

Cultivating **STEM**

Why West Michigan college students select majors in
Science, Technology, Engineering and Mathematics



A Report on the 2008
West Michigan College Student
Major Selection Survey



CENTER FOR
SOCIAL RESEARCH

A CENTER OF CALVIN COLLEGE

Cultivating STEM

**Why West Michigan college students
select majors in Science, Technology,
Engineering and Mathematics**

*A report on the
2008 West Michigan College Student
Major Selection Survey*

Neil Carlson and Amanda Stek

Foreword by Gordon Van Harn

May 2009

Prepared for the Van Andel Education Institute

This report is based on research conducted by the Calvin College Center for Social Research under contract to the Van Andel Education Institute (www.vai.org/education.aspx).

ISBN: 978-09-727260-4-7



The Center for Social Research at Calvin College aims to serve as a catalyst for scholarly research in the social sciences in the academy, church, and society. The Center undertakes collaborative and community-based research; we are committed to the development of faculty and students at Calvin College and to service in West Michigan and beyond.

Research Team

Calvin College Center for Social Research

James M. Penning, Ph.D., Director
Neil Carlson, Ph.D., Assistant Director
Amanda Stek, Research Associate
Kathy Bardolph, Administrative Assistant
Michael Evans-Totoe, Research Assistant
Tyler Greenway, Research Assistant
Brian Odegaard, Research Assistant
Leia Vos, Research Assistant
Nikole Voss, Research Assistant

Van Andel Education Institute

Gordon L. Van Harn, Ph.D., Director (through 2008)
Steven Triezenberg, Ph.D., Director (as of 2009)
Marcia Bishop, M.A., Associate Director

Cover photo: Microscope; © 2007 iStockPhoto.com/Jan Rysavy
Cover design and title by Nikole Voss and Brian Odegaard
Overall graphic design, charts and graphs by Neil Carlson

© Copyright: 2009 Calvin College Center for Social Research, all rights reserved.

Contact Information

Calvin College Center for Social Research

Mailing: 3201 Burton St. SE
Grand Rapids, MI 49546
Street: 2041 Raybrook St. SE, Suite 103
Grand Rapids, MI 49546
Phone: #616-526-7799
Fax: #616-526-7683
Email: csr@calvin.edu
Web: <http://www.calvin.edu/csr>

Table of Contents

Executive Summary.....	1
Foreword.....	3
Introduction	4
Prior Research.....	4
Existing studies and our research design	4
Is there a crisis in STEM? Emphasizing the demand side	6
Demand-side factors in our survey data	7
STEM Classification and Distribution	9
Influential factors in major selection by STEM group.....	11
Factors discouraging selection of a STEM major.....	14
Women and choosing STEM.....	16
Women and NOT choosing STEM	20
Perseverance, employment and achievement	22
Finishing a degree	23
Getting a good career GPA	24
Finding work	24
Achieving greatness	25
Summary of perseverance findings	25
Students have their say in comments.....	25
Comment Questions	26
Themes in comments	26
Factors influencing major choice – “Other, specify” responses	27
Factors discouraging a STEM major – “Other, Specify” responses	28
Optional Comments	28
How to recruit more STEM majors	30
Appendix A: STEM status of CIP codes	31
Appendix B: Student comments grouped by theme.....	32
“Other: Specify” volunteered responses on factors influential in the choice of a major	32
“Other: Specify” volunteered responses on factors discouraging choice of a STEM major	36
Optional Overall Comments	39
References	54

Executive Summary

The Van Andel Education Institute (VAEI) is “dedicated to strengthening science education and preparing and motivating individuals to pursue science or science-related professions.” At the VAEI’s request, and with significant survey design participation from VAEI staff, the Calvin College Center for Social Research designed and fielded an online survey of college juniors in November and December 2008. With official school support, the resulting West Michigan College Student Major Selection Survey included 888 juniors from four West Michigan colleges and universities: Aquinas College, Calvin College, Grand Valley State University, and Hope College. The overall response rate was 32.6 percent. Throughout this analysis, data are weighted by school and gender to represent the actual distribution of all juniors at all four schools.

The brief questionnaire asked students to:

1. confirm their major field, using broad categories set by the federal government; these categories were then used to identify majors in science, technology, engineering or mathematics (STEM);
2. select factors that influenced their choice of major;
3. [if not STEM majors:] indicate whether they had ever seriously considered a STEM major and select factors that discouraged such a choice;
4. judge their likely perseverance and achievement in their chosen field;
5. comment on the survey and related topics.

While the survey does not have a strong design link to existing literature in the field, it does connect to themes in the literature. One important theme emphasizes the persistent focus of STEM recruitment efforts on education and “supply-side” tactics, to the neglect of “demand-side” considerations such as reducing years of STEM schooling required and offering competitive pay for STEM work. These demand-side themes figure prominently in the student respondents’ multiple-choice selections and comments.

Given VAEI’s direct involvement in the medical field, our definition of STEM includes the health professions, an inclusion not always made in other studies of STEM recruitment and retention. 13 percent of our respondents were in the health professions and 26 percent were in other STEM fields. Another 9 percent of respondents had seriously considered a STEM field before selecting a non-STEM major. Had these been successfully recruited, they would be enough to increase total STEM enrollment by more than one student for every five now enrolled. Consistent with other studies, our data shows that West Michigan STEM students are disproportionately male and disproportionately drawn from students with higher grades in high school; but the health professions are disproportionately female and even more skewed toward high grades. (See **Figure 1** on page 10.)

Although demand-side factors such as job availability and earnings potential are important to respondents—markedly more so in the health professions—they do not trump the influence of students’ basic self-concepts. The number one factor driving major choice is the respondents’ perceived “area of natural gifts”; for health professions

students, the opportunity to improve the lives of others ranks highest (see **Figure 2** on page 13). Likewise, the most common themes among comments involve academic interests (what students like to do) and strengths (what students believe they are good at; see **Figure 7** on page 27). Among factors educational institutions can influence directly, internships and work experience were the most frequently cited as influential. Other educational factors like individual teachers and courses, counselors and fairs were infrequently cited.

When we asked about factors that discouraged non-STEM majors from taking a STEM major (see **Figure 3** on page 15), most respondents said they had nothing against STEM, they just liked their chosen field better, or that STEM subjects were “uninteresting” to them (though those who had seriously considered STEM were unlikely to cite this factor). Substantial numbers cited the difficulty of STEM fields. Those who seriously considered STEM were most likely to cite their inability to find a program they liked; cooking up programs that combine multiple fields on the borders of STEM is a prominent theme in the open-ended comments.

We paid special attention to the matter of female representation in STEM fields. Women in STEM fields are: much more likely than men to cite the opportunity to improve the lives of others; somewhat more influenced by job availability; much less concerned about earnings than STEM men, but still more so than average; and more likely than any other group to cite the importance of work experience and internships. (See **Figure 4** on page 17.) Women were also more likely to cite a lack of interest in STEM and the difficulty of STEM fields as reasons not to choose a STEM major (see **Figure 5** on page 21).

In the fall of 2008, West Michigan juniors were generally confident they would finish their degree programs, get good grades, find enduring work in their chosen fields and even accomplish great things in those fields. STEM majors outside the health professions were statistically less likely than others to expect to finish their degrees and achieve good grades. Health professions majors were statistically more likely than others to expect to find work in their fields and to accomplish great things. Women were less likely to expect to find work. (See **Figure 6** on page 22 and **Table 1** on page 24.)

In conclusion, we recommend that VAEI and others interested in science education and increasing STEM recruitment consider the following actions:

1. Focus on self-perception and recognition of personal capacity for and interest in STEM, especially through work experience and internship opportunities. This may necessarily involve increasing opportunities to be “hybrid” majors in STEM and non-STEM fields.
2. Recognize the structural, economic nature of students’ decision processes and work on the demand side, including efforts to reduce schooling time for STEM degrees and increase competitive pay for STEM jobs.
3. Handle recruitment for the health professions as a *sui generis* category that is manifestly unlike the rest of the STEM fields. Current health professions students are especially interested in serving others, in finding work and in higher earnings.

We welcome your comments at csr@calvin.edu and gradschool@vai.org.



Foreword

During the last decade, scientists, business executives, and government officials have published reports about their concern over the shortage of highly qualified scientists, engineers, and mathematicians. These reports note the importance of intellectual capital and creativity for the United States to maintain a primary leadership position in science and the global economy.

While there may be multiple reasons for the perceived shortage of science, technology, engineering, and mathematics (STEM) professionals, the published reports have all focused on improvement of science education as one part of a national solution. The performance of U.S. students on international achievement tests and the general lack of science literacy among the citizenry are cited as reasons for this focus on science education.

Since science education at all levels of education is the focus of the Van Andel Education Institute (VAEI), we take the concern over the quality of science education seriously and are committed to contributing to its improvement. National reports are helpful in identifying the challenges, but we also wanted to know more about the state of science education in Western Michigan. In order to improve our knowledge and understanding of this region, VAEI formed a committee of community persons from a three county area to collect information on science education in this area and to determine the need for and feasibility of a regional science education program.

The initial emphasis of the Science Education Committee was on student academic achievement in science, teacher preparation, and supporting instructional resources in the K-12 education sector. While this information was very useful in understanding science instruction, committee members wanted to know more about students, specifically what factors influence student selection of STEM as an area of study in postsecondary education. This information could shape the science instruction and programs that guide students in their choice of a career among the many worthy options available to them.

It was the question of “What factors influence students in their choice of a major area of study?” that led us to engage the Center for Social Research at Calvin College to survey local college students regarding their choice of major. We are grateful for the leadership of Neil Carlson in conducting this study for VAEI.

Gordon J. Van Harn, Director
Van Andel Education Institute

Introduction

At the request of the Van Andel Education Institute (VAEI), and with kind cooperation of administrators at four local colleges and universities, the Calvin College Center for Social Research (CSR) fielded the West Michigan College Student Major Selection Survey in November and December of 2008. The survey's purpose was to prioritize factors influencing college students' choice of major, especially majors in science, technology, engineering and mathematics ("STEM" majors). The survey was conducted entirely online. Over 2,700 college juniors were invited by electronic mail from Aquinas College, Calvin College, Grand Valley State University (GVSU) and Hope College, with lists provided by these institutions' Registrar's offices. We received 888 valid responses, a 32.6 percent response rate; rates ranged from a low of 15.5 percent at GVSU to a high of 47.5 percent at Hope.

For these analyses, the survey data have been weighted to approximate a representative sample, by school and sex, of all juniors from these four schools. This results primarily in reducing the weight of all respondents from Aquinas, Calvin, and Hope, especially females (each Hope female counts as just 0.3 respondents), and increasing the weight of GVSU students, especially males (each GVSU male counts as 7.7 respondents). We have not found any circumstances under which these weights radically transform our conclusions, and they permit greater generalization of the conclusions across West Michigan's schools.

The most important discovery we've made is that health professions majors differ systematically in the factors they report influenced their major choice. A second important recognition is that our analysis needs to focus on what characterizes those who seriously considered a major in STEM but didn't choose one, and how they might better be recruited into STEM. This group is sometimes more similar to STEM majors than to non-STEM majors, suggesting some potential paths to recruiting them.

