use of technology. Also to see if there is
a correlation between the type of learner the teacher is and whether or not they use technology in their classes.

The learner type question was included in the student survey to see if there was a relationship between the type of learner the student is and if they preferred technology or not.
Analysis

According to Lavicza, the use of technology in university math classes is about 40% higher than in secondary schools (Lavicza, 2008). Also, Thomas et al. believe that there is the perception that technology is used more at the tertiary level (Thomas et al., 2007). According to the data collected in the surveys, the reverse is seen. From the surveys collected, we can see that nearly 90% of secondary school math teachers use technology to present their lessons, either always or very often (see Figure 1). In comparison, less than 20% of university math professors use technology always or very often (see Figure 1).

![Q1: Do you use technology for presenting your lessons?](image)

**Figure 1**

Nearly 90% of the teachers positively agree (either strongly agreed or agreed) that their students get more out of a lesson when technology was present and used (see Figure 2). This correlates directly with their answer to the first question. About 40% of university professors agreed or strongly agreed (see Figure 2). We see a bit of disparity here, because less than 20% of university professors said they used technology for their lessons, yet nearly 40% said their students got more out of the lesson when technology was used. This might mean that professors would like to use technology but something is holding them back.
A comment on the surveys can be seen as a reason why it might be so:

“1. Flexibility- easy to modify on blackboard lecture plan; almost impossible with technology.
2. Easier and more transparent to draw and annotate blackboard lectures than making graphics using software.
3. Math notation easier by hand than on computer.”

We also see two very contrasting opinions with regards to the use of technology during lectures. A high school teacher writes:

“Technology gives the flexibility to explore several models in mere seconds with the click of a mouse.”

A university professor writes:

“Where chalkboard technology is superior to new technology: a chalkboard (with up/down sliding panels) can display the equivalent of four computer screens at once and the info stays in view for longer.”

The professor might believe that the chalkboard is better because there might be long calculations that need to be completed. Also, the professor might need to refer back to work that was done previously in the class. All of this can be done easily on the SMART board. This further indicates that beliefs are essential for motivations.
and drive action. If one believes that they cannot get the same uses (and more) out of the SMART board than the chalkboard they will keep using the chalkboard.

The survey asked for the use of technology in three different contexts in the classroom to determine if any differences between high school and university exist. From the surveys, we can also see that high school teachers use technology more often than university professors for presenting examples. 50% of teachers use technology to show examples to their classes all the time or very often (see Figure 3). This compares to less than 10% of professors that show examples in their class through technology all the time or very often (see Figure 3).

![Q5: Do you use technology during the lesson to show examples (ie. demonstrate ideas that would be difficult with a blackboard)?](image)

**Figure 3**

When asked if students understand the material better when technology is used to complement the lesson (i.e. to demonstrate ideas that would be difficult with the use of a blackboard), 100% of high school teachers positively agreed (see Figure 4). Nearly 55% of university professors also agreed with this statement (see Figure 4). We observe yet another disparity: less than 10% of professors use technology often for examples, however 55% say it would help their students to understand the content and concepts presented. If they did believe that technology could help complement their lessons, one would think they would use technology more. From the previous reply, the professors might believe that it takes a shorter amount of
time to draw a diagram on the board than it does to create and prepare it on software for the class. While this might be so in some cases, once the professor creates the diagram or graph on the software they can use it year after year.

**Figure 4**

The third question on the survey that dealt with using technology related to assignments and/or assessments.

**Figure 5**
Here we see a relatively small change: 25% of teachers use technology very often for assessment, and 37.5% use it sometimes, whereas a little more than 25% of professors use technology for assessment very often, and a little over 45% use it sometimes (see Figure 5). These results reflect the fact that many first year university classes have online assignments, for example, Wiley Plus or locally maintained systems. In addition, there is more programming in software such as Matlab, R, and Maple that is used in assignments in university.

50% of high school teachers agreed that when technology is used for assessment, it enables their students to better understand the course material (see Figure 6). This compares to about 27% of university professors who positively agreed with this statement (see Figure 6).

