# Math Online: Student's Perspective Based on Survey

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**Abstract**

In online education, technology replaces some or all face-to-face interactions as self-paced content is delivered online.

The assessment of technology in education is challenging because measuring learning is difficult and, it is hard and sometimes impossible to attribute learning to any one element, due to many confounding factors. In our paper, we discuss results of a student's survey related to online math courses and technology.

In our previous research, we discussed the benefits and challenges of online education from the point of view of teaching methods. Now we want to gauge and analyze what students think about their math online classes. We are asking students whether they prefer the online or onsite formats for math classes—or whether it matters at all. We also ask if learning math in online classes is more difficult than online courses in other subjects; and why students like the online format (convenience, time savings, working on your own schedule, more independent thinking, etc.) They can also add some other reasons.

We discuss with our students what makes online math classes more challenging then onsite classes, including lack of communication, time delays in answering your questions, lack of interaction with classmates, high level of computer literacy and technical problems.

One of the questions we examine is the usage of external resources like YouTube or Khan Academy. Also, students share and discuss some other websites and software they utilize as additional assistance tools for their math online classes.

Best practices and recommendations will be given based on our own experience and survey, along with results of other research.

**Keywords:** Math, online education, technology in education, student's opinion, survey

## Introduction

The use of technology when studying mathematics is not a new issue, since humankind always has been looking for solutions to avoid time consuming routine work. The only difference is that the definition of routine work might have changed, since the implementation of modern computers. Today we can not only get help with long and complicated calculations, we can also use computers and modern software to simulate and model complex situations described by mathematical structures. (Bergqvist, Holmquist and Lingefjärd, 2000). The views on how information and communication technology can be used to support learning of mathematics have changed over time (McSweeney, L. and Weiss, J. (2003), Hoskins, S. and van Hooff, J. (2005), Engelbrecht, J. and Harding, A. (2005), Angus, S. and Watson, J. (2009)).

Technology is ever increasing in new ways that make mathematics meaningful in many ways that seemed to be impossible. Technology-supported mathematics can now be easily connected to other disciplines and to real-world situations due to the ease and flexibility of dynamic, meaningful representations and inductive explorations that technology offers.

In a balanced mathematics program, the strategic use of technology strengthens mathematics teaching and learning (Dick & Hollebrands, 2011). They emphasized that just having access to technology in the classroom is not sufficient; the teacher and the curriculum have to play critical roles in mediating the use of technological tools.

Technology is an intellectual tool that offers ways to radically change mathematics and mathematics education in students' lives. The use of technology in mathematics education transforms the view of mathematics and its teaching.

In his article, "Thinking (And Talking) About Technology in Math Classrooms, Goldenberg stated that with technology, what changes is the pool of problems to choose among and the ways they can be presented."

Instructional software is computer programs designed specifically to deliver instruction or assist with the delivery of instruction on a topic. In their book, Integrating Educational technology, Roblyer and Doering (2013) described the roles of some instructional software as allowing learners to (1) work problems or answer questions and get feedback on correctness, (2) acting like a human tutor by providing all the information and instructional activities a learner needs to master a topic, (3)modeling real or imaginary systems to show how those systems or similar ones work or to demonstrate underlying concepts and (4) lastly increasing motivation by adding game rules to drills or simulation (p. ).

Successfully integrating technology for learning usually accompanies the changes in teacher training, curricula, and assessment practices. The

successful integration of technology generally involves three key principles namely students playing an active role in their learning and receiving frequent, personalized feedback, students critically analyzing and actively creating media messages, and teachers connecting classroom activities to the world outside the classroom.

Integration of technology into classroom also involves a radical move in both teaching style and the teacher's vision of what classroom life is all about.

**Rationale of the Study**

Nowadays, when online education at colleges and universities is getting more and more widespread we decided to find out what students say and how they feel about online classes, specifically online math classes.

We have pretty extensive experience in online teaching, and it helped us to develop o few questions for our survey.

The data were collected from two groups of students: upper division math (math major), and general education students.

**Results and Discussion**

You can see the results of the survey below: the first pie charts show results of the upper division math students, and the next – results of the students taking math classes as requirements for their general education credits. Also, we added student's comments to the questions below.