Prior Research

Existing studies and our research design

The West Michigan College Student Major Selection Survey was designed primarily in response to the particular and urgent interests of the Van Andel Education Institute (VAEI). VAEI has practical concerns about what kinds of programs and interventions would increase recruitment and retention of STEM students at West Michigan schools. While wide reading and experience inspired the survey design, it did not emerge from an explicit link to particular theoretical literature. Such independent design has advantages and disadvantages.

One obvious **disadvantage** is that we do not always have comparable data in a comparable setting to facilitate an analytical connection with other studies. One study (Adelman 1998) identified a linkage between selection of STEM majors and exposure to an advanced mathematics course in high school. We did not collect such specific data about course experiences, though we did ask students whether a particular high school teacher or course was influential. Adelman's and other studies (for example, Zhang *et al.* 2004) also draw on longitudinal data, tracking students over time and comparing early

dispositions and attributes to later achievements; our study depends on a single cross-sectional snapshot.

Such studies are usually focused on retention and graduation rates rather than recruitment (though for engineering students, major selection at the junior year is tantamount to retention in the program, since students start so early). We are interested in retention and achievement, but our design focus on college juniors limits us to requesting students' beliefs about their future degree completion and work achievement rather than actual measures of these things.

A key **advantage** of our independent survey development process is a relatively unique, succinct design that asks college juniors *directly* for their perceptions of factors that influenced their final choice of major at a time in the students' life when their choice is usually both firmly and yet recently made. Much literature in the field depends on indirect inference of causality from associations among items from general purpose surveys, particularly the Cooperative Institutional Research Program (CIRP) surveys coordinated by the Higher Education Research Institute (HERI), which collects data from first-year students and seniors. These surveys observe early disposition and late achievement but are not as directly pointed at the mid-college-career process of major selection. Such studies may find that a particular reported attribute is associated with selection of a STEM major, but students themselves have not often asked whether they perceived an attribute or experience to be influential.

For example, Nicholls *et al.* (2006)—who are concerned with female and minority underrepresentation in STEM fields—cite numerous studies using CIRP and conducted their own study on 12,000 CIRP responses from first-year college students at the University of Pittsburgh and Texas A&M. Their dependent variable is the students' intended majors, but these intentions may be subject to systematic change prior to actual major selection. For example, 9.1 percent of the West Michigan respondents (12.6 percent prior to weighting) reported that they “seriously considered” a STEM major before making their final selection. Had they all selected STEM, the result would be a 24 percent increase in the size of the STEM group! When weighted, these “seriously considered STEM” students are more than two-thirds women.

Nicholls *et al.* found, unsurprisingly, that “the most consistent variables for identifying students oriented towards STEM vs. non-STEM measure quantitative academic skills and qualitative motivations,” (Nicholls *et al.* 2006, 8) where the former include self-reported math ability, computer skills and general academic ability. The latter include a desire to contribute to science (perhaps not so much a cause as a symptom of an affinity for STEM), a desire to influence social values (negatively associated with intention to take a STEM major), and a desire to train for a specific career. Our survey echoes these categories, but not verbatim.

Raw intellectual or academic ability, measured with test scores and grade point averages (GPA), are consistently cited predictors for successful completion of STEM majors (for example, Mendez *et al.* 2008, and their citations). We requested self-reported high-school and college GPAs to provide a comparable basis for analysis.

Is there a crisis in STEM? Emphasizing the demand side

An important tone-setting publication for our discussion is the RAND Corporation's conference proceedings titled "The U.S. Scientific and Technical Workforce: Improving Data for Decisionmaking" (RAND Corporation 2003). The conference participants were concerned with what the nation needs to do, in terms of data systems and research design, to ascertain whether or not there is in fact a need for more STEM graduates in the workforce.

One conference participant documented the historical ebb and flow of crisis talk and "Chicken Little" doomsday proclamations about American science and technology education, from Sputnik to the dot-com boom (Teitelbaum 2003). Many of the pronouncements of doom for American science have later been revealed as methodologically weak or completely dishonest crisis-mongering by entities with conflicts of interest, including the National Science Foundation itself (seeking to persuade Congress to increase its own budget) and the Information Technology Association of America (seeking to persuade Congress to authorize more "H1B" visas for foreign talent willing to work for less than most Americans). Teitelbaum notes that a RAND study in 2003 "largely discredits the case being made for labor shortages" (13). In the natural sciences, "numerous reports by leading scientists have been pointing to increasingly unattractive career prospects for newly-minted PhDs" (14). Overall, "the available data show sufficient numbers or even surpluses of highly qualified candidates with extensive postgraduate education" (14). Surges of unemployment for scientists, engineers and technicians are not unusual, particularly in times like the present.

In a passage worthy of extended quotation, Teitelbaum argues:

Not only are claims of current or future shortages inconsistent with all available quantitative evidence, but alas many of the solutions proposed to deal with the putative "crisis" are profoundly misdirected. The most popular proposed solutions seem to focus mainly on the supply side, urging action to increase the numbers of U.S. students pursuing degrees in science and engineering. Recommendations often include calls for reform of the U.S. elementary and secondary education systems, especially inadequacies in science and mathematics; informational efforts to promote knowledge of such careers among U.S. secondary school students and of the science and math prerequisites required to pursue them at university level; financial and other incentives to increase interest in such fields among U.S. students; and increases in the number of "role models" in science and engineering fields for women and underrepresented minorities. Other commentators, apparently more pessimistic about the abilities of U.S. students, recommend increasing the numbers of students or workers from abroad to meet the needs of the U.S. economy.

This focus on supply to the virtual exclusion of demand is not warranted. However desirable many of these proposals may be on other grounds, they are unlikely to be very effective in attracting U.S. students to careers in science and engineering unless employment in these fields is sufficiently attractive to justify the large personal investments needed to enter them. Surprisingly enough, it is far from common to hear this rather obvious point raised in public discussions of the subject. To put the matter more succinctly, those who are concerned about whether the production of U.S. scientists and engineers is sufficient for national needs must pay serious attention to

whether careers in science and engineering are attractive relative to other career opportunities available to American students. And yet little such attention has been forthcoming in recent years. (Teitelbaum 2003, 15-6)

Teitelbaum goes on to note the ever-increasing length of the graduate education necessary to obtain degrees and earn research funding; “Unsurprisingly, the idea of spending nine to twelve years in postbaccalaureate studies [in the biosciences, an extreme example] before one is qualified for real job may be unattractive to substantial numbers of would-be young scientists” (16). Income levels are another issue; one study Teitelbaum reports showed an average lifetime earnings differential of \$2 million between MBAs and bioscientists.

This study takes a small step toward addressing Teitelbaum’s call for a look at competition between STEM and non-STEM fields and considering questions of supply and demand. We asked non-STEM majors if they ever considered a STEM major; 15 percent of them had “seriously” considered STEM; another 18 percent considered STEM, but not seriously.¹ We also asked about attraction to STEM due to job availability, earnings levels, and lifestyle attractions, all “demand-side” factors Teitelbaum mentions.

Demand-side factors in our survey data

A first look at our qualitative and quantitative findings adds some weight to Teitelbaum’s arguments. In open-ended comments,² our student respondents do not perceive a labor shortage crisis in the STEM job market; several complained in their comments about being uncomfortable and angry about efforts to persuade them to become STEM majors. Of 46 respondents who offered comments we coded as mentioning ideas related to the job market as a theme, just 11 were STEM majors, and only one of those said anything suggesting STEM is attractive because of the ease of finding work in the area.

These three non-STEM majors see STEM majors as dead ends. The first quote could be an abstract of Teitelbaum’s argument, explicitly describing the STEM labor market as a glut, not a shortage:

I have 6 years of natural resources experience, and I have found that anyone can get a natural science degree and be successful, which is why the wages are so low. Also jobs in the natural sciences are very competitive, which is very unsettling because your position can be easily replaced at any time due to the large applicant pool. For one position I held, I was one of 324 applicants, and on my first day of work they showed me the stack of applications to let me know how easily I could lose my job and not be missed. The field also requires a large amount of personal sacrifice of time and talent, which is a huge drain on family relations. The largest determining factor why I chose to get out of the natural sciences field was because the field is too competitive and unfortunately, having a 'rewarding job' does not pay the mortgage.

¹ As Teitelbaum notes (2003, 18), this fact alone should exonerate K-12 educators of any accusation that they fail to interest students in STEM—hypothetically, if STEM majors could attract all of these prospects, the number of STEM majors in our four West Michigan schools would increase 54 percent.

² We provide greater detail in our analysis of comments beginning on page 24 and document all the students’ comments in Appendix B on page 30.

I really enjoy mathematics, but have no idea what I would do with a career in math. The medical field has always been my number one interest.

I spent a great amount of time deciding what to major in. I wanted something I felt that I would stay interested in for the long term, something that would be important and meaningful, and that wasn't too narrowly defined so as to limit my options for future employment and region of living.

This respondent left chemistry for communications to “open up options” for future careers:

I majored in chemistry for a year and because I still did not know what I wanted to do for a career, decided it was too limiting. Majoring in communications opens up many options, and as good as I was at chemistry, I am even better in this subject area. My previous science experience also gives me an advantage in the research area of communications.

This non-STEM respondent perceived a labor shortage in STEM, but saw a more important shortage in the supply of clergy:

I was a biology/pre-med major, and I genuinely enjoyed it and was good at it. I did not like chemistry, though, and did not want to go into medicine very much, so when I was in a position where I had to choose between discontinuing chemistry or losing my academic scholarship I opted for the scholarship. I enjoy Greek and Religion, so I opted for those because they are good preparation for seminary and the church, like STEM fields, is running short of educated leaders right now.

Here are some more illustrative excerpts from students critical of the survey's focus on STEM:

I'm wondering why you are so interested in STEM majors, because I think Michigan's extreme focus on math in high school and now also in college is unfair to those who are not smart in that area.

I find that the pressure to choose a major during high school so as to apply to colleges or universities that offer the best opportunities for that field of study places unrealistic expectations on young people who have not yet had the experience they need to discern what field of study best encompasses their interests and utilizes their skills. ... I also believe that gifted students may be pressured into fields like premed during high school simply because they have the ability to compete in this type of field and it is something 'smart people' do, rather than because they truly have interest and passion for this type of work. Fields in the arts and humanities are considered less rigorous. Education, a field that requires high levels of creativity, organization, flexibility, and knowledge is often touted as a last choice for those who might not 'cut it' in other programs or who aren't sure what they want to do. I disagree with this implied relationship between intelligence and 'STEM' fields. STEM requires one type of intelligence. Genius musicianship or insightful historic[al] research requires another.

In our quantitative survey data, STEM majors do cite demand-side factors at slightly greater rates: STEM majors were more likely than others to cite potential earnings and job availability as reasons for choosing their major, but the differences are really substantial only for the health professions. See page 11 and following for more detail.

The bottom line is that STEM recruitment is probably most responsive to long-term, structural influences that have more to do with broad economic and cultural trends than with local programmatic changes or individual experiences; the latter are most effective when they are sustained (internships and work experience) rather than transient (job fairs, academic counseling experiences, etc.). STEM recruitment will remain constrained as long as STEM programs are in fact more difficult on average and as long as organizations are not believed to be hiring people *en masse* for STEM jobs.

