Factors that Motivate Students to Learn Mathematics

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Abstract

What motivates some students to want to learn mathematics while others are not similarly motivated? Are these factors intrinsic, extrinsic, or a combination of both? To answer these questions, we adapted a survey originally developed by Tapia (1996) and later shortened by Lim and Chapman (2015). We administered the survey to multiple middle schools, high schools, colleges, and universities. We obtained a total of 645 surveys. We offer an analysis of these data, including both descriptive statistics and confidence intervals. In addition to Likert scale items from the original survey, we explore a variety of qualitative data from a free response item. For the college and university sample, we also provide comparisons among students majoring

in mathematics or mathematics education, those majoring in elementary education, and those with a variety of other majors.

1 Introduction

What motivates someone to want to learn mathematics concepts and to persist even in the face of difficulties and obstacles? Are these motivational factors primarily extrinsic to the person and the mathematical concepts, such as earning a good grade, pleasing a parent, or applying the concept to a future career? Or are the factors more intrinsic in nature, such as enjoyment of math itself or enjoying the problem solving process? How does someone decide to pursue a career in the mathematical sciences? Although all of these questions are both interesting and important, we used the first two questions to design a research study. By identifying and classifying factors that motivate students to learn and persist in mathematics, we hope to provide insights for teachers, parents, and others who have a stake in the ultimate success of middle school, high school, and college or university students in the area of mathematics. This, in turn, may shed some light on the third question raised above.

2 Background and Research Questions

Prior research has explored the role of motivation in a variety of contexts, including mathematics. Tapia (1996) created a lengthy survey instrument designed to highlight which factor or factors most impact a person's attitudes toward mathematics. Lim and Chapman (2015) shortened this survey in a research study that explored sources of math anxiety as well as factors that motivate students to learn mathematics. The stakes of this research are high since many professions and many facets of our everyday lives assume a strong background in quantitative reasoning in general and the application of numerical and spatial reasoning skills in particular. Indeed, professional organizations have called for increased focus on conceptual reasoning and problem solving within the K-12 mathematics curriculum (cf., Common Core State Standards Initiative, 2011; NCTM 1989; 2000; 2014).

Other researchers have studied issues closely related to motivation and mathematics learning. Eggleton (2017) describes the importance of success as a motivational tool for students to persist in the face of cognitive obstacles and difficulties in mathematics. King (2019) addresses the same issue and emphasizes helping students to "tackle challenging problems and be creative problem solvers" and expecting them to "work hard, persevere, and learn from the mistakes they may make" (p.507). Kinser-Traut (2019) highlights the importance of connecting mathematics to other subjects, to future careers, and to everyday life. Finally, Wilkerson (2015) details ways that students value mathematics and calls for teachers to provide their students with a rationale for learning mathematics, one that uncovers mathematical patterns in God's Creation as well as ways to serve others in society through the application of statistical, numerical, and spatial reasoning.

In the present study, we seek to identify factors that motivate students to want to learn mathematics and to persist when confronted with difficult mathematical concepts. Some of these factors are intrinsic in that the source is either in the student herself or in the nature of the mathematics. Other factors are more extrinsic, such as a course grade, a future career, connections to other disciplines or to everyday life, or a person such as a teacher, a parent, or a friend. Based upon this framework and existing research, we designed a research study to address the following questions:

- Question 1: What similarities and differences exist among the primary motivation factor to learn mathematics for students at the middle school, the high school, and the college and university levels?
- Question 2: What is the preponderance of intrinsic versus extrinsic motivation factors for students at these grade levels?
- Question 3: Which groups or subgroups (e.g., individual schools, students with common motivation factor, college/university major, etc.) demonstrate unusually high or low Likert scale responses for specific items? What do these results tell us about how these students approach mathematics?

3 Research Methodology

At Trinity Christian College, all mathematics majors complete a research project as part of the senior capstone seminar. Ben Gliesmann approached his seminar professor, Dave Klanderman, to propose a study that explored different factors that motivate students to learn mathematics. This idea originated from both Ben's own unique path to becoming a secondary mathematics teacher as well as the preparation for his upcoming student teaching internship and his desire to motivate his own students to want to learn mathematics. After researching the topic, Ben identified the lengthy survey published by Tapia and the subsequent shortened version by Lim and Chapman. With input from his professor, Ben ultimately decided to adapt the shortened version of Lim and Chapman by adding five items at the end to produce a total of 20 Likert-scale items (see Appendix for survey items). To reduce the likelihood of survey fatigue in which a person eventually falls into a pattern of giving the same response to every item, the logic for items 6 through 10 is reversed. This means that the optimal response for these "negatively-stated" items was "strongly disagree," whereas we hoped to document a preponderance of "agree" and "strongly agree" responses for the remaining 15 items in the survey. At the very end of the survey, students were asked to identify the single "person, place, or thing" that most motivates them to learn mathematics. All surveys were completed anonymously. However, for students at the college or university level, the academic major was collected according to three subgroups: mathematics or mathematics education, elementary education, and all other majors. The last category was necessary because the number of students in any particular major was too small to allow further analysis. This additional piece of data later allowed for analyses of subgroups in the college or university samples.