1. **Do you prefer taking classes online or onsite or it does not matter?**

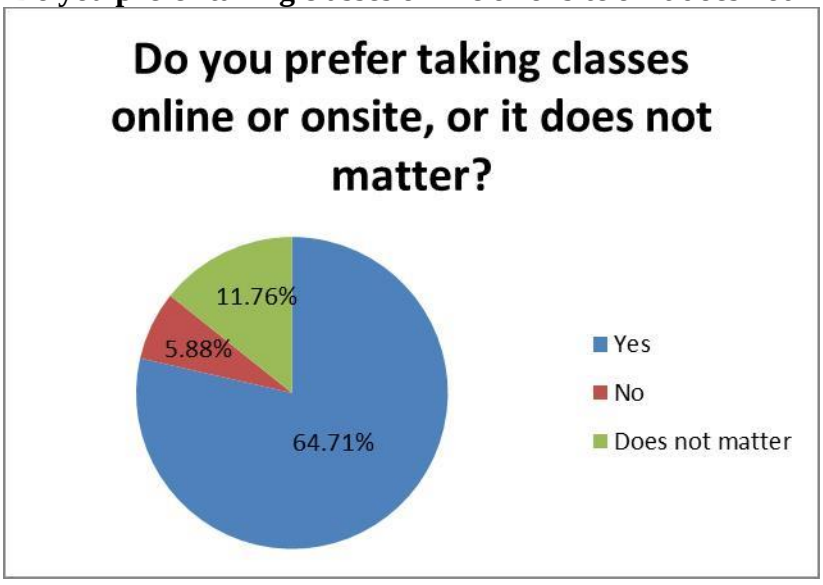


Figure 1: Upper division

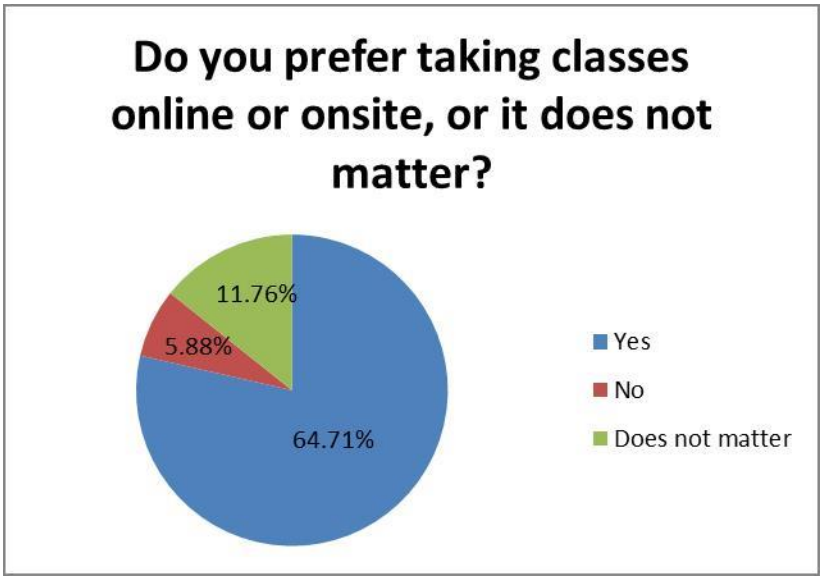


Figure 2: General Education

As you can see the results are different: for the first question "Do you prefer taking classes online or onsite or it does not matter?" students with math major show clear preference of online classes. The most of them like online classes, for some of them it does not matter, and only 6% prefer onsite classes. For general education students, the difference is remarkable: only less than half of them prefer online classes.

Comments:

"I prefer to be onsite for more difficult classes. I am online since I'm far from any campus"

"I prefer on-site"

"A hybrid class. Say class is held on a Monday and is taught covering the topics of that week. Then homework and tests are accomplished online. This will allow clarification on some of the major points and allows for a student to ask a question as that topic is being covered. Sometime the online meets, it's hard to understand the instructors because of the technology they are using and distractions do occur when phone rings, etc. Another issue is when multiple students have questions that are all over the place. Classroom environment would stream line the topics and questions as they arise".

"I enjoy taking regular classes online, but math is a bit hard online"

"Neither. I think it is the quality of the material that matters the most. Online is just as good if not better than onsite because the student isn't tied to just one resource. As long as the resources present the problems and solutions

in an easy to understand and follow manner then neither format should be better than the other".

2. **Is learning math in online classes more difficult than other online courses?**