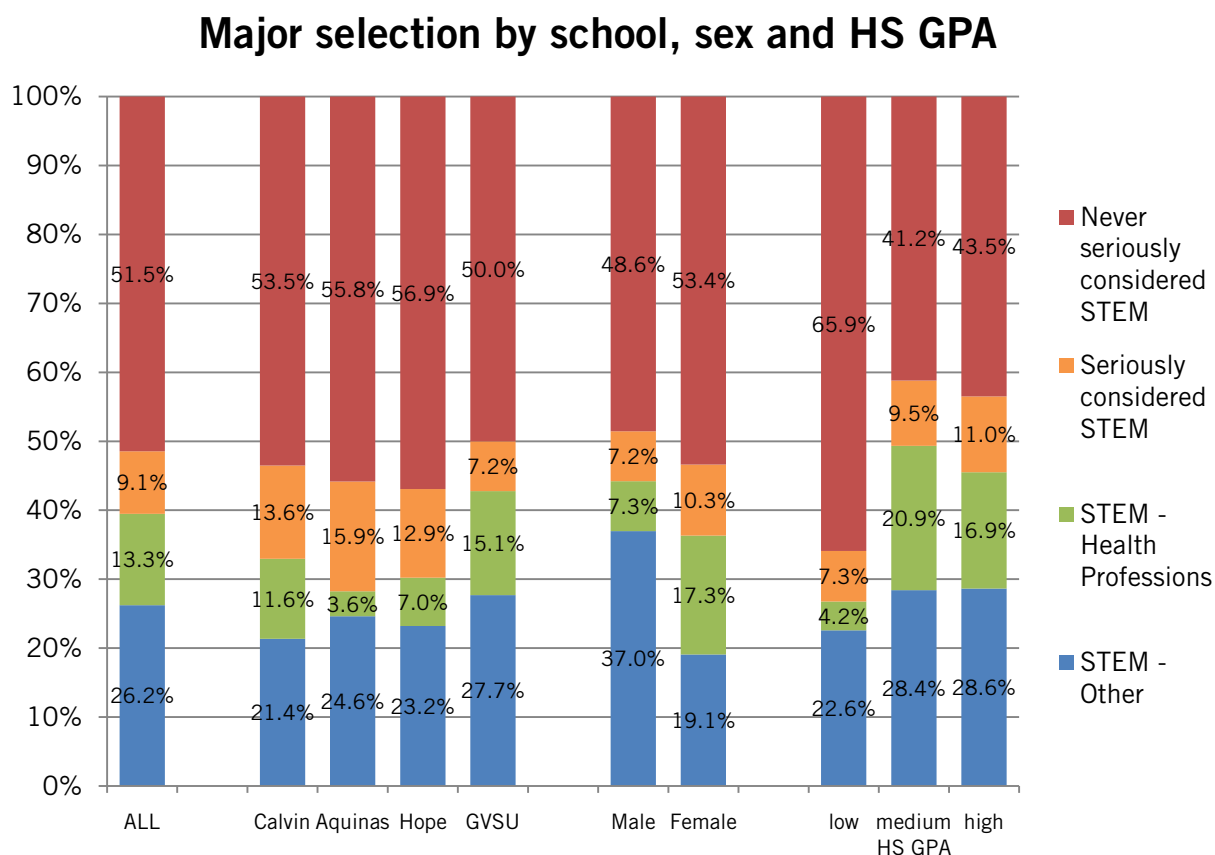
STEM Classification and Distribution

Using institutional data, each responding student was shown the federal Classification of Instructional Program (CIP2000) heading³ for the major on record with their school and was given an opportunity to correct the heading in the event their major had recently changed. These codes were classified as “STEM” or “non-STEM” (see Appendix A on page 31 for a list). This process resulted in 257 STEM cases. Non-STEM respondents were then introduced to the STEM acronym (“science, technology, engineering and mathematics”) and asked if they had ever considered a STEM major. Those who selected “Yes, and I believe my current major ought to be classified as a STEM major” (34 cases) were given the benefit of the doubt and included in the STEM group, for a total of 291 STEM cases.

We then further divided the STEM and non-STEM groups each into two smaller groups. Among STEM majors, those from the CIP “Health Professions” code are broken out (95 cases); among non-STEM majors, those who said they “seriously considered” at STEM major (111 cases) were broken out.

³ The CIP codes are part of the Integrated Postsecondary Education System (IPEDS) and are available from the National Center for Education Statistics (NCES) at <http://nces.ed.gov/pubs2002/cip2000/>.

Figure 1 Major selection type by college, sex and high school GPA



Source: 2008 West Michigan College Student Major Selection Survey

Figure 1 provides some background on these four STEM-selection categories. Looking at the leftmost column, you will see that health professions majors form 13.3 percent of the overall sample, about a third of the entire STEM major group. GVSU has the largest proportion of responding health professions majors (15.1 percent), while Aquinas has the smallest (3.6 percent). Females are more than twice as likely as men to join the health professions (17.3 percent of women versus 7.3 percent of men), while males are about twice as likely as women to select a major in the rest of the STEM universe.

While other STEM majors make up relatively similar proportions of students with low, medium and high GPAs in high school (about 28 percent of medium- and high-GPA students, but just 22.6 percent of low-GPA students), health professions majors have the highest average high school GPAs and are much more likely to be found among the middle and top thirds of students by HS GPA (just 4.2 percent of low GPA students, versus 20.9 percent of medium and 16.9 percent of high). In summary, the health professions third of the STEM population hails disproportionately from GVSU and Calvin and has a disproportionately female and higher-GPA profile.

Figure 1 also shows that STEM's opportunity to recruit greater numbers is significant, with 9.1 percent of all respondents indicating they seriously considered a STEM major but did not choose one. If just half of these “seriously considered STEM” students could be recruited and retained, it would represent a 11.5 percent increase in the number of

STEM cases.⁴ This key group is largest at the school with the lowest proportion of STEM majors (Aquinas, 15.9 percent) and smallest (7.2 percent) at GVSU, where there is the largest proportion of STEM respondents. Women are more likely than men to consider and reject STEM (10.3 percent vs. 7.2 percent), and the highest GPA students are more likely to consider and reject STEM than lower categories (11.0 percent of high HS GPAs versus 9.5 percent of medium and 7.3 percent of low).

Influential factors in major selection by STEM group

Our survey respondents were asked, “Please check two to five factors below which were influential in your choice of a college major.” They were offered this list of 15 options, in random order, with instructions to check all that apply:

- A K-12 (elementary, middle or high school) teacher or course
- A college professor or course
- A counselor or advisor
- The availability of jobs in the field
- A parent's or relative's advice or example
- A specific role model's example
- Current societal need for people to work in the field
- An extracurricular school activity, e.g., club, science fair
- A career fair
- An internship, job shadow, or work experience
- Your opportunity to improve the lives of others
- Your area of natural gifts
- Your opportunity to make a name for yourself
- Your potential earnings in the field
- Other, specify

We developed a statistical model of the probability a given box was checked by a given STEM or non-STEM group, while controlling for the sex, race (white or nonwhite), residence (West Michigan or not) and high-school GPA (in tenths from 1.8 to 4.0) of the respondent. The results are similar to ordinary figures, but these models effectively compare apples to apples—they show how STEM majors compare to non-STEM majors who are otherwise identical in demographics and academic potential.

Figure 2 (on page 13) may require some orientation for the reader, but it is a powerful visualization tool once the principle is grasped. First, this chart’s data is based not

⁴ This calculation is $(9.1 \text{ percent “seriously considered”} / (13.3 \text{ percent STEM Health} + 26.2 \text{ percent STEM Other})) / 2 = 11.5 \text{ percent}$.

directly on frequencies (how many respondents checked which option), but rather on predicted probabilities from a statistical model, where each dot shows what percentage of the indicated color-and-symbol group is projected to check the box, given that sex, region of residence and high school GPA are held at their average or “typical” values (60 percent female, 9.8 percent nonwhite, 55 percent from West Michigan, 3.67 GPA). In other words, this chart (and its twin in **Figure 3**) guards against the possibility that the STEM-related numbers are spurious due to correlation with GPA, region, race or sex.

The vertical axis of **Figure 2** ranks the fifteen options we offered to respondents by the percentage of all “average” respondents who are predicted to check that option; you'll notice that the black dots decrease monotonically in value from top to bottom, with “Your area of natural gifts” checked most often and “A career fair” checked least often.

Within each row, the colored shapes indicate the four subgroups from **Figure 1**: those who never seriously considered STEM, those who seriously considered it but rejected it, those who chose health professions and those who chose another STEM major. We can immediately see that the STEM and “seriously considered STEM” cases were all less likely than the average to cite “natural gifts” as a choice (they lie to the left of the top black dot labeled 64.8 percent), with health professions least likely to do so (the green cross, 57.6 percent), while non-STEM cases were most likely to do so (the red square, 68.8 percent).⁵ Still, “natural gifts” is a powerful theme across all four groups.