**Q12: I believe that using technology for assessment helps my students better understand the material being presented.**

![Bar Chart](image)

**Figure 6**

This time, we see a difference in the way the high school teachers replied. 50% of high school teachers agree that their students understand better when technology is used for assessment, yet 25% use it often. The results for the university professors match: 27% use technology often and 27% think it helps their students better understand the material.
All of these facts point to a conclusion that in terms of the use of technology there is a greater use in secondary schools for presentation and demonstration and a slightly greater use in universities for assessment.

Nearly 70% of high school students feel that they are very engaged or engaged during a lesson taught with technology (see Figure 7). This compares to about 30% of university students who feel engaged during a lesson taught with technology (see Figure 7). This difference might be due to the type of technology used, also might be due to how the technology is used. For example, in high school GSP sketches are often used and they are very interactive, keeping the students engaged. It seems that, in a university classroom, the technology does not engage students to the same level.

![Figure 7](image)

**Q8: How engaged do you feel during a lesson taught with technology?**

When asked if they felt like their students were participating and learning more in class, 100% of the high school teachers positively agreed (strongly agreed or agreed) with this statement and about 27% of university professors agreed with this statement (see Figure 8a). This difference is quite shocking. High school teachers really do have a strong belief that technology is benefiting their students in the classroom. If they believe it is helping their students, they will keep using it.
When the students were asked, over 60% of high school students and about 18% of university students agreed that they participate more and have a better understanding of the material when technology is used (see Figure 8b).
Over 80% of high school teachers believe that students have a better understanding of the material when technology is used in some form in the classroom. This compares to 40% of professors (see Figure 9a).

**Figure 9a**

When compared to the student surveys, we observe similar results. Over 70% of high school students replied that they have a better understanding of technology when it is used in the classroom, compared to 40% of university students (see Figure 9b). It appears that university students are more neutral than university professors on the technology use. Over 50% of university students stated neutral on this statement and less than 10% of university students “disagree”. This compares to 30% of university professors who “disagree” with this statement. This could, in fact, lead to transition issues since more than 70% of high school students rely on technology and believe that it enables them to better understand the material and only 40% of professors agree that students have a better understanding of technology when it is used in the classroom.
When asked if the instructors believe that technology is essential for teaching mathematics at their specific level we see a similar pattern to the rest of the questions. Nearly 90% of high school teachers believe it is essential, whereas only 25% of university professors have a similar view, with 50% disagreeing entirely with the statement (see Figure 10a).
Once again, we see nearly 70% of secondary school students agreeing that technology is essential for learning mathematics at the high school level (see Figure 10b). In this case, we see a bit of a change in the way the university students answered. 50% of university students responded that technology is essential for learning university level mathematics.

**Figure 10b**

Although this is less than what the secondary school students replied, it is higher nevertheless than what had been answered for the previous questions. I believe this could potentially be explained through a comment from a university student:

“It’s not only important that technology is used, but that it is used WELL.”

Back to Question 13, we see that students might not like technology because it is not used appropriately or to their liking. In Question 14, the students show a strong belief that technology is important at the university level. Comparing the numbers, the survey shows that this is twice the percentage of what the professors answered to this question. It would appear that the students are more willing to accept the fact that “technology is becoming essential in mathematics” as stated by The National Council of Teachers of Mathematics in my Literature Review (Li & Ma, 2008).
Conclusion

Summary

In summary, it was found that more high school teachers are using technology for presenting lessons and showing examples in their classroom than university professors and university professors use technology more often than high school teachers for assessment. High school teachers believe that their students get more out of their lesson when technology is used. Also, high school teachers believe more so than university professors that their students understand the material better when technology is incorporated into the lesson. In addition, more high school students than university students believe the same is true. High school teachers and high school students believe technology is essential for teaching and learning mathematics at the secondary school level. Nearly double the amount of university students compared to university professors believe that technology is essential for learning at the university level.