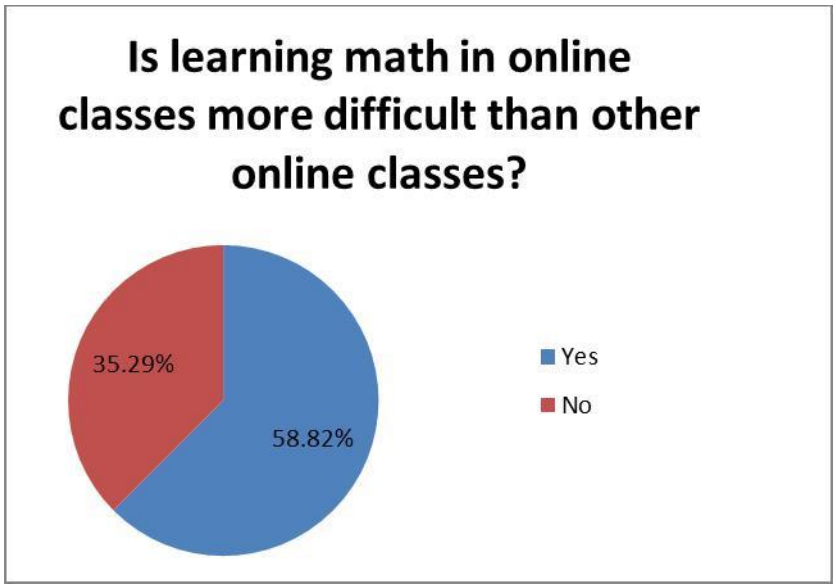


Figure 3: Upper Division

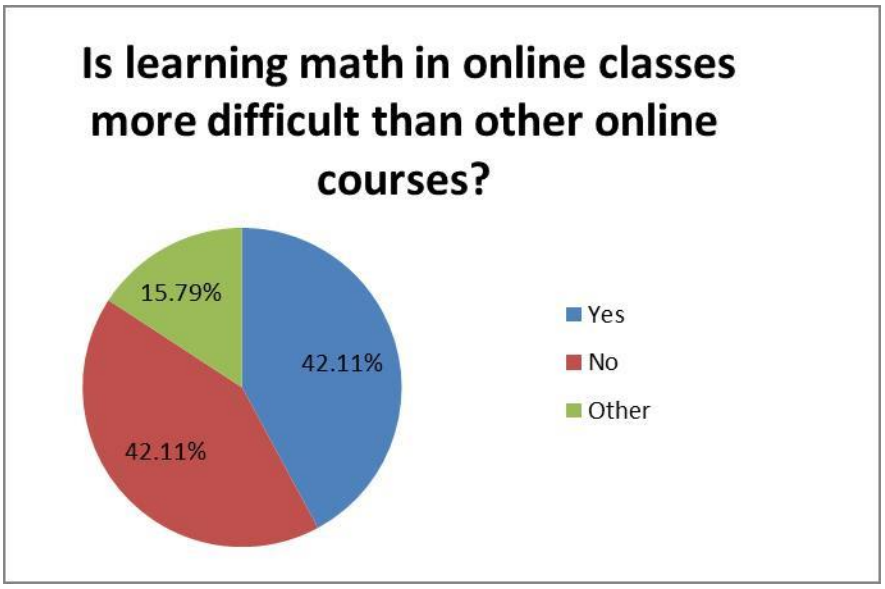


Figure 4: General Ed

For the second question: "Is learning math in online classes more difficult than other online courses?" the picture is similar: the students with

higher level math show that math online is more challenging than other online classes. The general education students don't see much difference.

**Comments:**

"I understand the concept of math, however covering demanding topics like Calculus was extremely difficult to learn and had to utilize multiple websites to help explain. khan academy, wolfram alpha, google, youtube, and multiple websites to help understand the topics. Other classes like are easily understood for me and I'm able to get the concept and equations more quickly".

"Learning part, no. Having to scan everything yes. I am always on the go and have to make time to find a place to scan my documents"

"Depends how the lessons are taught and how much explanation is given during the blackboard collaborate sessions".

"I think all classes are equally difficult in an online format if there are no resources to suppor the student. This course could be difficult if not for the quality of instruction from the instructors, the textbooks and third party resources such as Khan Academy".