As we explored potential samples for the survey, we identified the need to include students at multiple educational levels. Specifically, we hypothesized that middle school students, high school students, and students at the college and university levels would exhibit different underlying factors that motivate them to learn mathematics. In part, the specific schools included in this study are a convenience sample. However, we took steps to include a cross section of students from each educational setting with the goal of producing an overall sample that is representative of students at these levels. At the middle school level, we surveyed a total of 245 students by including all available students in multiple sections. At the high school level, we surveyed 163 students from a variety of different mathematics courses. At the college and university levels, we surveyed a total of 237 students enrolled in both general education mathematics courses such as statistics and content courses for elementary education majors as well as courses taken primarily by students majoring in mathematics.

Furthermore, we chose to include both public and private schools at each of the three major educational levels. While we hypothesized that the type of school setting might affect the nature of the motivation factors, we were interested to explore both the similarities and differences that might exist. Overall, four middle schools (two public and two private), two high schools (one public and one private), and three colleges or universities (one public and two private) were included in the sample. Our research team expanded by three members in an effort to reach this wider audience of students in a variety of educational settings. Each team member applied for permission to administer the survey through an appropriate administrative channel, including institutional review boards, school principals, and classroom teachers. In addition, all students under the age of 18 needed to obtain a signed permission form from a parent or guardian before the survey could be administered.

Once the data were collected, a variety of descriptive methods were used to analyze the data. First, the Likert scale responses were converted to a numerical scale, with 1 denoting "strongly disagree" and 5 denoting "strongly agree." For each of these 20 items, mean values were determined for the entire sample, for each school setting, and for the academic major subsamples mentioned earlier.

For the free response item ("What is the one person, place, or thing that motivates you to learn mathematics?"), a more qualitative analysis was used. Different categories emerged and were eventually grouped as follows:

- Teacher – this includes both the general term and specific names of teachers ranging from first grade through university
- Family and Friends – this includes both "my mom" and "my dad," but also incorporated other family members (siblings, aunts and uncles, grandparents, etc.) and friends
- Future/Job/Application – this includes references to a career goal, future financial and related activities, and other applications in the surrounding world
- Grades – some students identified the grade on a test or assignment or the course grade as the primary motivation
- Intrinsic – some students identified features of the mathematical concepts, the personal challenge and satisfaction of solving difficult problems, or other related factors
- Other – some of the responses were either left blank or were essentially unique (e.g. Albert Einstein, music, Jesus, etc.)

We used these free response categories to identify subgroups within different subsamples. Means for the 20 Likert scale items were then computed for the subgroups. In an effort to highlight unusual response patterns, we decided to identify school samples and subsamples which were outliers, as defined by means that were at least 1.0 higher or lower than the overall item mean. We later used 95% confidence intervals for the mean to discover how each educational level (middle school, high school, college/university) compared to the overall sample. Finally, the total number of responses at the college/university level that were classified as mathematics or mathematics education majors were sufficiently large to allow interval estimation.

4 Results

Overall, 645 students completed the survey, including 245 students from a total of four different middle schools, 163 students from two high schools, and 237 students from a total of three different colleges and universities. In this section, we provide an overview of the findings from these surveys. Figure 1 provides a summary of the mean scores for the entire sample, for each of the three different educational level settings, and for those students who identified as mathematics or mathematics education majors. As a reminder, a score of 1 represents "strongly disagree," a score of 2 represents "disagree," a score of 3 represents "neutral," a score of 4 represents "agree," and a score of 5 represents "strongly agree."

As seen in the table below, the combined sample showed mean responses in the "neutral" range (between 2.5 and 3.5) with some exceptions. Items 11 through 15 were in the "agree" range, meaning that the students tended to agree that math is worthwhile, important to everyday life, important to study, important for the future, and helpful in life. A similarly high mean for item 16 indicates that students tend to agree that grades are an important motivational factor for learning mathematics. Two of the 20 items had overall mean scores in the "disagree" range (less than 2.5 but above 1.5). One of these was Item 8, indicating that even thinking about doing a math problem is a major cause of anxiety. The other item in this range was item 17, perhaps an indicator that most students are not familiar with non-textbook literature related to mathematics or that those who are familiar with this genre do not find reading such books to be enjoyable.