Improving Survey Instrument

There are two main parts of my survey that I would have done differently to get more concise answers. For survey question number 14, “I believe technology is essential for teaching mathematics at the (secondary/university) level” I should not have specified the level. Since I did specify the level, it becomes more difficult to make a comparison, but I made one, nonetheless. Another survey question I should have worded differently is question number 8 on the high school teachers and university professors’ survey. This question asked the instructor to gauge the level of engagement of their “typical” lesson. This typical lesson may or may not include technology, and therefore it is hard to compare with question number 9: “By using technology my students participate more in class and I feel that they are learning more”. I should have asked the same question that was used on the student survey: “How engaged are your students during a lesson with technology?” and then continued with the original question number 9. Questions that I found that were not useful for my purposes were: number of years of teaching (instructor survey),
school grade (student survey), and learner type. I found that there was no correlation with these questions to technology. The latter- lack of correlation between learning style and technology use- is a bit intriguing and could be further investigated.

Next Steps

The next steps that I would take in my research would be to determine, specifically how to effectively integrate technology in the university classroom. From my research, it appears that there is some technology used, but its effectiveness is unknown. A suggestion would be to look at the process of the course content delivery in high schools and the ways it integrates technology and proceed from there. High schools use technology for class notes. These typed handouts are distributed or posted online; they have blanks for calculations, or problem solving type questions. The teacher then uses a SMART board to write out and discuss a solution to the problem.

Another possibility of further action would be to have theoretical and historical viewpoints on the use of technology. I would take a look at the technologies used in the past and their advantages and disadvantages. I could then look at historical issues of transition and determine if there are any in relationships to technology. As well, a comparison could be undertaken to determine which methods worked historically, and which did not.
References


Appendix

Changing Technology Through Transition: Teacher Survey

The purpose of this survey is to determine the prevalence of the use of technology at the university and secondary school level, and to obtain students’ and instructors’ opinions on its effectiveness. I will use this data for research purposes, for instance to compare the survey answers of secondary school teachers and university instructors, as well as, secondary school and university students.

For this survey, technology is defined as any piece of equipment used for teaching that includes an electronic hardware component. Examples include: computers, laptops, tablets, Internet, SMART boards, and software (such as MATLAB, Geometer’s Sketchpad, or R).

Your participation and cooperation in filling out this survey is greatly appreciated. The survey is not long; it will take less than 10 minutes to complete.

Presentation of Lessons

1. Do you use technology for presenting your lessons? (choose one)
   □ Always     □ Very Often  □ Sometimes □ Rarely      □ Never

2. What technology do you use? (choose all that apply)
   □ PowerPoint Presentation  
   □ SMART Board Technology (Interactive White Board)  
   □ Other, please specify ____________________________

3. If you do not use technology, how do you present your lessons? (choose all that apply)
   □ Chalkboard  
   □ Overhead projector  
   □ Other, please specify ____________________________

4. I believe that students get more out of my lesson when technology is used.
   □ Strongly Agree    □ Agree     □ Neutral     □ Disagree     □ Strongly Disagree

Showing examples, illustrations, graphs, simulations

5. Do you use technology (such as programming, PowerPoint, Maple, internet) during the lesson to show examples (ie. demonstrate ideas that would be difficult with a blackboard)? (choose one)
6. If yes, what type of technology? (choose all that apply)
   □ Software, please specify program ____________________
   □ Internet
   □ Geometer’s SketchPad (GSP)
   □ Visual demonstrations and diagrams on SMART board
   □ Other, please specify ________________________________

7. I believe that using technology to complement lessons helps the students to better understand the content and concepts presented. (choose one)
   □ Strongly Agree    □ Agree    □ Neutral    □ Disagree    □ Strongly Disagree

Engagement

8. How engaged are your students during your typical lesson? (choose one)
   □ Very Engaged    □ Engaged    □ Neutral    □ Disengaged    □ Very Disengaged

9. By using technology, my students participate more in class and I feel that they are learning more. (choose one)
   □ Strongly Agree    □ Agree    □ Neutral    □ Disagree    □ Strongly Disagree

Assessment

10. Do you use technology to assess students? (choose one)
    □ Always    □ Very Often    □ Sometimes    □ Rarely    □ Never

11. If yes, what type of technology? (choose all that apply)
    □ Online Assignments (such as WileyPlus)
    □ Edmodo
    □ Bistrips for Schools
    □ Software (such as MATLAB, R, etc.)
    □ Other, please specify ________________________________