3. **Why do you like taking classes online?**

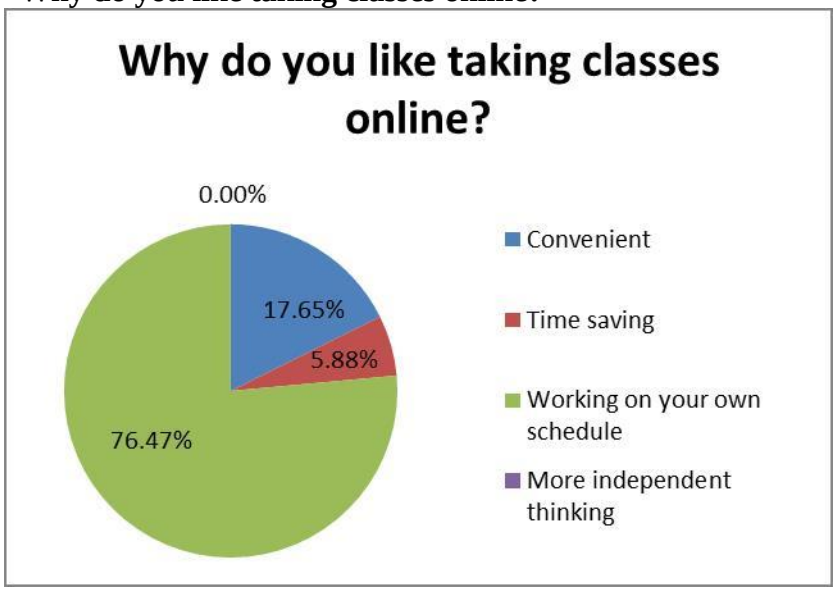


Figure 5: Upper Division

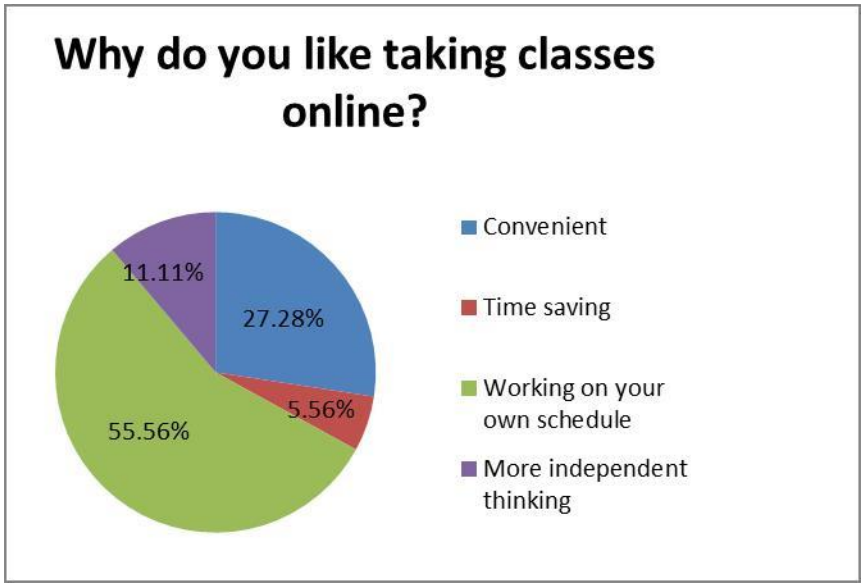


Figure 6: General Ed

The third question is one of the most interesting and informative: we try to find out what is attractive for students in online classes: "Why do you like taking classes online?" and we suggest four options:

a. Convenient
b. Time saving
c. Working on your own schedule
d. More independent thinking

The charts show that for both groups of students, working on their own schedule is the most valuable choice. They don't care much about convenience and time saving, and we were surprised by the fact that they don't see online classes as a way of independent thinking.

**Comments:**

"Full time job, family, and being far from a university make this my only option".

"I agree with all the options but I simply wish it could be more in depth as to be able to solidify an intuitive understanding of material. I want to know all material to the intuition of which one calculates x+3 =4 where x = 1"