Looking more closely at the mean values for the subsamples listed in Figure 1, the reader will notice that some of the values are printed in boldface. These indicate cases where the mean of the subsample and the mean of the combined sample for that item were determined to be different based on non-overlapping 95% confidence intervals (CIs). For example, for item number 1, the 95% CI for the combined sample would be (3.31, 3.49). The 95% CI for the college and university subsample would be (3.32, 3.68) which overlaps with the combined sample CI. By contrast, the 95% CI for the mathematics and mathematics education subsample would be (4.07, 4.73) which does not overlap with the combined sample CI and hence is statistically different.

Applying this analysis, we see that the middle school subsample is very similar to the combined sample. In fact, the only item with a statistical difference is item 9, indicating that, on average, middle school students experience confusion in math class more often than the combined sample. Similarly, the college and university subsample means are very similar to those of the combined sample. The only item showing a difference was item 19, perhaps an indication that connections between math and other content areas are more important to students at the college and university level.

Shifting the focus to the high school subsample, it is interesting that all five of the survey items that anticipated a response of disagreement showed lower means for high school students than for the combined sample. Perhaps this education level is the sweet spot for avoiding negative experiences with mathematics. However, another interpretation might be the impact of particular teachers since all of these high school students were enrolled in a math course taught by one of two teachers.

Although perhaps unsurprising, it is nonetheless worth mentioning that the subsample of the mathematics and mathematics education majors were very different than the combined sample. In fact, the means for this subsample were significantly higher than the combined sample for all 15 of the positively-stated items. In addition, the means of this subsample were significantly lower than the

Item Number (Brief Summary of Item – see Appendix for full wording)	Combined Sample (N=645) MoE=0.09	Middle School (n = 245) MoE=0.15	High School (n = 163) MoE=0.18	College or University (n = 237) MoE=0.15	Math or Math Educ. (n=52*) MoE=0.33	Elementary Education (n=32*) MoE=0.42*
1 Enjoy math	3.4	3.3	3.5	3.5	**4.4**	**2.8**
2 Like to solve math problems	3.4	3.2	3.6	3.5	**4.3**	2.9
3 Really like math	3.2	3.1	3.3	3.3	**4.4**	**2.7**
4 Happiest when in math class	2.7	2.8	2.8	2.6	**3.7**	**2.0**
5 Math is interesting	3.5	3.4	3.4	3.6	**4.5**	3.2
6 Studying math makes me nervous	2.8	2.9	**2.4**	3.0	2.5	**3.5**
7 Always under strain in math class	2.6	2.8	**2.3**	2.5	2.2	3.0
8 Thinking about doing a math problem makes me nervous	2.1	2.3	**1.8**	2.1	**1.5**	2.5
9 Always confused in math class	2.6	**2.9**	**2.2**	2.5	**2.1**	3.0
10 Insecure when attempting math	2.5	2.6	**2.0**	2.6	**2.0**	**3.0**
11 Math is worthwhile	3.9	3.8	3.9	4.1	**4.6**	3.9
12 Math is important in everyday life	3.9	4.0	3.9	3.9	**4.4**	3.8
13 Math is important subject to study	3.8	3.8	3.8	3.7	**4.2**	3.6
14 Math is important for future	3.7	3.7	3.7	3.6	**4.2**	3.5
15 Math background helps me in life	4.0	4.1	3.8	4.1	**4.6**	3.7
16 Getting good math grades motivates me	4.0	3.8	4.0	4.1	**4.4**	4.1
17 Enjoy math reading	2.4	2.3	2.6	2.4	**3.1**	**1.9**
18 People motivate me to learn math	3.1	3.0	3.1	3.2	**3.8**	3.0
19 Math connections motivate me	3.4	3.2	3.3	**3.7**	**4.1**	3.4
20 Difficult math motivates me	2.9	2.9	3.0	2.9	**3.6**	**2.3**

Figure 1: Item Mean Scores:
∗ A total of 52 of the students in the college/university sample are included in the math and math education subsample. Similarly, 32 of the students in the college/university sample are included in the elementary education subsample.
∗∗ Constructing 95% confidence intervals (CIs) for the mean produces the stated margin of error (MoE) in each case. Mean values listed in **boldface** denote items where the 95% CIs for the indicated subsample and the overall sample do not overlap.

combined sample for three of the negatively-stated items. Thus, college and university students with a major in mathematics or mathematics education tend to provide more optimal responses to these survey items. Whether this finding is correlational or causational cannot be determined by this study, although it may help to explain why these students select these majors.

