What Motivates Business Calculus Students?

Emalina Huerta-MTED 511-Final Paper-Fall 2022

**Introduction**

“Motivation is an important prerequisite for learning” (Stroet, Opdenakker, & Minnaert, 2015). In Business Calculus where we develop mathematical techniques for describing  
relationships between quantities, like price and demand, time and sales, or production level and profit. Then we use calculus to analyze these relationships, to predict the future and describe the past and present. The focus of the study is to help understand what makes a student want to succeed in their course. We need a deeper understanding on what motivates students and how they study to stay engaged throughout the semester. Based off existing research students lose interest in math because they did not do well in prior math courses (Rasmussen & Ellis, 2013). Students who get good grades in math are self-motivated, self-efficacy and self-government (Mueller, Yankelewitz, & Maher, 2011).

We can help prepare students with the resources needed to succeed based off their prepared method of choice to study. *What do Business Calculus students believe motivates them to want to engage and spend time learning mathematics? Are these students willing to modify their choices to improve their performance?* We need to understand what motivates students to be able to support their success. Based off previous research and my survey from Business Calculus students (Math 115) we can get an idea what motivates them and how we can help future students in Math 115.

**Review of Literature**

First, we need a basic understanding to why students lose motivation. Previous research shows students decide not to continue with math because they do not feel they were well prepared in Calculus I in order to continue on to the next mathematics course (Rasmussen & Ellis, 2013). The consequence of being under prepared from previous courses will result in students needing to spend more time and effort in future courses. Since Calculus I is content heavy, students spend more time copying down what is written on the board and not fully understanding the material that is being presented (Rasmussen & Ellis, 2013). Since students are too busy writing class notes it makes it difficult for them to contribute to class discussions. If students believe they did not do well enough in Calculus, then they believe they will not do well in future math classes and believe a strong foundational knowledge of the subject is strongly needed to do well in future math courses. Second, if they did not put enough time and effort in Calculus then the student must put in more time and effort in Calculus II to succeed and students either don’t have the time with their current academic load or prior commitments made outside of school (Rasmussen & Ellis, 2013). Next, students and instructors believe there is too much material to be covered in Calculus I. This causes a lack of time spent with students to grasp the material. Rasmussen and colleagues shared student perspectives in Calculus I. For example, “overburden with content and with pacing structure that inhibit comprehension and reflection” (Hagman, Johnson, & Fosdick, 2017). The overwhelming amount of material creates a negative atmosphere for the students. These contributing factors make students either disengage in the subject or decide to change majors.

We have examined how students lose interest in math but now we need to look at students who stay engaged throughout the course. Various research agree that good grades are based off “three fundamental human needs autonomy, competence, and relatedness” (Stroet, Opdenakker, & Minnaert, 2015). Further, research indicates that another contributing factor to good grades is intrinsic motivation (Mueller, Yankelewitz, & Maher, 2011). Students found autonomy as an important factor in wanting to do well in the course. Those were also the same students that wanted to modify their studies to do better in the course if they were struggling. Leading to self-efficacy. Students with high self-efficacy believe they will succeed in math before their grades are even given out. Their motivation stems from cognitive approach and are more aware of their academic performance. These students would be more consciously aware that they are not giving enough time to a subject and are more willing to adjust their study time. Intrinsicly motivated students tend to be more persistent studiers and give more time to task (Mueller, Yankelewitz & Maher, 2011) leading to self-efficacy. Students who are more intrinsicly motivated seek to develop an understanding for the subject through their own reasoning. These students are not looking for appraisal from parents or teachers and they are not seeking understanding of the subject through the teacher’s reasoning but their own.

Lastly, research has shown that classroom settings such as teacher support by answering questions can give back to student motivation (Mueller, Yankelewitz, & Maher, 2011). Student confidence is a contributing factor to student success in the classroom we need to find a way to help build student confidence in the classroom. A common resource for students to use when they need help in their math course are professor office hours. A safe environment will allow students to feel comfortable to ask questions in the classroom.