**4. What do you think makes online math classes more challenging?**

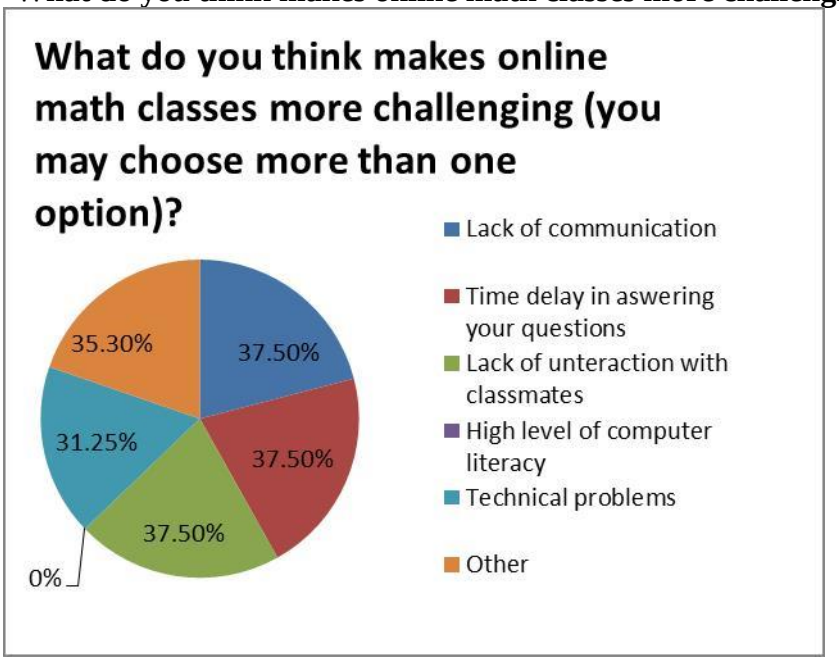


Figure 7: Upper Division

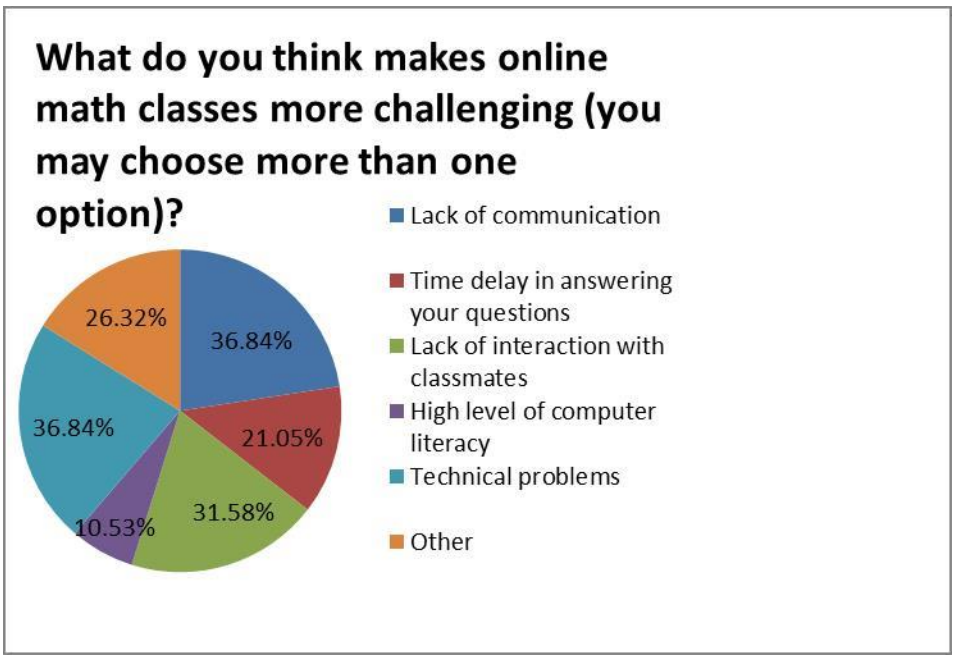


Figure 8: General Ed

The questions number four is based on students' comments in course evaluations "What do you think makes online math classes more challenging (you may choose more than one option)?", and six options for answers:

a. Lack of communication
b. Time delay in answering your questions
c. Lack of interaction with classmates
d. High level of computer literacy
e. Technical problems

The results are pretty equally distributed; it means that all those factors take place in online classes. The only answer which is different from what we expected is the answer with 0% presence on the left and the smallest value on the right – that is the questions about high level of computer literacy. While technical problems are among others have an equal share, somehow students believe that technical problems are not related to their computer literacy. As teachers, we certainly see that connection, and the difference in students' and instructors' assessment is quite interesting.

**Comments:**

"Some math courses offer too much homework".

"The online lectures do not relay information any differently than what is typically in the lecture notes or book. With the short term length of the classes, by the time you realize you need help in an area, and arrange tutoring the term is over and a new concept is being taught".

"I feel that sometimes it requires more busy work than in class methods"

"I think seeing lecture in person would be easier".

"Instruction ability varies with professor. One of my math courses did not have any instruction with visuals. It was all verbal".

"lack of practice. Could use more repetition"

"it was hard to figure out certain symbols to type for the weekly quizzes so i wasted time trying to figure it out"

"Difficult to maneuver the website"

"A classroom environment may be beneficial for the visual learners that are more kinesthetic and visual. I know that blackboard does appeal to those senses, but there is something about being present in a class and being able to ask a question and being walked thru the question until you have full comprehension of the problem or formula being presented. For some, it requires a certain level of explanation since everyone learns differently".

"The biggest roadblock with this class, so far, has been a lack of easily explained problem solving. Our textbook does a great job but every now and then will go over our heads with the assumption that we should know

something. After hours of searching online I can usually find a forum or some isolated parts of the web with a clear explanation".

5. **What do you think about using external resources like WebAssign or MyMathLab?**