On the other hand, the results for the subsample of elementary education majors is sobering. For nearly all of the 20 items, the means scores for this relatively small subsample (n=32) were less optimal than for the combined sample of all students. This includes several items related to enjoying or liking mathematics where these future teachers had significantly lower means as well as multiple items related to math anxiety which had significantly higher means. It is also notable that this subgroup does not seem to enjoy math-related books nor experiences with difficult mathematics. Given the impact that these elementary school teachers have on students and their dispositions towards mathematics, these findings, even based upon a relatively small sample, should raise alarm bells among the colleges and universities that prepare future teachers.

We next turn our attention to the qualitative data provided in item 21. Figure 2 below presents a word cloud for the combined sample in which the font size of the response category is relative to its frequency.

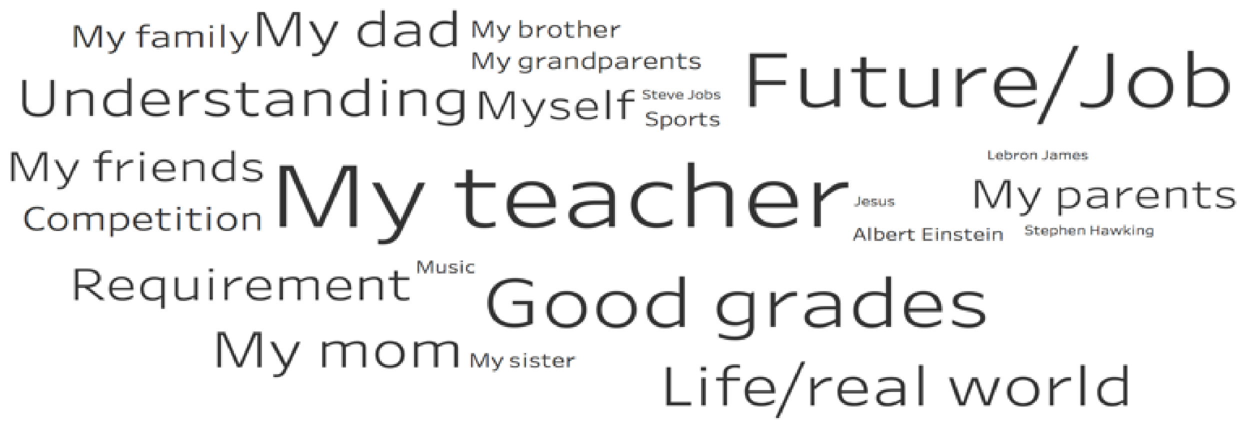

Figure 2: Word Cloud for Item #21

A few trends follow from the above figure. First, the teacher is the most commonly cited motivation factor. It is also true that if categories related to family and friends are grouped together (e.g., My mom, My dad, My parents, My friends, etc.), then this combined category occurs even more often than the teacher. Notice also that "My Future/Job" is also frequently mentioned by these students. By contrast, other categories occur less frequently and a few, such as "music" or specific individuals such as "Jesus," "Albert Einstein," or "Stephen Hawking" occur only a few times. Overall, responses classified as "friends or family" constitute 25% of the total, responses grouped under the heading "future, job, or application" comprise 23% of the total, and approximately 20% of the responses identified the teacher as the most important motivational factor. Achieving good grades (12%) and intrinsic motivational factors (10%) occurred somewhat less often.

Based upon these responses for Item 21, we conducted two additional sets of analyses. First, we compared responses from the three different educational levels and produced bar graphs to summarize the findings in each case. They are offered in the pages below as Figures 3, 4, and 5. Note that responses that could not be easily categorized or were left blank are excluded. Collectively, these "other" responses constitute 10% of the total data set.