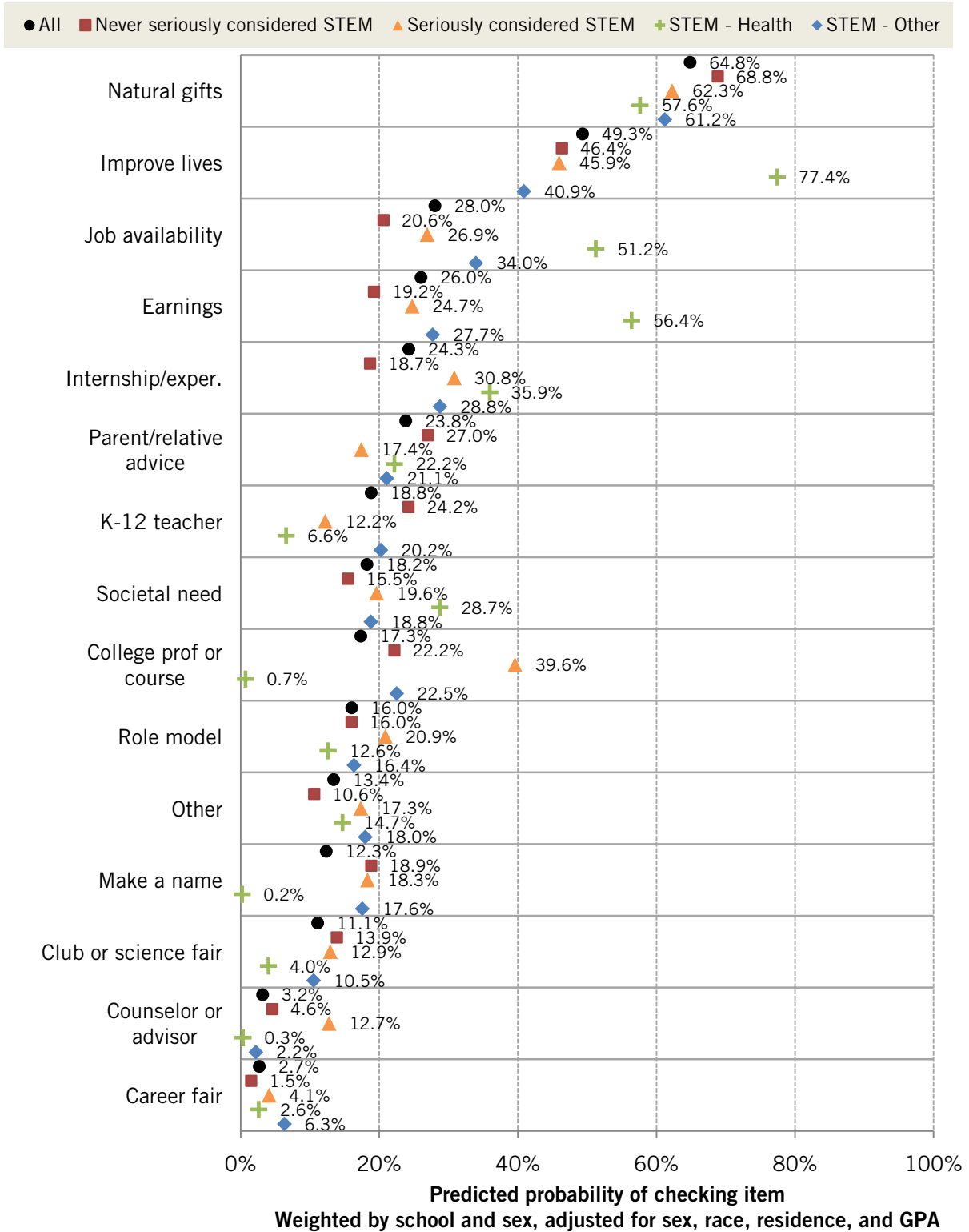
The most notable pattern in **Figure 2** is the unique profile of health professions majors (green crosses). They are much more likely than the average respondent to select “Your opportunity to improve the lives of others” (green cross labeled 77.4 percent in the second “improve lives” row), while the other STEM majors are the least likely (40.9 percent); job availability and earnings (third and fourth rows) are also of greater influence among health professions majors. Internships, job shadows and work experience (fifth row) are also relatively more important to them. Conversely, you'll note that the red-square, never-considered-STEM cases are correspondingly lower than average on all these items. These data provide some support for Teitelbaum's (2003) expectation that perceptions of market demand for STEM majors are important to offset STEM's greater demands on students (see discussion on page 6).

Toward the middle of the chart, we find that the STEM health professions cases were least influenced by a K-12 teacher, most motivated by social need, and credited almost zero influence to a college professor or course. The “seriously considered STEM” cases were unusually likely to cite a college professor or course as an influential factor (yellow triangle labeled 39.6 percent, versus just 17.3 percent overall), suggesting that about four in ten of these potential STEM majors were not so much repelled by STEM as they were “lured away” by an enticing personality or topic in one of the non-STEM disciplines. Finally, it is notable that science fairs and career fairs were infrequently cited by all groups.

⁵ These differences are not “statistically significant,” but this data is not random-sample data, except for GVSU, so handling sampling error is complex. For the most part, this is population data, and “what you see is what you get.”

Figure 2 Factors influential in choice of major

Factors influential in choice of major



Source: 2008 West Michigan College Student Major Selection Survey

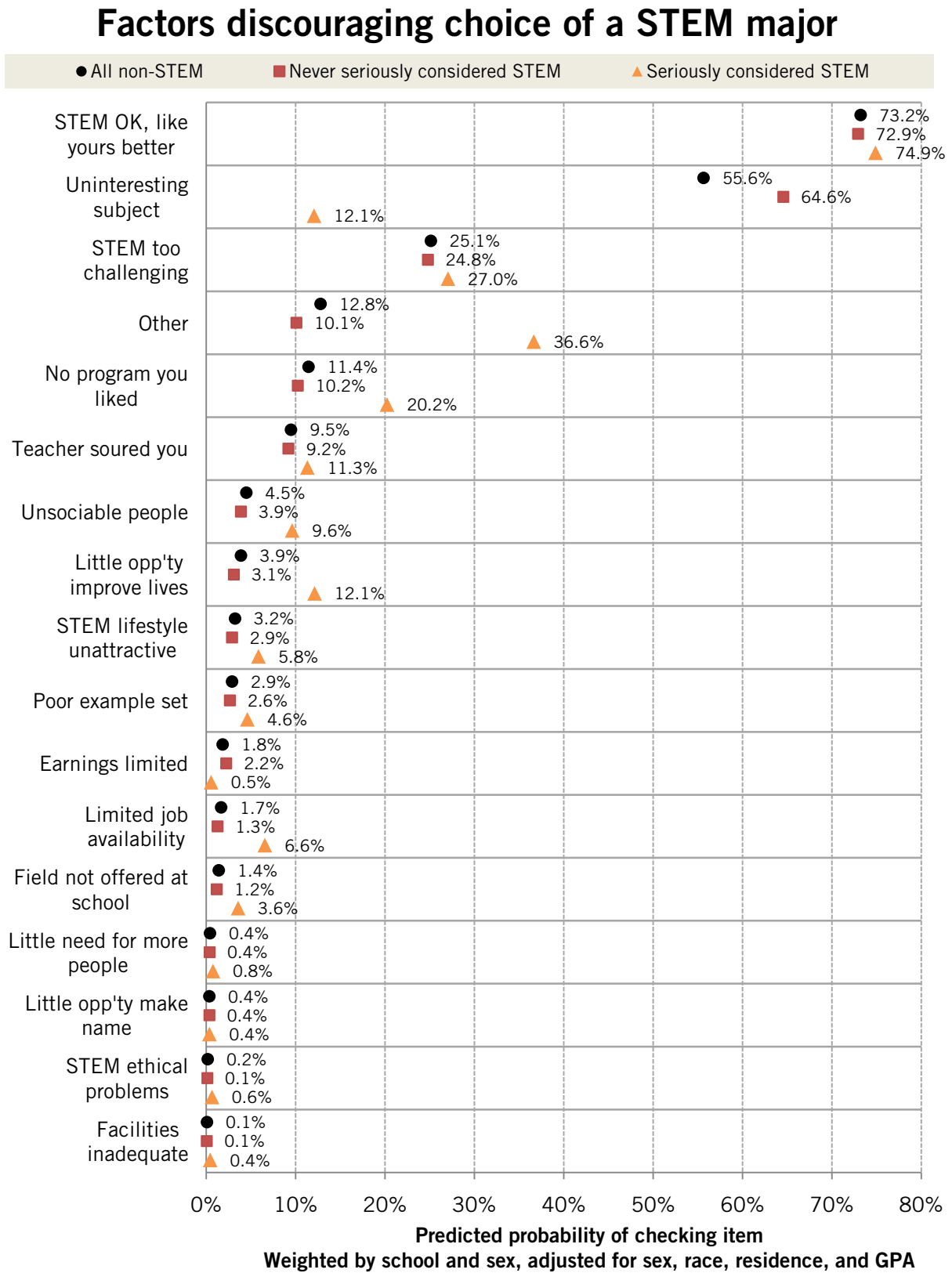
Factors discouraging selection of a STEM major

After selecting the above influential factors, non-STEM majors were asked, “Please check two to five factors below which discouraged you from choosing a major in science, technology, engineering or mathematics (STEM).” The 17 factors offered (in random order) were:

- The subject matter is uninteresting to you
- A teacher or professor soured you on it
- You could not find a STEM program you liked
- STEM facilities and equipment are inadequate
- The limited availability of jobs in the field
- Someone set a poor example for you
- STEM people aren't sociable enough
- There is little need for additional people in the field
- There is too little opportunity to improve the lives of others
- There is too little opportunity to make a name for yourself
- Your potential earnings in the field are too limited
- STEM fields have too many ethical problems
- STEM fields are too challenging academically
- Your current institution doesn't offer the STEM field you prefer
- STEM people have unattractive lifestyles
- There's nothing wrong with a STEM major, you just like yours better
- Other, specify

Figure 3 illustrates the frequency with which each option was selected, using the same statistical models as in **Figure 2**, but displaying only the non-STEM groups, since STEM majors were not asked this question. The most frequently selected discouraging factor are “easy out” options we provided, “There’s nothing wrong with a STEM major, you just like yours better,” and “The subject matter is uninteresting to you.” Both non-STEM groups were similarly fond of the first option. But, logically, “seriously considered STEM” students were much less likely to mark the “uninteresting subject” option (12.1 percent versus 64.6 percent of the “never considered STEM” group). Loss of interest in STEM subjects accounts for only a small fraction of the loss of these potential STEM recruits; stronger competing interests are the real issue.

Figure 3 Factors discouraging choice of a STEM major



Source: 2008 West Michigan College Student Major Selection Survey

The next most frequently selected option is that STEM fields are too challenging. “Seriously considered STEM” students were only slightly different from “never STEM” students in considering STEM too challenging (27.0 percent compared to 24.8 percent). This factor also figures in a few of the “other, specify” options that come next in the rankings and rank a strong second for “seriously considered STEM” cases. For example, “I was a STEM major, but was struggling in one class and had to drop it to keep my scholarship.”; “didn't want to [negatively] impact my GPA,” “classes were too hard, uninteresting, and inapplicable to real life.” Many of the “other, specify” comments from “seriously considered STEM” cases concern the difficulty of combining intensive STEM fields with other pursuits:

- “The length and intensity of the programs make them too exclusive/narrow for additional concentrations.”
- “Science/Biology labs weren't offered at times I could [because] I work full time and have a family.”
- “Study abroad opportunity interfered with rigid course schedule required”

Some non-STEM majors turned this logic on its head, extolling the virtues of interdisciplinary balance: “I am interested in medicine, and believe that a social science major provides a nice balance in addition to the natural science courses I am required to take.”

Beyond this, the respondents’ “other, specify” options are fairly scattered. One powerful theme among “never STEM” students is “I’m not good at it,” “I’m terrible at it,” and so forth. The “other, specify” reasons against STEM volunteered by students are further described below, beginning on page 28.

Next in the rankings is “You could not find a STEM program you liked,” again logically more popular with the “seriously considered STEM” group than with “never STEM” (twice as popular, in fact: 20.2 percent versus 10.2 percent). “Seriously considered STEM” respondents were also more likely to cite unsociability (9.6 percent versus 3.9 percent) and a lack of opportunity to serve others (12.1 percent versus 3.1 percent). These are not large differences in absolute terms, but they do indicate that non-STEM majors are motivated in their major choice primarily by what they believe to be intrinsic attraction to their own majors and by fairly intractable characteristics of STEM fields (their academic difficulty, their structural position in the economy and society, and the limited availability of specific fields).