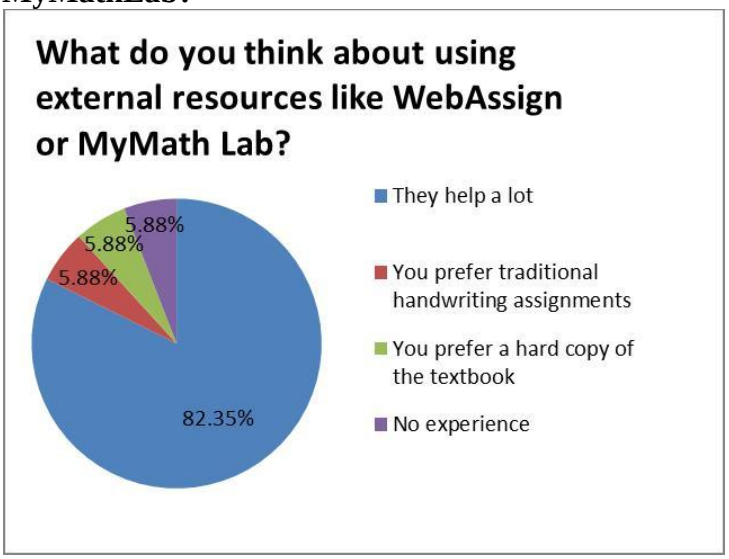


Figure 9: Upper Division

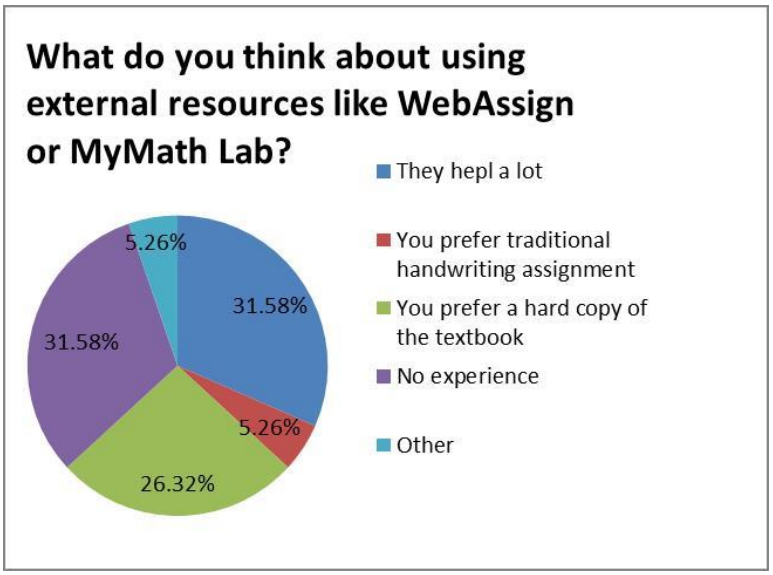


Figure 10: General Ed

The next question is about external resources like WebAssign and MyMathLab. The question is related to our experience with those resources in teaching math inline. Our opinion based on students' performance is positive

– students show better understanding and better results on tests. As for students' perspective, results are different in two different groups: while upper division students show great appreciation to those resources the general education students either prefer a hard copy textbook, or have no experience.

**Comments:**

"I have not used those resources yet, I will in my next class, but again as long as assumptions are kept to a minimum and problem solving is easily explained then they shouldn't be a problem. Not all of us will be getting Ph.D. in math".

**6. What other external resources do you use?**

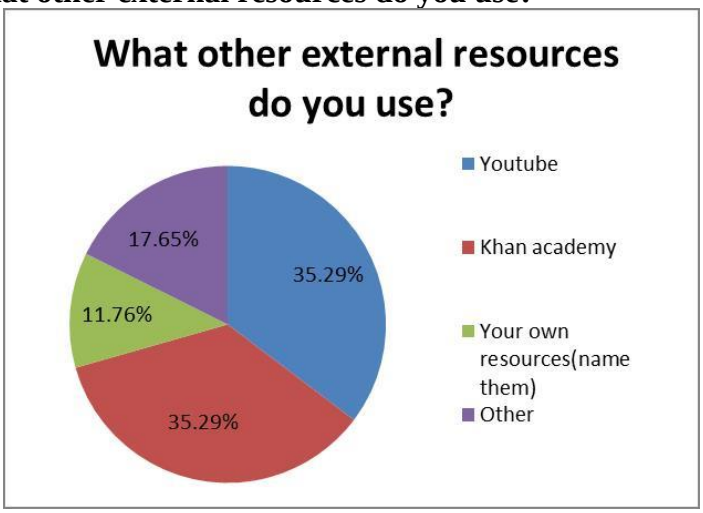


Figure 11: Upper Division

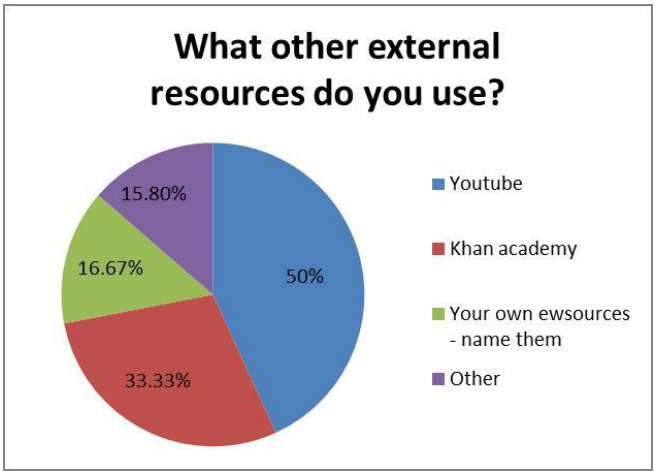


Figure 12: General Ed

Also, in the next question, we ask about usage of the most popular free internet resources, and the answers are predictable: Youtube and Khan Academy prevail. What is interesting and useful though that's information about their own recourses – they name a few, but not many.