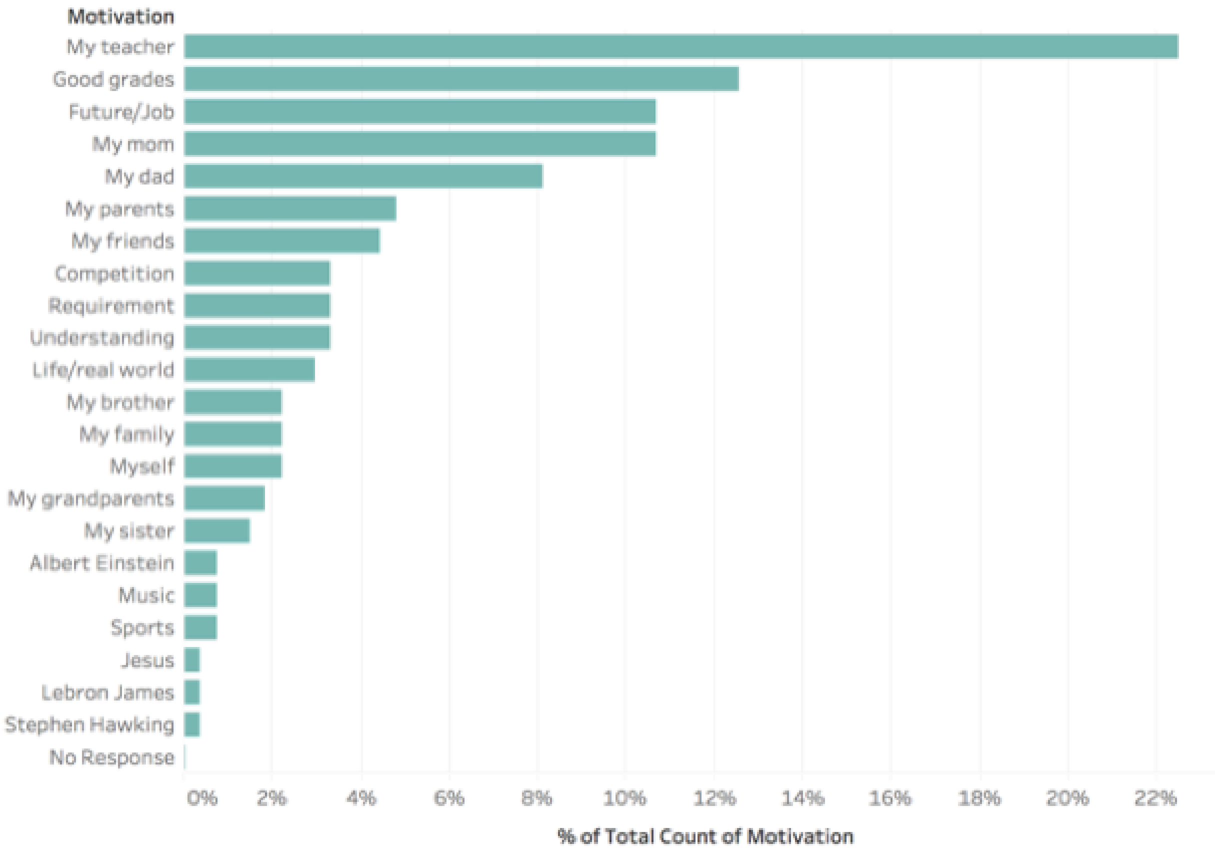

Figure 3: Summary of responses for item 21 at the Middle School Level

Comparing these three bar charts, it is interesting that the top three categories are the same at each educational level. However, the importance of "Future/Job" as a motivating factor increases from 3rd place (middle school) to 2nd place (high school) to 1st place (college/university). This confirms our suspicion that students become more and more career-focused as they progress academically. Once again, it is important to point out that there are multiple response categories that could be grouped into the larger category of "family and friends." However, though achieving good grades is not the most frequent motivator at any of the educational levels, neither is it irrelevant.

Finally, we used the broad categories discussed earlier for item 21 (teacher, family and friends, future/job/application, grades, intrinsic) to create subsamples at each educational level and for each individual school site. In some cases, the resulting subsample sizes were quite small, so we will only highlight cases where the subsample mean was at least 1.0 higher or lower than the mean of the combined sample, indicating a mean response that was at least one category different from the total group. Figure 6 provides a summary of these findings. The following abbreviations are used: IN-MS (Indiana Public Middle School), IL-MS (Illinois Public Middle School), P-MS (Illinois Private Middle School), P-HS (Texas Private High School), IL-HS (Illinois Public High School), U (Midwest Public University), P-U (Midwest Private University), P-C (Midwest Private College). Items left blank indicate an absence of subsamples with responses outside of the mean.

Based upon the table in Figure 6, several trends emerge. First, students who are motivated by intrinsic factors tend to provide more optimal responses. In this case, optimal means higher values for the positively-worded items and lower values for the negatively-worded items. Notice that all