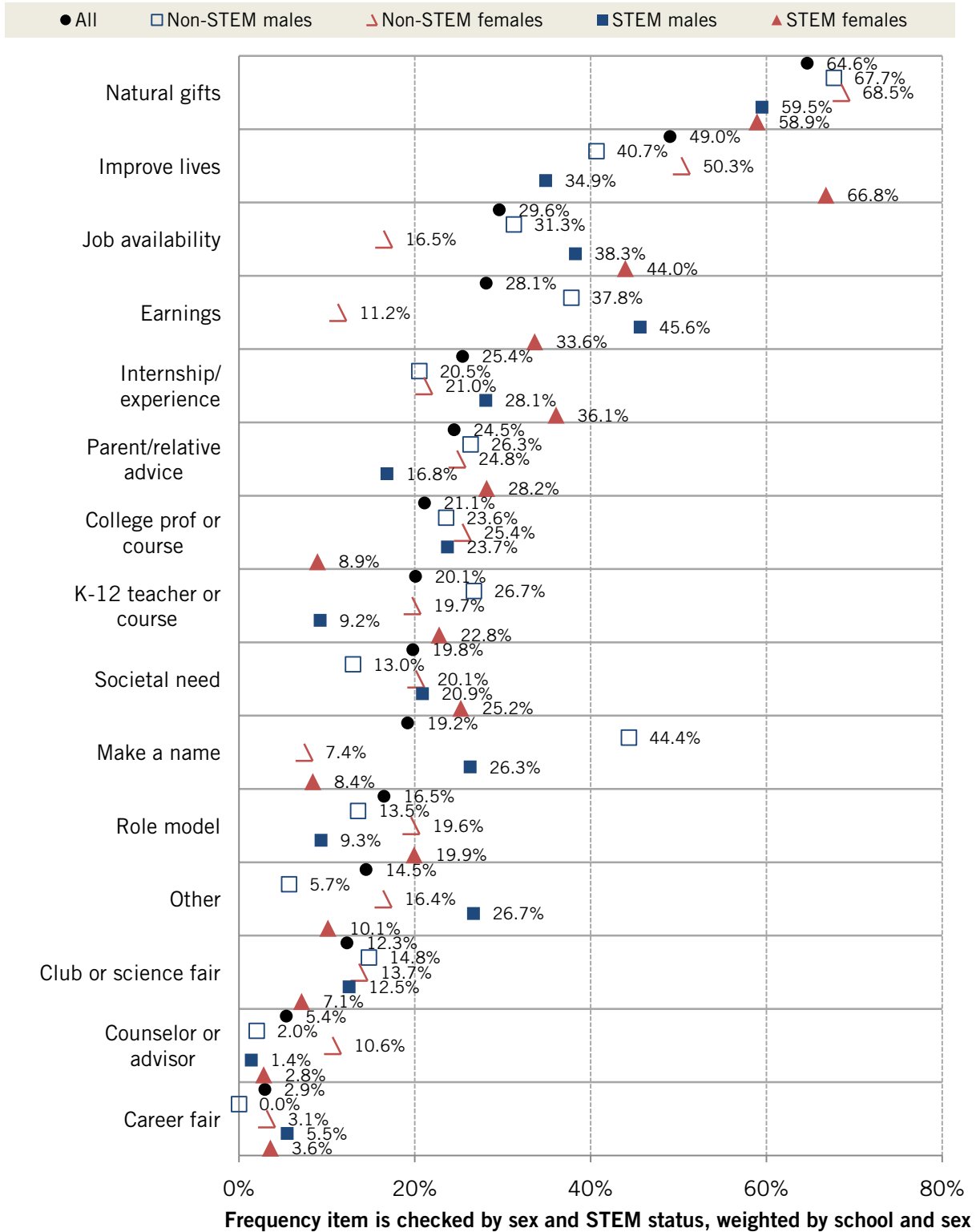
Women and choosing STEM

As seen in **Figure 1** on page 10, women remain relatively scarce in many STEM fields. Among our respondents, women outnumbered men by more than two to one in the health professions (largely due to nursing programs), but men outnumbered women by two to one in other STEM fields.

Figure 4 is very similar to **Figure 2** on page 13, except that (1) it breaks things down by sex and STEM or non-STEM and (2) it displays weighted frequencies (counts of how many checked the box) rather than statistical model probabilities.

Figure 4 Factors influential in choice of major, by sex

Factors influential in choosing a major, by sex



Source: 2008 West Michigan College Student Major Selection Survey

In the first row, labeled “natural gifts,” we see a similar pattern to the first row of **Figure 2**: while “your area of natural gifts” was the most frequently checked factor overall, all STEM respondents, regardless of sex, were considerably less likely to check “natural gifts” than non-STEM respondents (both filled shapes are STEM). When we look at the ranking data, females from both STEM and non-STEM (red triangles) were less likely to rank this option first among the options they checked; males ranked it first about two-thirds of the time, non-STEM women first about 45 percent of the time, and STEM women about 31 percent of the time.

Thus, though a sense of giftedness is important to all, STEM majors are less likely to feel gifted for their chosen fields, while women are less likely to perceive giftedness as the leading reason to pursue a STEM major.

The second row of **Figure 4**, “improve lives,” shows clearly why women differ in their ranking of “natural gifts”: for females in STEM majors, “improving the lives of others” is the most frequently cited factor, outranking even natural gifts. As we saw in **Figure 2**, this is primarily a motive for entry to the health professions, not for other STEM fields; the strong representation of women in nursing primarily accounts for this finding. Males in STEM fields were the least likely to cite improving lives; about half as many men as women checked the option.

In the third row, “job availability,” we find that both sexes in STEM majors were considerably more likely to cite job availability than non-STEM majors, with STEM females most likely to cite job availability (44 percent) and non-STEM females least likely (16.5 percent). STEM females differ much more from non-STEM females than STEM males do from non-STEM males on this factor, suggesting that job availability is a major distinguishing draw to STEM for women.

In the fourth row, “earnings,” males from both STEM and non-STEM majors are more likely to cite earnings as a factor than either group of females. But STEM majors in both sexes are more likely than their counterparts of the same sex to cite earnings. In job availability and earnings, we again find greater leverage on the demand side of the equation as Teitelbaum (2003) emphasizes, especially for women.

Females in STEM majors stand out in the next three rows. In the fifth and sixth rows, females in STEM majors were more likely to check “internship, job shadow or work experience” and “a parent or relative’s advice or example” than any other group, though the gap is small for “parent/relative advice.”

In the seventh row, “college professor or course,” STEM females were notably least likely to select it. In the eighth row, STEM males stand out as the least likely to indicate a “K-12 teacher or course” influenced them to choose STEM. Taken together, it appears that females in STEM are more likely to be influenced in their choice early (during K-12) than males, though neither group is especially likely to select a teacher or course as a factor.

Another marked standout is the strong differentiation between the sexes in the importance of “making a name for yourself.” Males, especially non-STEM males (44.4 percent), were much more likely to check the option than both STEM and non-STEM

females. Other fields apparently have an advantage in attracting men interested in earning a public reputation.

STEM females were more than twice as likely as STEM males to select “a specific role model’s example,” though non-STEM females were very similar. STEM females were the least likely to cite “an extracurricular school activity, e.g., a club or science fair.”

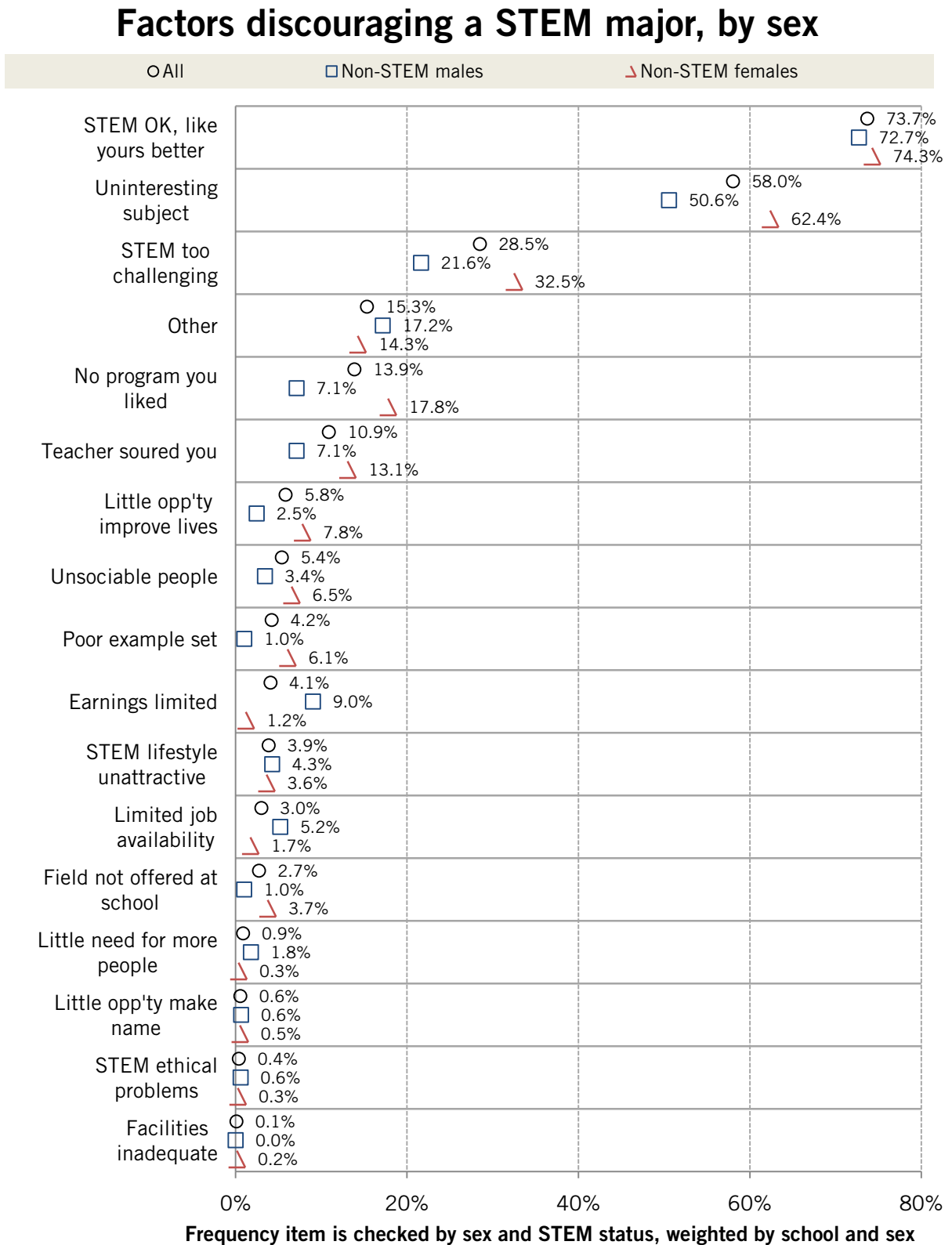
In summary, the picture of positive influences displays some marked differentiation by sex; females in STEM are more likely than males in STEM to cite improving the lives of others, finding jobs, and having work experience and less likely to cite college courses and reputation building as factors in their choice.

Women and NOT choosing STEM

Similar to **Figure 3** on page 15, **Figure 5** below shows factors indicated by respondents who had not selected a STEM major, but using a breakdown by gender parallel to **Figure 4** on page 17. Female respondents checked nearly every box more frequently than males did. Marked differences are seen in the second, third and fifth rows of the chart. Females were 12 percentage points more likely to check “The subject matter is uninteresting to you,” 11 points more likely to select “STEM fields are too challenging academically,” and almost 11 points more likely to cite “You could not find a STEM program you liked.” Women were more likely to select several of the remaining factors by 3 to 6 percentage points.