**Comments:**

"All of the above"

"Kahn academy, Wikipedia, MIT ocw, Kahn, any other sites that come from a Google search that is relavant wolfram alpha, google, and the above listed just to name the major websites used. Wolfram because it would show how to break down the equation to get to the answer".

"All of the above and a few others such as virtualnerd and purplemath"

**7. Are online math courses helping you to think critically?**

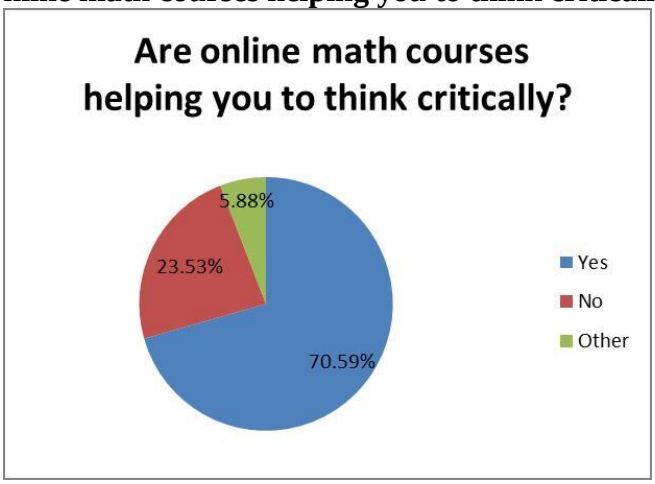


Figure 13: Upper Division

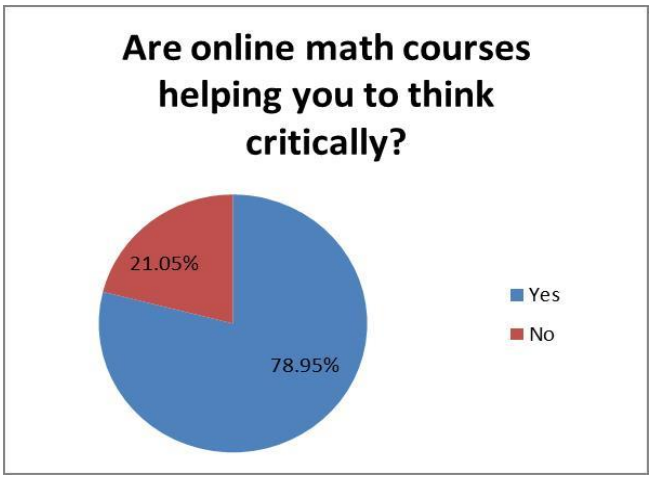


Figure 14: general Ed

The next question is related to the most common and popular expression "critical thinking" – "Are online math courses helping you to think critically?" Since we believe that math might be the best way of developing critical thinking we want to know what our students think about that. While the most of the students believe that's a true statement, it's still far from 100%, and some students feel differently. One of the student's comment is "How do I know that I think critically?", and this is the answer of really critical thinking person.

**Comments:**

"I believe so but how would I know if I can't think critically?"

8. **Do you have any recommendation on how to improve online classes? Please, share.**

**Comments:**

"Other than a couple of glitches with online test and quizzes, such as the timer not functioning or logging me out, my overall experience has been very positive and rewarding. I guess my only other complaint would be consistency week to week with homework. Some weeks I have 2-3 hours per day of work (which is normal), and then the next I'll allot that amount time and end up spending an additional 5-6 plus hours on the last day trying to catch up. It makes it hard when you work full time too, and plan for one thing and then feel rushed at the last minute".

"Have more written example problems. I have a very hard time with blackboard collaborate, and would prefer being able to watch video examples for each problem type"

"Firstly, I am genuinely intrigued and interested in Discrete Math. However, I do feel as though the load of assignments due in one week is overwhelming. Having a midterm and a weekly quiz is also quite unnerving. The content of this class is so powerful yet the workload to turn in is a bit exhausting".

"Lengthen the upper division math classes.!!!!!!!!!! Turn them into two month courses. This will allow time for the student to look for help and synthesize the information being taught. Online math is very difficult, especially for advanced subjects. Online math works, but turn the calculus and higher courses into 6 or 8 week classes and pass the same information over a longer period of time".