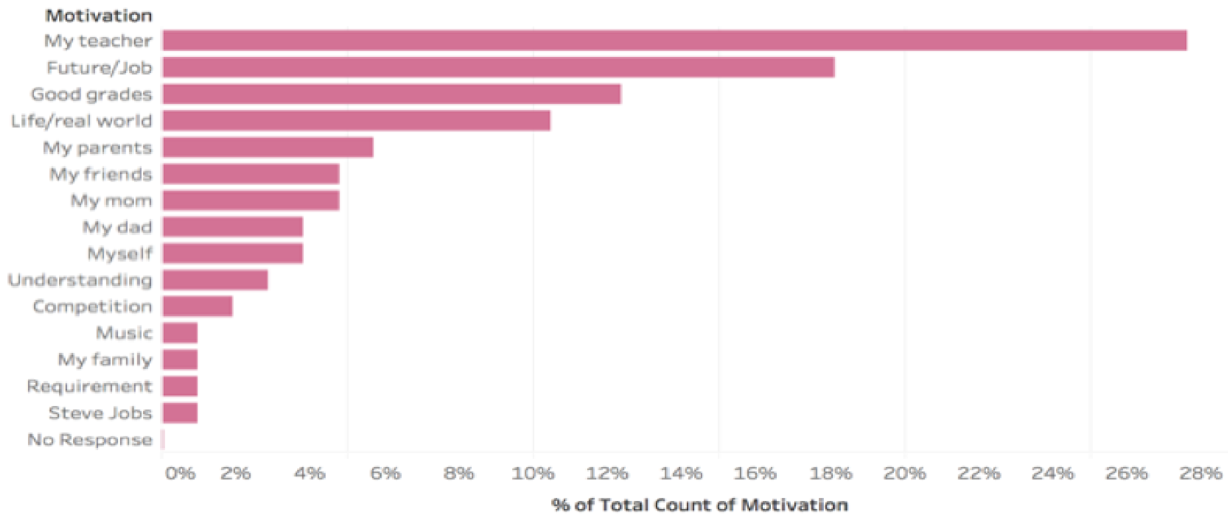

Figure 4: Summary of responses for item 21 at the High School Level

three middle school samples and the public university sample appear multiple times in the table for which those "intrinsically motivated" have unusually high means (or unusually low means for the negatively-stated items). Second, students who identify teachers as the key motivational factor exhibit more optimal means for at least one school subsample at each educational level. The exception to this finding was the public university subsample for which those indicating "teachers" provided less optimal responses. Third, the subsample from the Illinois public school typically provided more optimal responses whereas the subsample from the public university typically provided less optimal responses. Finally, with one exception for item 7, students indicating "grades" as the primary motivational factor tended to exhibit less optimal responses.

5 Conclusions

Based upon the results presented in the previous section, we draw several important conclusions. Recall that we originally hoped to provide insight on the following questions:

1. What similarities and differences exist among the primary motivation factor to learn mathematics for students at various grade levels?
2. What is the preponderance of intrinsic versus extrinsic motivation factors for these students?
3. Which groups or subgroups demonstrate unusually high or low Likert scale responses for specific items, and what do these results say about how these students approach mathematics?

First, related to the second research question, there is a relative paucity of students at all three grade levels who claim to be motivated by intrinsic factors. At the same time, those students who are intrinsically motivated tend to give the most optimal responses for nearly every item in the survey. For teachers, it may prove useful to highlight intrinsic reasons to study mathematics and to identify those students who find this factor most helpful and who may benefit from differentiated instruction that prompts them to dig deeper into mathematical topics.