The key exceptions males were more likely to select have to do with the “demand side” of STEM. Though they were not frequently cited by either sex, males were more likely than females to cite limited earnings potential (9 percent versus 1.2 percent) and limited job availability (5.2 percent versus 1.7 percent) as reasons not to choose a STEM major. So we saw in **Figure 4** that demand factors (pay and job availability) are relatively more important as positive factors for STEM majors of both sexes and in **Figure 5** that they are slightly more important to males than to females as obstacles to choosing STEM.

Figure 5 Factors discouraging a STEM major, by sex



Source: 2008 West Michigan College Student Major Selection Survey

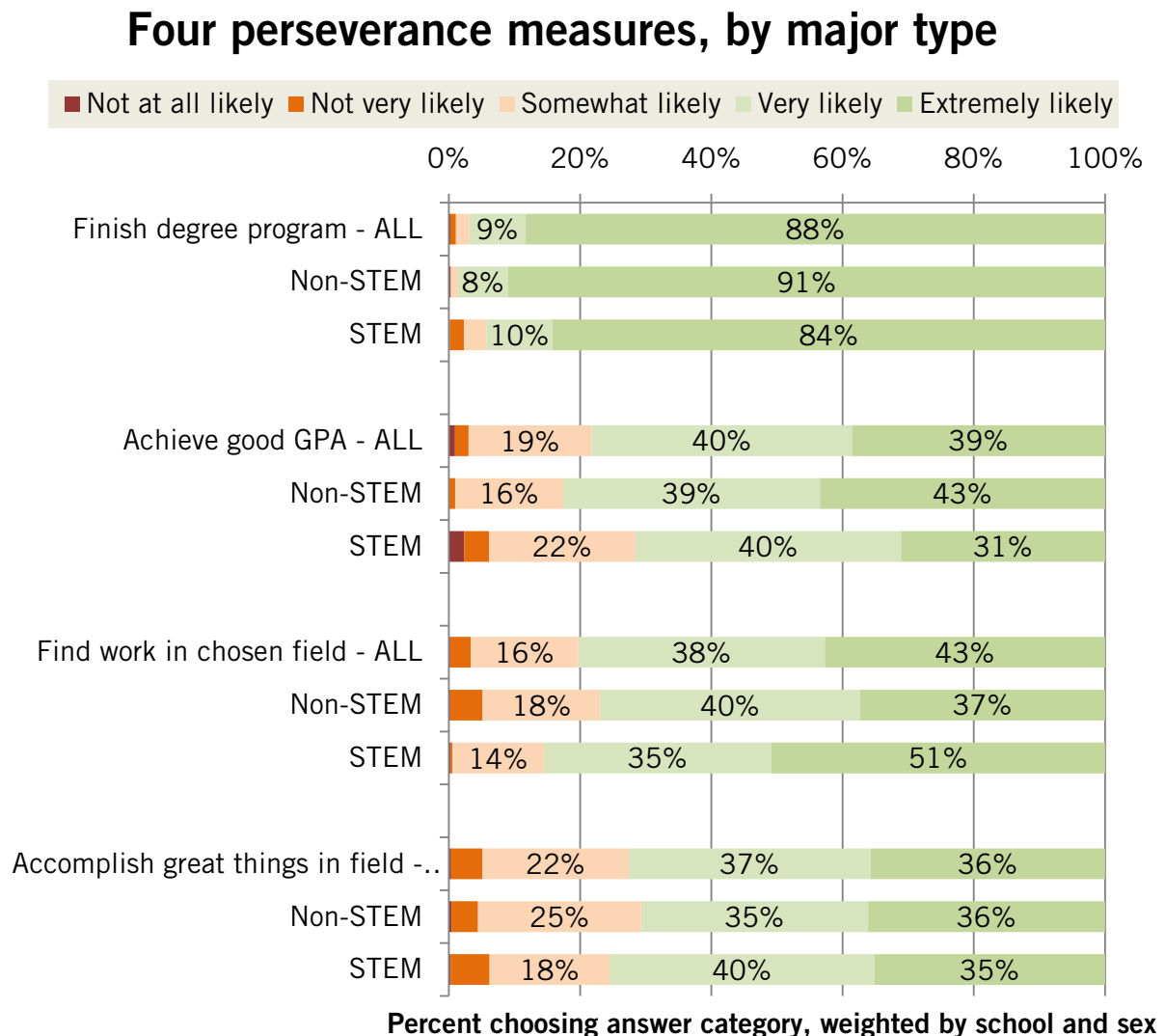
Perseverance, employment and achievement

We asked respondents four questions about their expectations to persevere in their selected fields. Using a five-point Likert answer scale from “Not at all likely” to “Extremely likely,” we asked, “In your opinion, how likely is it that you will ...”

- Finish your current academic degree program?
- Achieve a good final GPA in your current degree program?
- Find work in your chosen field for at least ten years?
- Accomplish great things in your field?

Figure 6 below displays the breakdown of answers for each of the four questions, with groups of three bars representing all respondents, non-STEM majors and STEM majors.

Figure 6 Four perseverance measures, by major type



Source: 2008 West Michigan College Student Major Selection Survey

To ensure our conclusions from the chart are informed, **Table 1** (below on page 24) displays the results from a multivariate ordered probit⁶ model of each perseverance question that controls for sex, race, West Michigan residence, high school GPA and each of the STEM options: “seriously considered STEM,” “STEM – Health” for health professions majors and “STEM – Other” for majors from the rest of the STEM fields. We refer to and explain interpretations of this table below. In every question, the respondents are relatively confident of their prospects.

Finishing a degree

In the first bar of **Figure 6**, as should be expected for college juniors, we see that the vast majority (97 percent total) thought it “very likely” (9 percent) or “extremely likely” (88 percent) that they would complete their degree program. But, befitting the difficulty of their fields, STEM majors were less confident than average, with about five times as many (almost 6 percent) having some doubt they would finish, compared to non-STEM majors (1 percent). Our statistical model—the first column of numbers in **Table 1**—shows that when demographics are held constant, health professions majors are not much more pessimistic than average (just -0.08), while it is majors in the other STEM fields who are measurably more likely to expect a disappointing final GPA (-0.44).⁷ That’s the only sizeable difference in the model—sex, race, residence and GPA are not significant and consistent influences. Positive but insignificant coefficients for female students (0.14), high school GPAs (0.34) and “seriously considered STEM” (0.28) indicate these students had greater average confidence in finishing their degrees, all else equal.⁸

⁶ Ordered probit is a statistical estimator comparable to linear regression (where a change of 1 in variable X is associated with a change of *beta* in outcome Y), but suitable for *ordinal* outcome variables like Likert scales, where an outcome coded “2” (such as “not very likely”) is sequentially greater than an outcome coded “1” (such as “not at all likely”) but not mathematically greater (so that a code of “2” is not necessarily equivalent to twice a code of “1”). The estimated “cut points” help estimate whether the answer options are actually differentiable or should be considered interchangeable. That is, if the cut point between two adjacent options is statistically zero, the two answer options are identical in practice—respondents are as likely to choose one as the other. If a cut point is significant, the options are distinguishable. Due to the skewed distribution of responses to each of these questions, in most cases several of the options are not distinguishable (that is, practically speaking, it is as if each question had only two or three answer options, rather than five).

⁷ The coefficient for “STEM – Other” is -0.44 (and is significant at the 0.10 level), meaning that STEM majors outside the Health Professions segment are 0.44 standard deviations lower on the probability distribution of the answer scale than students who never considered STEM but are otherwise similar in sex, race, GPA and residence.

⁸ With population data like most of our cases (except for GVSU students), statistical significance tells us there is less noisy variation around differing group averages, but it is not as important to insist on significance as it is with sample data.

Table 1 Multivariate models of four perseverance measures

<i>Ordered probit models of four perseverance measures</i>	<i>In your opinion, how likely is it that you will ...</i>			
	<i>Finish degree program</i>	<i>Achieve a good final GPA</i>	<i>Find work in chosen field</i>	<i>Accomplish great things in field</i>
Female	0.14	0.22	-0.26 +	-0.23
Non-white race	0.06	0.08	-0.06	0.30
West Michigander	-0.08	-0.33 *	0.00	-0.15
High School GPA	0.34	0.54 **	0.17	0.30
Seriously considered STEM	0.28	0.02	0.15	0.20
STEM - Health	-0.08	-0.22	1.05 ***	0.49 *
STEM - Other	-0.44 +	-0.52 **	0.07	-0.21
<i>Cut points:</i>				
"not at all" vs. "not very likely"	-1.83 *	-0.82	-2.35 ***	-1.90 **
"not very" vs. "somewhat likely"	-1.26	-0.33	-1.32 *	-0.80
"somewhat" vs. "very likely"	-0.79	0.88	-0.31	0.28
"very" vs. "extremely likely"	-0.07	2.05 ***	0.78	1.28
<i>N</i>	888	887	882	877
<i>F(7, N)</i>	1.58	5.89 ***	2.67 ***	2.75 ***

+ $p < 0.10$; * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$

Getting a good career GPA

In the second group of bars in **Figure 6**, we find that when it comes to achieving a good GPA, students are less confident than they were about degree completion, with 79 percent expressing confidence (40 percent “very likely” and 39 percent “extremely likely”). Again illustrating the perceived difficulty of STEM fields, respondents in STEM majors were considerably less likely than non-STEM majors to expect a good finishing GPA, with just 71 percent selecting “very” or “extremely likely,” compared to 82 percent of non-STEM majors. The second column of numbers in **Table 1** shows that West Michigan residents are significantly less likely to expect good GPAs (coefficient -0.33), while those with higher high school GPAs expected higher college GPAs as well (coefficient 0.54). “STEM – Other” majors remain significantly less likely to expect good career GPAs, even when the other factors are held constant.

Finding work

Looking at the third group of bars in **Figure 6**, we see that STEM majors are more likely to expect to find work in their chosen fields; fully 86 percent selected “very” or “extremely likely”, compared to just 77 percent of non-STEM majors. Looking at the model in the third column of numbers in **Table 1**, we find that this difference holds true even when other factors are controlled, but only for “STEM – Health” students

(coefficient 1.05, a very substantial shift); the rest of STEM students have no greater confidence in finding work than non-STEM students (coefficient 0.07). Female students were significantly less likely to expect to find work (coefficient -0.26). Overall, we see a picture consistent with an economy in which the health care industry is known to be growing faster than others and in which women still face barriers to employment.

Achieving greatness

Our college juniors have high expectations—73 percent said it is very or extremely likely they will achieve great things in their chosen field. STEM majors were a little more confident than non-STEM (75 percent versus 71 percent); our statistical model in the fourth column of **Table 1** shows that this difference is again attributable entirely to health professions majors (coefficient 0.49). Other STEM students actually were less likely than non-STEM students to expect great achievements (the coefficient is -0.21, sizeable but too noisy to be statistically significant).