12. I believe that using technology for assessment helps my students better understand the material being presented. (choose one)
    □ Strongly Agree    □ Agree    □ Neutral    □ Disagree    □ Strongly Disagree
**Technology and Understanding**

13. Students have a better understanding of the material when there is some form of technology used in the classroom.
   □ Strongly Agree  □ Agree  □ Neutral  □ Disagree  □ Strongly Disagree

14. I believe that the use of technology is essential for teaching mathematics at the secondary school level.
   □ Strongly Agree  □ Agree  □ Neutral  □ Disagree  □ Strongly Disagree

15. How long have you been teaching?
   □ 0-9 years  □ 10-19 years  □ 20-29 years  □ 30+ years

16. What type of learner are you?
   □ Auditory  □ Visual  □ Tactile

17. If you do not use technology any aspect of your classroom lessons, please state your reason why:
   ____________________________________________________________
   ____________________________________________________________
   ____________________________________________________________

18. Please add any additional comments and/or suggestions related to technology:
   ____________________________________________________________
   ____________________________________________________________
   ____________________________________________________________
**Changing Technology Through Transition: Professor Survey**

The purpose of this survey is to determine the prevalence of the use of technology at the university and secondary school level, and to obtain students’ and instructors’ opinions on its effectiveness. I will use this data for research purposes, for instance to compare the survey answers of secondary school teachers and university instructors, as well as, secondary school and university students.

For this survey, technology is defined as any piece of equipment used for teaching that includes an electronic hardware component. Examples include: computers, laptops, tablets, Internet, SMART boards, and software (such as MATLAB, Geometer’s Sketchpad, or R).

Your participation and cooperation in filling out this survey is greatly appreciated. The survey is not long; it will take less than 10 minutes to complete.

**Presentation of Lectures**

1. Do you use technology for presenting your lectures? (choose one)
   - □ Always  □ Very Often  □ Sometimes  □ Rarely  □ Never

2. What technology do you use? (choose all that apply)
   - □ PowerPoint Presentation
   - □ SMART Board Technology (Interactive White Board)
   - □ Other, please specify __________________________

3. If you do not use technology, how do you present your lectures? (choose all that apply)
   - □ Chalkboard
   - □ Overhead projector
   - □ Other, please specify __________________________

4. I believe that students get more out of my lecture when technology is used
   - □ Strongly Agree  □ Agree  □ Neutral  □ Disagree  □ Strongly Disagree

**Showing examples, illustrations, graphs, simulations**

5. Do you use technology (such as programming, PowerPoint, Maple, internet) during the lecture to show examples (ie. demonstrate ideas that would be difficult with a blackboard)? (choose one)
   - □ Always  □ Very Often  □ Sometimes  □ Rarely  □ Never

6. If yes, what type of technology? (choose all that apply)
□ Software, please specify program ______________________
□ Internet
□ Geometer’s SketchPad (GSP)
□ Visual demonstrations and diagrams on SMART board
□ Other, please specify ________________________________

7. I believe that using technology to complement lectures helps the students to better understand the content and concepts presented. (choose one)
□ Strongly Agree    □ Agree    □ Neutral    □ Disagree    □ Strongly Disagree

Engagement

8. How engaged are your students during your typical lectures? (choose one)
□ Very Engaged    □ Engaged    □ Neutral    □ Disengaged    □ Very Disengaged

9. By using technology, my students participate more in class and I feel that they are learning more. (choose one)
□ Strongly Agree    □ Agree    □ Neutral    □ Disagree    □ Strongly Disagree

Assessment

10. Do you use technology to assess students? (choose one)
□ Always    □ Very Often    □ Sometimes    □ Rarely    □ Never

11. If yes, what type of technology? (choose all that apply)
    □ Online Assignments (such as WileyPlus)
    □ Software (such as MATLAB, R, etc.)
    □ Other, please specify _______________________________

12. I believe that using technology for assessment helps my students better understand the material being presented. (choose one)
□ Strongly Agree    □ Agree    □ Neutral    □ Disagree    □ Strongly Disagree
Technology and Understanding

13. Students have a better understanding of the material when there is some form of technology used in the classroom.
☐ Strongly Agree  ☐ Agree  ☐ Neutral  ☐ Disagree  ☐ Strongly Disagree