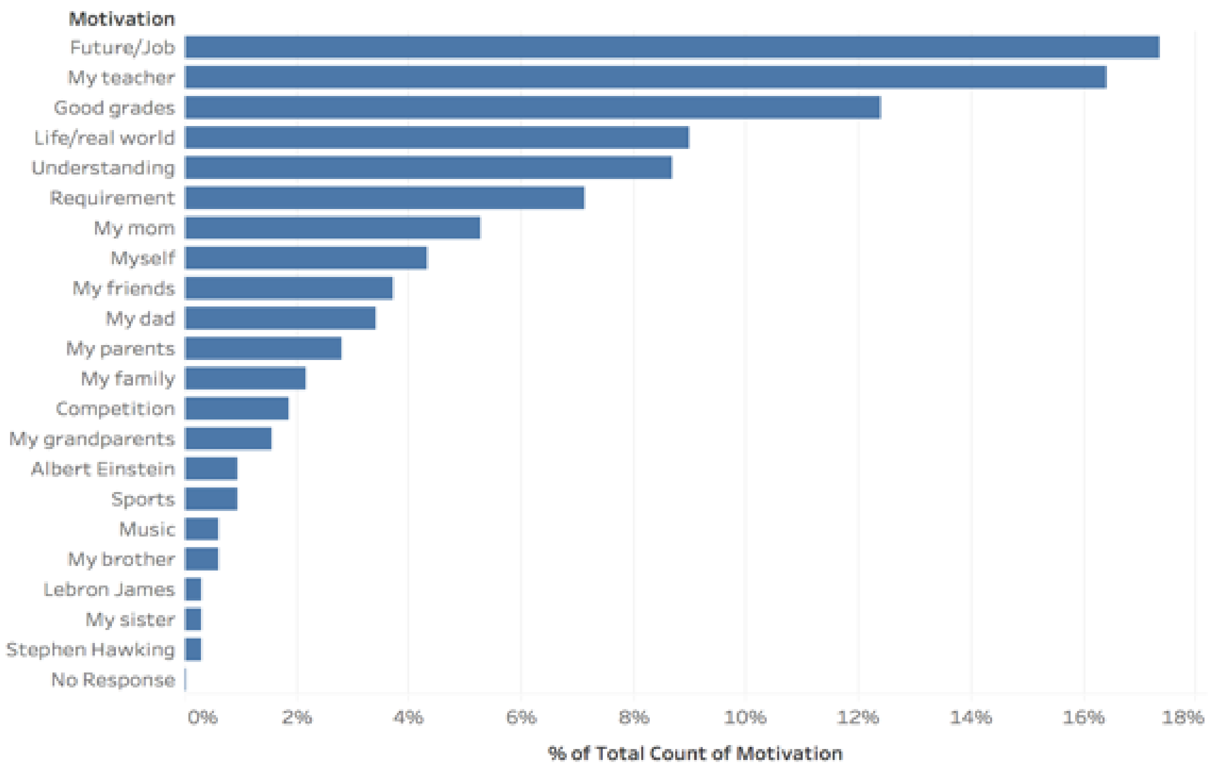

Figure 5: Summary of responses for item 21 at the College/University Level

A second similar theme relates to the third research question and emerged from the subsample of college and university students who indicated a mathematics or mathematics education major. While this result is hardly surprising, it does remind college and university mathematics professors that these students often select such a major because of positive experiences in the mathematics classroom over multiple years. Efforts to excite students at the middle grades, whether through enrichment tasks, local competitions, or other initiatives, often bear fruit later at the college and university levels. A related theme is the consistently less optimal responses given by the subsample of college and university students who indicated an elementary education major. This result confirms other studies (e.g. Vinson, 2001; Uusimaki and Nason, 2004; Malinsky, Ross, Pannells, and McJunkin, 2006) that have documented math anxiety within this group and underscores the need to help these future teachers to overcome their negative feelings towards mathematics to avoid perpetuating these attitudes to future generations of students. It is interesting that the levels of anxiety were actually lower for the middle school students in this sample, although the impact of a few middle school teachers with both deep content knowledge and the ability to support learners is probably relevant.

A third conclusion relates to the first research question and emerges from the finding that teachers, along with the combined category of family and friends, are consistently primary sources of motivation for students, especially at the middle school and high school levels. This serves to remind those of us who teach at these levels, or perhaps those of us who help to prepare future teachers for these grade levels, of the key role that classroom teachers play in motivating students to persist and achieve in mathematics. On a related matter, the regular communication between teachers and parents or guardians, whether during a face-to-face conference, a phone call, or an exchange of written communications, serves as a critical moment in the overall effort to keep students motivated

Item Number	Combined sample means	Unusually high subsample means	Unusually low subsample means
1 Enjoy math	3.4	IN-MS "Intrinsic" (4.5) P-C "Teachers" (4.6)	U "Grades" (2.0)
2 Like to solve math problems	3.4	P-C "Teachers" (4.5)	U "Future Job Applications" (2.4)
3 Really like math	3.2	IL-MS "Teachers" (4.3) IL-HS "Teachers" (4.3) IN-MS "Intrinsic" (4.3) P-C "Teachers" (4.5)	U "Future Job Applications" (2.0)
4 Happiest when in math class	2.7	IL-MS "Teachers" (4.1) IL-MS "Family and Friends" (3.9) IL-MS "Future Job Applications" (3.7) IL-MS "Intrinsic" (3.7) P-MS "Intrinsic" (4.0) IN-MS "Intrinsic" (3.8) P-C "Teachers" (3.9)	
5 Math is interesting	3.5	P-C "Teachers" (4.5)	U "Future Job Applications" (1.9) U "Grades" (2.0)
6 Studying math makes me nervous	2.8	**U "Future Job Application" (3.9)***	**IN-MS "Intrinsic" (1.8)**
7 Always under strain in math class	2.6		**P-MS "Future Job Application" (1.8)** **P-MS "Grades" (1.8)** **IN-MS "Intrinsic" (1.5)**
8 Thinking about math makes nervous	2.1		
9 Always confused in math class	2.6	**IN-MS "Grades" (3.9)**	**P-MS "Intrinsic" (1.5)**
10 Insecure when attempting math	2.5	**IN-MS "Grades" (3.5)**	None
11 Math is worthwhile	3.9		U "Teachers" (2.8)
12 Math is important in everyday life	3.9		
13 Math is important subject to study	3.8		
14 Math is important for future	3.7		IL-MS "Intrinsic" (2.0)
15 Math background helps me in life	4.0		
16 Getting good math grades motivates me	4.0		U "Teachers" (2.8)
17 Enjoy math reading	2.4	IL-MS "Future Job Application" (3.7) IL-HS "Teachers" (3.7)	
18 People motivate me to learn math	3.1	U "Intrinsic" (4.4)	
19 Math connections motivate me	3.4		U "Teachers" (2.3)
20 Difficult math motivates me	2.9	P-MS "Intrinsic" (4.8) U "Intrinsic" (4.2)	