Summary of perseverance findings

The bottom line for these perseverance measures is consistent with our previous findings that health professions majors differ from other STEM majors in important ways. Health professions majors are more confident about their work and achievement futures than other STEM majors, while majors in other STEM fields are less confident than other students about degree completion and getting good grades. Female students from all fields were more likely to expect to finish their degrees and to get good grades, yet less likely to expect to find stable work and to achieve great things.

Students have their say in comments

To increase our understanding of students beyond the numbers, let's turn to their comments given about their major selection. How do students describe their reasons for choosing a major? What other factors, besides those listed in the survey, influence their decisions to choose a certain major? To add more meat to both **Figure 2** and **Figure 3**, we now turn to comments like this one, from a student at Hope College:

I loved science and especially math my whole life. I took anatomy on top of AP Bio and AP calc my senior year... and attended college with the intent of going into some sort of science for a profession. Shortly after arriving my freshman year, I realized that though math and science are interesting, they are not very social careers and I am a very social person. But more importantly, they don't really make a difference in the everyday lives of people. They do to a certain extent, of course, but I wanted to influence people in the matters of things that are eternally important. Nothing is more important in life than having those sort of things thought about and figured.

This student had talent and interest in STEM fields, but was not convinced or shown how STEM majors and vocations make a difference in people's lives beyond physical healing. Considering the goal of understanding how to better encourage and support students who are interested in STEM majors, comments like this are very helpful. Responses that will be described in this section hold equally revealing and useful insight into the students of West Michigan.

Comment Questions

Students clarified their choice of major and their views on topics related to the survey in the three questions listed below. The first two questions were “other specify” options at the bottom of a battery of other factors.⁹

1. Please check factors that were influential in your choice of a college major (Other, specify).
2. Please check factors which discouraged you from choosing a major in science, technology, engineering or mathematics (STEM) (Other, specify).
3. Your comments are welcome about this survey or about selecting a major. We are especially interested in your thoughts about the choice between STEM (science, technology, engineering and mathematics) and other fields.

The comments from the first two questions should be understood as stressed factors or additional reasons to either choose a major or negatively influence a choice of a major. The battery of factors was lengthy and quite comprehensive. Some important factors have a low frequency in these comments, but only because they are redundant with existing multiple-choice options.

Themes in comments

The comments were categorized by the following themes:

- Academic interests
- Academic strengths
- Amount of social interaction
- Job market/Graduate school preparation
- Length or cost of schooling
- Past experiences or people
- Programs in combination (meaning the respondent combined different academic programs, often mentioning combining STEM and non-STEM fields.)
- Religious reasons
- Other

These themes are not mutually exclusive, meaning that a comment could be coded under the theme “Academic interests” and “Religious reasons.” **Figure 7** illustrates the proportion of comments in each theme.¹⁰

⁹ To see other factors, refer to **Figure 2** and **Figure 3** (pages 14 and 17, respectively).

¹⁰ To see a full list of comments and how they were categorized, see Appendix B on page 32.

Figure 7 Themes by comment type

Theme	Percent mentioning theme		
	"Other, specify" responses		
	Factors influencing major choice	Factors discouraging STEM major	Optional general comments
Academic interests	54%	43%	58%
Past experiences or people	27%	6%	22%
Academic strengths	2%	24%	22%
Job market/Graduate school prep	11%	5%	15%
Programs in combination	2%	4%	13%
Religious reasons	12%	1%	5%
Length or cost of schooling	0%	15%	6%
Other	5%	7%	6%
Amount of social interaction	0%	4%	9%
Total respondents offering a comment	127	82	193

Factors influencing major choice – “Other, specify” responses

When asked about factors influencing their major choice, over half of students offering an “other, specify” wanted to put extra emphasis on *academic interests*, whether their major was as STEM major or a non-STEM major. A student from Aquinas College who is pursuing a STEM major said:

It’s exciting! Passion should be on the list!

This theme captured students who remarked on interest for and passion in certain fields and who see themselves in certain fields more than others. A student from Calvin College who is pursuing a non-STEM major remarked:

I want to study something I love.

The second most mentioned theme among volunteered influential factors was *past experiences or people*, with 27 percent of the volunteered responses mentioning it. This theme included remarks from students about good experiences with past teachers, counselors, role models, professors, or classes. A student from a Hope College studying in a STEM major stated:

I had wonderful nurses when I was in the hospital when I was younger, and I wanted to be that for some other child.

Given that most of the respondents attend religious schools, it’s not surprising that a number invoked “spiritual calling,” “a way to honor God” and other faith-related reasons.

This theme is as prevalent among STEM majors as among non-STEM; for example, the two quoted phrases above are from STEM majors.

Factors discouraging a STEM major – “Other, Specify” responses

When students volunteered other factors that discouraged them from choosing a STEM major, responses were more varied. While *academic interests* was still the most frequent response, less than half (43 percent) mentioned it. A quarter of the “other specify” responses (24 percent) were discouraged from choosing STEM because of their *academic strengths*. This theme included comments mentioning poor performance in a subject area within a STEM major. These two categories are both mentioned in a single short response by a student from Calvin College:

My academic strengths and interests are not complimentary to those in a major of STEM.

A student from Grand Valley State University expressed why he/she did not choose a STEM major this way:

There is too little opportunity to improve the lives of others in the ways I feel are most important.

Reinforcing Teitelbaum’s (2003) argument, students were more likely to mention *length and cost of schooling* as a “Negative Influence” than in response to the other two open-ended questions. While students may have an interest in STEM fields, spending many years in school deters them from pursuing those vocations. An Aquinas College student said:

Another reason I did not major in the STEM area is because I would like to get a job out of college and not spend another 4-10 years in school or in a residency.

Another student cites conflict with family life:

Science/Biology labs weren't offered at times I could b/c I work full time and have a family.

Another concern in this category is the inflexibility of the programs:

The length and intensity of the programs make them too exclusive/narrow for additional concentrations.

Optional Comments

The optional comments that students offered reveal the thoughtful and insightful reasoning of students in West Michigan regarding major choice. Many students wanted to explain in full why they choose the major they did and seemed to encourage changes in areas that hindered them in pursuing their true interests. The three most frequently mentioned themes found in the optional comments were *academic interests* (58 percent), *past experiences or people* (22 percent), and *programs in combination* (13 percent).

An Aquinas College student offered a comment (categorized as *academic interests*) on why he/she never considered a STEM major:

I've never seriously considered a STEM field major ... because I've never really felt inclined or pulled in that direction. While I do find the knowledge and information of those fields highly interesting, I lose interest when it comes to having to learn them through a classroom setting. The social sciences, in general, stimulate my interest far more than any other science or technology-based learning.

A student from Calvin College was honest about past experiences that hindered his/her possible pursuit of a STEM major:

I have always struggled with subjects involved in STEM majors. I was never encouraged to participate, beyond minimal requirements, in math or science courses previous to coming to college. Therefore, my strengths are in areas I was encouraged in (social sciences) and have been given the most opportunity in (internships, experiences, etc).

A student from Grand Valley State University described how he/she could not find a STEM major that fulfilled his/her curiosities and interests. This comment was categorized as *programs in combination* (this category grouped comments that addressed combining majors to better fit students' interests):

I have always liked math and been interested in the science; however, there is no program that integrates the two. For example, I would major in science if I wasn't required to take so [many] chemistry and physics classes. I am not going to be a researcher or everyday scientist and have no interest or real ability to do well in high level chemistry classes. This is why I say there is nothing wrong with STEM majors technically, I just feel mine, an education major/minor, is all around more tailored to me.

While many students used the comments section to explain their avoidance of STEM majors, other students attempted to describe why they feel STEM majors are important and worthy vocations. A student from Hope College, pursuing a STEM major, explained why science was an interesting field to study (categorized as *past experiences or people*):

I was drawn to this field not only because of the factors previously identified, but also because I have always loved science. I am intrigued by the improvements in the scientific field; I knew going into the field of health professions, I would always have the opportunity to learn new things and that I would be engaged in a dynamic career.

A student from Grand Valley State University described how the job market and future developments make the STEM majors exciting fields to study:

The STEM fields are by far the most advancing in our current world. Every single day more knowledge in a subject is gained and used to advance society as a whole. What better profession to be in that encourages people to learn new things every day, advances technologies to new unforeseen heights, and provides a constant challenge to better oneself.

Among the more verbose respondents were those who have philosophical objections to an emphasis on STEM in education. One vocal critic described STEM as serving the “cycle of discontent in American materialism” and “benefiting a new weapons-based cultural imperialism.” Another, more moderate critic wrote:

Though I understand the importance of STEM majors to society and I strongly considered being one, I wish that our society as a whole would value a broader

spectrum of studies. STEM majors are great for society, but without our history, our religions, and our culture we would be much worse off. These studies (those of the humanities) are what improve our humanity as a nation. We are a nation which looks too far into the future and not far enough into the past. How can we know who to become if we do not know who we were and are now?

With the direct words of student respondents on our minds, in addition to the quantitative data displayed and described in previous sections, let's turn to ideas for achieving the goal of recruiting more STEM majors.

How to recruit more STEM majors

In conclusion, here are some brief but potentially valuable insights into STEM recruiting from the West Michigan College Student Major Selection survey:

1. **There's no quick fix or easy out—create more jobs, increase pay, reduce years of schooling!** Short-term events like career and science fairs, and longer-term exposures like teachers, courses and role models, all play relatively small parts in students' conscious mental models of the major selection process. The high-impact factors are chronic, tenacious components of students' personal self-images and their perceptions of STEM fields, including the economic structural demand for these careers (Teitelbaum 2003).
2. **Motivate attraction to STEM by revealing “natural gifts” for STEM fields.** Whether these gifts are really a result of “nature” or of “nurture” matters little—perception is everything. Transient events probably won't alter self-perceptions, nor even yearlong course exposure to charismatic teachers and students. Rather, students who really are gifted in science and math need to be reminded regularly of their potential. Do present recruitment efforts merely try to persuade student observers that science is interesting and doable, or do they demonstrate it convincingly by bringing student participants into a scientific workflow?
3. **Health professions apparently attract a relatively unique disposition for service to others and to self.** Recruitment efforts that treat health professions the same as other STEM fields may miss opportunities to attract some students. Health professionals are unusually concerned with their field's impact on others and themselves.
4. **Students who seriously consider STEM need good information.** Do STEM field recruiters offer potential students accurate information about degree completion rates and real-world academic difficulty? Earnings potential? Social impact?
5. **Students considering STEM want flexibility.** Is there anything STEM fields can do about making the STEM workload more manageable, without lowering quality standards? About offering programs that link STEM training to programs in the social sciences, arts and humanities? If such efforts already exist, are they adequately publicized and supported?