**Methods**

A survey was given to undergraduate students at a four-year university all the participates attended California State University-Long Beach. Every student who participated in the research were enrolled in Business Calculus known as Math 115 at the university. The survey took place towards the end of the Fall semester of 2022. The ninety students had already taken two exams and five quizzes. The course is based off a grading scale of either an A, B, C, D, or F in the course based on exams, quizzes, homework, ALEKS, and participated in the activity portion of the course. All surveys were completed online from a phone, tablet, or computer. Participants’ identity remained anonymous in the survey process in hopes of receiving honest answers. Participants were not given any incentives for completing the survey. To get as many of the responses as possible to the survey they had to show the last page, or a screen shot of the survey to leave for the day. Most of the participants took the survey during the activity portion of the course, a few took the survey at home, and some took the survey while walking to their next class.

**Analysis**

The primary goal of the research was to see what motivates students to engage and succeed in the Math 115 course. I used Qualtrics as an online survey operator. The data was based on three categories (1) what motivates students to engage and succeed in Math 115, (2) Math 115 students’ choice of study, and (3) the likelihood of taking another math class to start coding the participants responses. The goal of the sample survey was to see what motivates students to get good grades and if they are willing to modify their study habits to increase their grade. The results of the survey are in the appendix for reference. The participants took a sample survey online that consisted of one level of agreement question with multiple parts, four multiple choice questions that allowed for open responses. I started by asking the participants if they believed they are doing well in the course. The results were shocking. Almost half of the participants believed they were doing well and only 3% believed they were not doing well in the course. The scary result was 17% of participants were not willing to modify their study habits to increase their grade. The next step was to get an of what motivated the participants, if it was their parents, good grades, financial assistance, etc. Based off the top three responses participants are motivated to get good grades first, complete their educational goals second and to learn career information was third in priority list. Multiple choice questions asked what resources participants used to study and prepare for exams. In order to achieve these goals participants, need to understand the course material and seek help when needed. 23% of participants used their notes to help study and 14% used YouTube videos to help study. Some of the video were sent out by the instructor of the course. The choices were based off resources offered through the course such as Webassign homework, ALEKS to assist with basic algebra skills, professor or TA office hours, YouTube videos, and a chance to list any option that was not listed or if they had other resources that were not provided by the school/professor. The last part of the survey asked if more math classes were an option in their future.

Based off the percentage of participants in each category was analyzed by the most used resource and the main component of motivation to each participant. Open responses were given to the participants to see what the likelihood of them is taking more math classes in the future. Participants were only willing to take more math classes based on the fact if they were good in the subject and if their degree depended on it. The responses were based on their educational goals and some students were unsure if math classes were in the future.

**Results**

Reasons students lose motivation comes from not understanding the material. A lack of confidence in knowing the material makes students less engaged in the course. In the survey I asked what motivates students of Math 115 to engage and succeed in the course. Majority of students (Figure 1) motivation factor is to get good grades. Resulting those students “consider their schoolwork as personally valuable or interesting” (Stroet & Opdenakker, 2015).

An important study resource for students throughout the semester were their notes. Based off the survey a fourth of the students used their notes as a study resource for an exam or quiz. As instructors we can provide a well-structured lesson to provide students notes that are resourceful in their study process. In doing so, “help students to feel effective in their schoolwork by communicating clear and consistent guidelines and expectations and by being available when students have questions” (Stroet & Opdenakker, 2015). The next main source of study content is their offline homework which is not collected by the instructor or worth any points in the course but are extra homework problems that can be completed by the student to help them study for an exam and study with classmates. This follows into their next source of help attending office hours for both their professor and TA. Structured notes, homework problems that follow notes and being able to seek help from the professor allow students feel competent to accomplish the task at hand.

Peer Feedback in the classroom of mathematics is beneficial to the learning process. “Being provided with more than one level of feedback is beneficial to learner” (Husband & Nikfarjam, 2022). This allows students to have the opportunity to have the material explained by “equal status learners”. In a groupwork setting it allows the students peers to help explain the material to each other by someone else who is also learning the lesson for the first time. Another main contributing factor of group work “the opportunity to engage in ongoing back and forth conversations” (Husband & Nikfarjam, 2022) about Math 115. Discussing the topic can help the student to better understand the material as well as helping their classmates to better understand the material. This allows students to connect and feel the need of acceptance in their course and in hopes to make them want to study more in the course.