14. I believe that the use of technology is essential for teaching mathematics at the university level.
☐ Strongly Agree  ☐ Agree  ☐ Neutral  ☐ Disagree  ☐ Strongly Disagree

15. How long have you been teaching?
☐ 0-9 years  ☐ 10-19 years  ☐ 20-29 years  ☐ 30+ years

16. What type of learner are you?
☐ Auditory  ☐ Visual  ☐ Tactile

17. If you do not use technology any aspect of your classroom lectures, please state your reason why:
_________________________________________________________________________________________________
_________________________________________________________________________________________________
_________________________________________________________________________________________________

18. Please add any additional comments and/or suggestions related to technology:
_________________________________________________________________________________________________
_________________________________________________________________________________________________
_________________________________________________________________________________________________
Changing Technology Through Transition:
Secondary School Student Survey

The purpose of this survey is to determine the prevalence of the use of technology at the university and secondary school level, and to obtain students’ and instructors’ opinions on its effectiveness. I will use this data for research purposes, for instance to compare the survey answers of secondary school teachers and university instructors, as well as, secondary school and university students.

For this survey, technology is defined as any piece of equipment used for teaching that includes an electronic hardware component. Examples include: computers, laptops, tablets, Internet, SMART boards, and software (such as MATLAB, Geometer’s Sketchpad, or R).

Your participation and cooperation in filling out this survey is greatly appreciated. The survey is not long; it will take less than 10 minutes to complete.

Presentation of Lessons

1. How often are your math lessons presented using technology? (choose one)
   - □ Always
   - □ Very Often
   - □ Sometimes
   - □ Rarely
   - □ Never

2. What type of technology? (choose all that apply)
   - □ PowerPoint Presentation
   - □ SMART Board Technology (Interactive White Board)
   - □ Other, please specify ___________________________

3. I believe I get more out of the lesson when technology is used. (choose one)
   - □ Strongly Agree
   - □ Agree
   - □ Neutral
   - □ Disagree
   - □ Strongly Disagree

4. If technological resources are not used, how does your teacher present your lessons? (choose all that apply)
   - □ Chalkboard
   - □ Overhead projector
   - □ Other, please specify ___________________________

Showing examples, illustrations, graphs, simulations

5. Does your teacher use technology (such as programming, PowerPoint, Maple internet) during the lesson to illustrate concepts, run simulations, graph, etc.? (choose one)
   - □ Always
   - □ Very Often
   - □ Sometimes
   - □ Rarely
   - □ Never
6. If yes, what type of technology? (choose all that apply)
   □ Software, please specify program ______________________
   □ Internet
   □ Visual demonstrations and diagrams on SMART board
   □ Other, please specify _________________________________

7. I believe that using technology to show examples, illustrates concepts, etc. helps me better understand the content and concepts presented. (choose one)
   □ Strongly Agree   □ Agree   □ Neutral   □ Disagree   □ Strongly Disagree

**Engagement**

8. How engaged do you feel during a lesson taught with technology? (choose one)
   □ Very Engaged   □ Engaged   □ Neutral   □ Disengaged   □ Very Disengaged

9. By using technology I participate more in class and feel like I am learning more. (choose one)
   □ Strongly Agree   □ Agree   □ Neutral   □ Disagree   □ Strongly Disagree

**Assessment**

10. Does your teacher use technology for assessment? (choose one)
    □ Always   □ Very Often   □ Sometimes   □ Rarely   □ Never

11. If yes, what type of technology? (choose all that apply)
    □ Edmodo
    □ Bitstrips for Schools
    □ Software, please specify program______________________________
    □ Other, please specify________________________________________

12. I believe that using technology for assessment helps me better understand the material being presented. (choose one)
    □ Strongly Agree   □ Agree   □ Neutral   □ Disagree   □ Strongly Disagree
13. I have a better understanding of the material when technology is used in some degree in the classroom. (choose one)
☐ Strongly Agree ☐ Agree ☐ Neutral ☐ Disagree ☐ Strongly Disagree