Figure 6: Unusually high or low subsample means
∗ For items 6-10, the entries are in **boldface** to remind the reader that these are "negatively-stated," meaning that lower values are more optimal.

to continue learning mathematics. Taken together, these groups of adults constitute the majority of the sources of motivation for both middle school and high school students.

Finally, and also related to the first research question, it is interesting to note the relative importance of mathematics in future careers, everyday life activities, and patterns in the surrounding world. The fact that these connections are a major source of motivation for students at all educational levels should prompt teachers to continue looking for real-life applications in the learning activities they create for students. Indeed, more students are likely to pursue careers in science, technology, engineering, and mathematics (STEM), or perhaps also art (expanding the acronym to STEAM), if teachers make a conscious effort to help students discover the myriad connections among the disciplines.

6 Limitations of the Study

Although our research includes multiple schools at three different educational levels, we must acknowledge several limitations of the study. First, we used a convenience sample rather than a random sample, so our conclusions are only generalizable to the extent that our selected schools form a combined sample that is representative of typical students at these educational levels. Second, we provide a descriptive snapshot for these students rather than a longitudinal study. Although it appears that some factors, such as the role of a future career, appear to become more important as a student progresses academically, it would be more compelling to survey the same group of students at multiple points along their academic journey. Finally, a longer survey with multiple items linked to each potential motivational factor would better address validity and reliability concerns.

7 Implications for Future Research

After completing this research study, several potential avenues for future research have emerged. First, several colleagues in the Association of Christians in the Mathematical Sciences have responded favorably to a recent overview of our study and have asked to extend the data collection to their own colleges and universities. It is possible that an updated version of this research may be presented that encompasses this larger set of survey data. Second, the finding that the importance of the future uses of mathematics in a career or everyday life appears to increase as one progresses from middle school to high school to college might lead to two potential extensions: a longitudinal study might be able to document this growth over time; a study of adults in the workplace might document an even higher importance placed upon the applicability of mathematics in various careers and in other life activities. Third, a future survey of high school students might allow the comparison of senior students enrolled in advanced placement mathematics courses such as calculus and statistics with other seniors who are not enrolled in a mathematics course. Any of these future studies could deepen our understanding of the different factors that both motivate people to learn mathematics as well as to think mathematically in settings outside the classroom.

8 Summary

We entered into this research study based upon the motivation of a single undergraduate mathematics education major. Our findings point to a complex web of factors which, taken as a totality, help to motivate middle school, high school, and college or university students to study mathematics, to persist at solving mathematical problems, and to pursue careers that make use of mathematical reasoning.

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9 Appendix

(For Items 1-20, choose strongly agree, agree, neutral, disagree, or strongly disagree):

1. I have usually enjoyed studying mathematics in school
2. I like to solve new problems in mathematics
3. I really like mathematics
4. I am happier in mathematics class than in any other class
5. Mathematics is a very interesting subject
6. Studying mathematics makes me feel nervous
7. I am always under a terrible strain in mathematics class
8. It makes me nervous to even think about having to do a mathematics problem
9. I always feel confused in mathematics class
10. I feel a sense of insecurity when attempting mathematics
11. Mathematics is a very worthwhile and necessary subject
12. Mathematics is important in everyday life
13. Mathematics is one of the most important subjects for people to study
14. Mathematics lessons would be very helpful no matter what I decide to study in the future
15. A strong mathematics background could help me in my life
16. Getting good grades motivate me to do better in mathematics
17. I enjoy reading about mathematics (non-textbook readings)
18. The people around me motivate me to do better at mathematics
19. Having mathematics connect to other content areas and the world around me, motivates me to learn mathematics
20. I am motivated by how difficult math is
21. (free response): What is the one person, place, or thing that motivates you to learn mathematics?

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