"Blackboard Collaborate takes forever to load on my Mac. Like 15 minutes. Is there anyway the recordings can be moved to a site like Youtube but with a password?"

"If there were an option to be able to have "review classes" where you could take the same course again or to have classes with extended time (some courses are perhaps 2 months long) so that there can be a deeper understanding of material. Also Web assign is great for immediate feedback plus a plethora of example problems. More video resources to accompany the textbook while I learn to read mathematics textbooks as well as i read a textbook in English".

"None. I have taken many online classes and I wasn't too sure if having math classes online would be easy. It turns out, I love it and the teachers are awesome!"

"Through my experience, math is the subject that is the hardest for people to understand. Maybe they don't see the purpose or can put it into a practical use. English you can, science you can, math is not so easy. Once I understand the ins and out of an equation, I am good. Other people tend to need a helping hand to understand the topic. I honestly believe the best way is a Hybrid class. A class where the class would meet on Monday, cover the topics of that week in one night and then homework and test be completed online. The online meets, seem to be restricted because of technology. When a teacher is trying to draw out an equation and is using a mouse vs. a drawing tablet it's causes a distraction because it's sloppy and hard to understand. When a teacher is trying to discuss this week's topics and the phone rings, it's another distraction. If a teacher doesn't have a good microphone, it's hard to hear and understand them. I can go on and on about distractions that I have come across while doing online meets. Allot of these distractions would go away if there was an instructor based class. Forums can still be utilized to help establish a level of knowledge on the topics. Homework and tests can easily be turned in via the internet as well. This will allow the student to complete their assignments and tests on their time. Which is great, especially with someone like me who works fulltime, goes home to a family, has to cook clean and ensure children are fed and ready for the next day. If you have any questions or concerns please let me know."

"My geometry class made hw optional. I really liked that because I still worked on hw and I didn't have to worry about it hurting my grade. I guess t just gets difficult fitting all that into my crazy schedule on top of studying for exams and quizzes"

"Online math classes depend considerably on the teaching skills of the instructor and the independent learning skills of the student. Professor is an example of someone who has a system that works and I would recommend emulating her. There are lectures multiple times a week with a variety of visuals, plenty of practice problems, and she responds very rapidly to emails. Although I'm not thrilled about weekly assessments, they do force me to keep my pace up. I have been very pleased with the majority of the math courses that I've taken. If they were not offered in the online format, I would not be

able to pursue my second bachelors and make a career shift within the education profession. I'm thankful and pleased with what is currently offered. WebAssign was very helpful when I was taking calculus because it allowed me to make errors and figure out what was happening. The instant feedback and access to similar example problems was very helpful".

"I liked webassign a lot. i felt it really helped because of the videos and examples. There is a lot of material covered in these courses in a short period of time. Webassign really helped since there can only be so much material covered in 2 2 hour lectures".

"I would have liked to have more time on the quizzes and test so I could format my answers better and I would like to see how i came to the wrong answers on some of my questions, but overall it was a great class".

"Be more communicative with instructors just like if I was in class for help and what not",

"More detailed and clearer explanations of problems".

"No, the site is simple and straight forward".

"At this time I do not, however I do like the layout national university has for online classes".

"Since it is an online class we shouldn't have to submit papers. I have to go out of my way every week to submit my homework. All the other math classes I have ever been enrolled in were all done online. Very convenient"

"Make my sure the syllabus matches the calendar due dates".

"My only recommendation would be to make website more user friendly"

"Definitely break up the blackboard sessions into two different sessions during the week. Having one long session once a week is too much for most students, especially if they have long days at work and they have to sit thru four hours of problem solving explanation. The brain is tired and the question is; "How much is the student really retaining?" The online exam and mid-terms are a bit difficult to complete for the questions that require showing work for the problems. Not everyone understands how to type out math problems using a standard keyboard (e.g. exponents, multiplication symbols). I recommend that an 'upload button' is created to a student can upload a picture or PDF file of the problems that required work to be shown".

"The online sessions with the instructors may bore some students but they have been invaluable to me beyond any other resource so far. In MTH12A, the online sessions were 4-5, sometimes 6 hours longs but the instructor kept on going even with no students online. They have helped me the most so far."

## Conclusion

Based on the results of the survey, online classes seem to enjoy as high, if not higher, as on site. What does this implies? Simple. The online education is an effective mode of education in the area of math. Our results are limited by just a couple of surveys of our students, but they give a direction for future research. There are a lot of questions to ask: what kind of online classes fit the best students need; is online education more beneficial financially; should we stop offering on site classes; etc. More data should be collected and analyzed in order to determine exactly what's going on; knowing the outcome is not the same as knowing what works.

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