A negative impact of learning so much material in a short period of time can become a burden to mathematic students. If students feel overwhelmed by material in the course, they are less likely to want to take more math classes in the future. Based off the survey students only wanted to take more math classes because “i like math” or “I am good at math, and it is fun!” As instructors we are aware of the issue at hand but still struggle to keep our students interested in the subject and to stay motivated from the beginning to the end of the function. We can help contribute to help student feel less overwhelmed by exposing the content to students more often. YouTube videos is a resource to help students review math content being learned that week in the semester at home and explained possibly in another way. This can contribute to “content exposure by the “amount of time devoted to instruction and time-on-task” (Hagman, Johnson, & Fosdick, 2017).

The main purpose of the activity portion of Math 115 is working in groups to finish offline homework. This has allowed many of the students to make study groups in the classroom and outside the classroom. Student engagement is crucial for the student to learn and do well in their math courses. Based off Figure 4 12.94% of students use classmates as a resource to help prepare for exams. Figure 5 shows almost 100% of those students say it is their most used resource.

Figure 3 had twelve different options to choose from that motivates them the most in the course. While Figure 4 listed what they used the most to study throughout the semester. Many of the options provided in the survey were resources provided by the professor or the TA to the course. The goal was to see if students were doing well in the course and what resources they used to help study for the course and if they would change any study habits in hopes of doing better in the course.

**Discussions**

The research was based off a small scale of data in hopes to navigate future research on the topic of motivation. The finding shows the main source students use to study for exams and the motivated students are more likely to do well in the course. Students who do well in math are more prone to taking more math classes in the future or to seek a minor in the subject. Motivated students are students who use resources outside the classroom and will spend additional hours or resources to study to improve their grade.

Findings from this report indicate that students are find it more resourceful to watch YouTube videos, offline homework, and go to the review session to help them prepare for an exam. These findings are resources used outside the classroom that help students to study.

**References**

Carlson, M. P., Madison, B., & West, R. D. (2015). A study of students’ readiness to learn calculus. *International Journal of Research in Undergraduate Mathematics Education*, *1*(2), 209–233. https://doi.org/10.1007/s40753-015-0013-y

Hagman, J. E., Johnson, E., & Fosdick, B. K. (2017). Factors contributing to students and instructors experiencing a lack of time in college calculus. *International Journal of STEM Education*, *4*(1). https://doi.org/10.1186/s40594-017-0070-7

Husband, M., & Nikfarjam, P. (2022). Peer feedback in the Mathematics Classroom. *Journal of Mathematics Education at Teachers College*, *13*(1), 1–6. https://doi.org/10.52214/jmetc.v13i1.8984

Mueller, M. (2022, February 7). *Sense making as motivation in doing mathematics: Results from two studies*. The Mathematics Educator. Retrieved December 4, 2022, from https://www.academia.edu/70848761/Sense\_Making\_as\_Motivation\_in\_Doing\_Mathematics\_Results\_from\_Two\_Studies

Rasmussen, C., & ellis, J. (2013). STUDENTS WHO SWITCH OUT OF CALCULUS AND THE REASONS THEY LEAVE.International Group for the Psychology of Mathematics Education,5. <https://files.eric.ed.gov/fulltext/ED584594.pdf>

Stroet, K., Opdenakker, M.-C., & Minnaert, A. (2015). What motivates early adolescents for school? A longitudinal analysis of associations between observed teaching and motivation. *Contemporary Educational Psychology*, *42*, 129–140. https://doi.org/10.1016/j.cedpsych.2015.06.002

**Appendix**

**Figure 1 Chart, bar chart

Description automatically generated**

**Figure 2**

**Graphical user interface, application

Description automatically generated**

**Figure 3**

**A picture containing table

Description automatically generated**

**Figure 4**

**A picture containing table

Description automatically generated**

**Figure 5A picture containing background pattern

Description automatically generated**

**Figure 6**

**Background pattern

Description automatically generated**

**Figure 7**

**A picture containing application

Description automatically generated**

**Figure 8**

**Graphical user interface, text, application

Description automatically generated**