14. I believe that the use of technology is essential for learning mathematics at the secondary school level. (choose one)
☐ Strongly Agree ☐ Agree ☐ Neutral ☐ Disagree ☐ Strongly Disagree

15. What grade are you in? (choose one)
☐ 9 ☐ 10 ☐ 11 ☐ 12

16. What type of learner are you? (choose one)
☐ Auditory ☐ Visual ☐ Tactile

17. Please add any additional comments and/or suggestions related to technology in the mathematics classroom:
_________________________________________________________________________________________________
__________________________________________________________________________________________________________________________________________
__________________________________________________________________________________________________________________________________________
Changing Technology Through Transition:

University Student Survey

The purpose of this survey is to determine the prevalence of the use of technology at the university and secondary school level, and to obtain students’ and instructors’ opinions on its effectiveness. I will use this data for research purposes, for instance to compare the survey answers of secondary school teachers and university instructors, as well as, secondary school and university students.

For this survey, technology is defined as any piece of equipment used for teaching that includes an electronic hardware component. Examples include: computers, laptops, tablets, Internet, SMART boards, and software (such as MATLAB, Geometer’s Sketchpad, or R).

Your participation and cooperation in filling out this survey is greatly appreciated. The survey is not long; it will take less than 10 minutes to complete.

Presentation of Lectures

1. How often are your math lectures presented using technology? (choose one)
   □ Always    □ Very Often    □ Sometimes    □ Rarely    □ Never

2. What type of technology? (choose all that apply)
   □ PowerPoint Presentation
   □ SMART Board Technology (Interactive White Board)
   □ Other, please specify ________________________________

3. I believe I get more out of the lecture when technology is used. (choose one)
   □ Strongly Agree    □ Agree    □ Neutral    □ Disagree    □ Strongly Disagree

4. If technological resources are not used, how does your instructor present your lectures? (choose all that apply)
   □ Chalkboard
   □ Overhead projector
   □ Other, please specify ________________________________

Showing examples, illustrations, graphs, simulations

5. Does your instructor use technology (such as programming, PowerPoint, Maple, internet) during the lecture to illustrate concepts, run simulations, graph, etc.? (choose one)
   □ Always    □ Very Often    □ Sometimes    □ Rarely    □ Never
6. If yes, what type of technology? (choose all that apply)
   □ Software, please specify program ______________________
   □ Internet
   □ Other, please specify ________________________________

7. I believe that using technology to show examples, illustrates concepts, etc. helps me better understand the content and concepts presented. (choose one)
   □ Strongly Agree      □ Agree      □ Neutral      □ Disagree      □ Strongly Disagree

**Engagement**

8. How engaged do you feel during a lecture taught with technology? (choose one)
   □ Very Engaged        □ Engaged        □ Neutral        □ Disengaged        □ Very Disengaged

9. By using technology I participate more in class and feel like I am learning more. (choose one)
   □ Strongly Agree      □ Agree      □ Neutral      □ Disagree      □ Strongly Disagree

**Assessment**

10. Does your instructor use technology for assessment? (choose one)
    □ Always          □ Very Often   □ Sometimes   □ Rarely   □ Never

11. If yes, what type of technology? (choose all that apply)
    □ Online Assignments (such as Wiley Plus)
    □ Software, please specify program______________________________
    □ Other, please specify_________________________________________

12. I believe that using technology for assessment helps me better understand the material being presented. (choose one)
    □ Strongly Agree      □ Agree      □ Neutral      □ Disagree      □ Strongly Disagree
Technology and Understanding

13. I have a better understanding of the material when technology is used in some degree in the classroom. (choose one)
☐ Strongly Agree ☐ Agree ☐ Neutral ☐ Disagree ☐ Strongly Disagree

14. I believe that the use of technology is essential for learning mathematics at the university level. (choose one)
☐ Strongly Agree ☐ Agree ☐ Neutral ☐ Disagree ☐ Strongly Disagree

15. What year are you in? (choose one)
☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ Masters

16. What type of learner are you? (choose one)
☐ Auditory ☐ Visual ☐ Tactile

17. Please add any additional comments and/or suggestions related to technology in the mathematics classroom:
_________________________________________________________________________________________________
_________________________________________________________________________________________________
_________________________________________________________________________________________________