Appendix A: STEM status of CIP codes

CIP text	CIP 2-digit code
STEM majors	
Agriculture, agriculture operations, and related sciences.	1
Biological and biomedical sciences.	26
Computer and information sciences and support services.	11
Engineering technologies/technicians.	15
Engineering.	14
Health professions and related clinical sciences.	51
Mathematics and statistics.	27
Military technologies.	29
Natural resources and conservation.	3
Physical sciences.	40
Science technologies/technicians.	41
Non-STEM majors	
Architecture and related services.	4
Area, ethnic, cultural, and gender studies.	5
Business, management, marketing, and related support services.	52
Communication, journalism, and related programs.	9
Communications technologies/technicians and support services.	10
Construction trades.	46
Education.	13
English language and literature/letters.	23
Family and consumer sciences/human sciences.	19
Foreign languages, literatures, and linguistics.	16
History	54
Legal professions and studies.	22
Liberal arts and sciences, general studies and humanities.	24
Library science.	25
Mechanic and repair technologies/technicians.	47
Multi/interdisciplinary studies.	30
Parks, recreation, leisure, and fitness studies.	31
Personal and culinary services.	12
Philosophy and religious studies.	38
Precision production.	48
Psychology.	42
Public administration and social service professions.	44
Security and protective services.	43
Social sciences.	45
Theology and religious vocations.	39
Transportation and materials moving.	49
Visual and performing arts.	50

Appendix B: Student comments grouped by theme

Code	Code Text
AI	Academic interests
AS	Academic strengths
ASI	Amount of social interaction
JM/GSP	Job market/Graduate school preparation
LCS	Length or cost of schooling
PEP	Past experiences or people
PC	Programs in combination
RR	Religious reasons
O	Other

“Other: Specify” volunteered responses on factors influential in the choice of a major

Comment Text – other factors influencing major choice	Themes
Religious Faith	RR
God's calling	RR
Injured while working in the Forestry field	PEP
I saw teachers treat their children awful--calling them names, bad teaching methods...I want to be different and show them the love of the Lord they deserve...I want to show them their individual value...I want to give them ambition to learn	PEP, RR
Personal experience	PEP
Jesus.	RR
A film called 'The Interpreter'	PEP
My nephew who is delayed in the area I intend to study	PEP
volunteer experiences	PEP
Mission Trips	PEP, RR
Faith/ Religion	RR
my experience studying abroad in a non-English speaking country	PEP
sibling attended	PEP
View that this is what I am called to do (faith factor)	RR
literature and the movie, 'Stand by Me'	PEP

Comment Text – other factors influencing major choice	Themes
Time spent immersed in the language and culture	PEP
The type of life I want to have. E.g.: Family time.	PEP
my own experiences in having to deal with psychological disorders	PEP
All Creatures Great and Small by James Herriot	PEP
My father's injury and need for help	PEP
calling from God	RR
Experience working with children	PEP
Called by God	RR
A friend/role model	PEP
I feel God (Christian) has called me into this field	RR
high school athletic trainer	PEP
A way to honor God	RR
Spiritual Calling	RR
I like working with people/children	PEP
Feeling of Religious calling	RR
Personal experience - I had wonderful nurses when I was in the hospital when I was younger, and I wanted to be that for some other child.	PEP
life experience	PEP
prayer and searching for God's calling for me	RR
medical missions	RR
I really enjoy it	AI
It's exciting! Passion should be on the list!	AI
Curiosity sparked by my observations of the world (not addressed in any high school class), similarity to my first choice program which was discontinued during the period I entered college	AI
I like learning about history	AI
My love of and passion for acting	AI
It was one of the few subjects I can see myself still liking after several years in the field.	AI
I like history	AI
A lifelong interest	AI
Sustainable Business is my major and I know current forms of business focusing on the bottom line are unethical and unsustainable at times and I wish to learn more about triple bottom line theories.	AI
I have fun doing math	AI
The opportunity to better myself through hardship.	O
I've been working with special needs children most of my adult life	PEP
Only field I feel drawn to.	AI

Comment Text – other factors influencing major choice	Themes
I enjoy writing	AI
math is fun	AI
I read a novel that had a psychologist and I thought it would be an interesting field	PEP, AI
It is what I enjoy	AI
Education Goals	AI
It is what I enjoy	AI
I want to be an architect and Business was the best course for that given that my college doesn't have an Architecture major.	PC, AI
It's something I was interested in and had talent in doing	AS, AI
interest	AI
Favorite subject	AI
always wanted to be a teacher since I was a kid, chose science to be more marketable in this competitive workforce	AI, JM/GSP
Aptitude Test	PEP, AS
future goals in life	AI
personal interest	AI
A love of writing and reading	AI
it is the field I am passionate about	AI
my interests	AI
My Spanish classes have always been my favorite class, so I thought I should continue to develop my Spanish skills!	PEP, AI
Interested	AI
interest in the subject	AI
Interest in the subject	AI
it interested me most out of other options: seems useful to use in the pursuit of various careers/grad school studies	AI, JM/GSP
I want to study something I love.	AI
I just simply enjoy it	AI
Personal enjoyment of subject and classes	PEP, AI
Interest in the subject itself	AI
I love helping young athletes succeed	AI
My interest and general love of the subject	AI
Watching television and seeing what I love to do.	AI
Great Interest in the subject matter	AI
One of the options for Elementary Education Minors.	PC
I love biology!	AI

Comment Text – other factors influencing major choice	Themes
Personal reasons relating to my health, and also exercise and health have always been very important to me.	PEP, AI
Studying abroad	PEP
Enjoyment in learning the subject	AI
Loved working with computers	AI
It is incredibly interesting to me and crucial to know	AI
Which classes sounded interesting	AI
area of interest	AI
Love of Learning Science	AI
I liked it	AI
useful for my future career in medicine/health care	JM/GSP
I have always wanted to study things relating to religion and philosophy.	AI
I just like the subject	AI
it's what I am passionate about	AI
I love helping people in Chemistry	AI
Something that I could relate to sports, which I am passionate about	AI
Personal Interest	AI
my passion	AI
Love/ interest for the field	AI
An area where I wanted to have particular skill	AI
An area of great importance and interest to me. Also inspired by living in a developing country for a while.	PEP, AI
It is something that I enjoy and is interesting to me	AI
The interest to learn about the body and how to take care of myself	AI
my love for children!	AI
always fascinated	AI
veterinary camp	PEP
a college course	PEP
assistantship opportunities for grad school	JM/GSP
career tests	PEP
Childhood love of astronomy led me to Physics as a stair step to astronomy	AI
It was something that I enjoyed and a route to go to graduate school for something more	AI, JM/GSP
A study-abroad experience	PEP
My belief that philosophy was the best way to truth, and that truth is the most important thing to pursue. I wanted to make the world a better place and I thought that this was the most effective, most important way to achieve that goal.	AI

Comment Text – other factors influencing major choice	Themes
I was unhappy with everything else.	O
My major of choice isn't offered, so I made up my own.	O
it is a good undergrad degree to have as far as choices for a Masters degree	JM/GSP
In preparation for graduate school for occupational therapy	JM/GSP
personal interest in creating my own study program	AI, O
I chose this major as a precursor of occupational therapy.	JM/GSP
I believe our educational system needs all the help it can get and once I have accomplished this I will be moving on to see what else I can help with	AI, JM/GSP
Prepare myself for a globalizing job market	JM/GSP
I didn't like any other areas	O
Freedom within the Field	JM/GSP
just because.	O
Practicality in projected graduate studies	JM/GSP
I was told it was a good major with a law degree	PEP, JM/GSP
versatility	JM/GSP
Help children with special needs and children who have illnesses	AI
The major was relatively small (i.e. allowed room for lots of electives)	PC

“Other: Specify” volunteered responses on factors discouraging choice of a STEM major

Comment Text – other factors discouraging STEM	Themes
too much school required to be able to use skills	LCS
When I thought about it, I would have had to stay in college longer since I had already taken a year of classes in my major	LCS
Not enough interpersonal interactions	ASI
It's not what I felt called to do	RR
my experience is in special education	PEP
Science/Biology labs weren't offered at times I could b/c I work full time and have a family	PEP
I want to work with people	ASI
The length and intensity of the programs make them too exclusive/narrow for additional concentrations	LCS
Long waiting lists for programs-medical programs	LCS
a bad internship experience in pharmacy, which was my primary interest	PEP
The necessary classes to achieve this are not readily available.	LCS

Comment Text – other factors discouraging STEM	Themes
I did a job shadow and didn't like it	PEP
I was afraid I would not graduate in time if I switched majors.	LCS
Too much schooling	LCS
not personal enough	ASI
years of schooling	LCS
In Education I am focused on Mathematics, so I am still part of STEM	PC
My natural talents and abilities coincide better with business/marketing	AS
An 'academic' weakness, thus not one of my stronger abilities.	AS
I'm not good in these fields	AS
I was not interested in it anymore	AI
didn't want to negatively impact my GPA	AS
Don't like mathematics	AI
I would not want a career in it, but it is interesting	AI
Though I love biology, I am a poor mathematics student.	AS
Difficult	AS
I am interested in medicine, and believe that a social science major provides a nice balance in addition to the natural science courses I am required to take.	AI
not academically inclined to the sciences at all.	AS
Started Studying engineering and did not like it	AI
my future goals in life	AI
Love science, love literature more	AI
Not what I want to do with my life	AI
I like to work outside and not in a lab	AI
I am terrible at it!	AS
was not what I truly wanted to do or where my gifts were	AS, AI
I have never considered myself good at any of the above.	AS
I didn't think that physics and mathematics could help the world without philosophy. I didn't have faith in the natural sciences that they have a monopoly on truth. I believed that philosophy was the best chance at understanding the world and helping people.	AI
I never thoroughly enjoyed mathematics or science.	AI
Accounting seemed more enjoyable	AI
It was just something I never considered because I never liked any of those subjects	AI
I had to admit that I don't like science	AI
no interest!	AI
my major fit better	AI
My academic strengths and interests are not complimentary to those in a major of STEM	AS, AI

Comment Text – other factors discouraging STEM	Themes
lack of creative outlets.	AI
I originally chose it, but switched to better fit my future grad school need for an art portfolio.	JM/GSP
I am bad at science and math	AS
Just don't enjoy it	AI
I am more interested in Philosophy	AI
not my gifts	AS
it's interesting, but I'm just more interested in arts and humanities	AI
hate math	AI
Not particularly gifted in the area	AS
I really don't like science	AI
It's my minor.	PC
Have difficulties in Science classes	AS
There is too little opportunity to improve the lives of others in the ways I feel are most important.	AI
not talented in that area	AS
I liked it, but couldn't see myself in that field for the rest of my life.	AI
classes were too hard, uninteresting, and inapplicable to real life	AS, AI
Didn't enjoy it as much as I thought I would.	AI
I have a stronger interest in other areas	AI
I don't like those fields of study,	AI
It is not what I am interested in	AI
I really want to teach grade school.	AI
I transferred, and didn't have the opportunity to have a double major which I wanted	LCS
I am a highly technical person, however I choose English/Communications as my double major to enter into Film from a creative angle rather than Engineering or Architecture	AI, JM/GSP
hard	AS
I'm going into education which incorporates all, but English is my major because it's what I'm best at and most interested in.	PC, AS, AI
Not interested in medical profession and other professional programs related to STEM; only interested in teaching and decided against it	AI
there is more than one way to benefit society	O
I plan to go to Medical School so I wanted to study the humanities before focusing on science	JM/GSP
The DNR & US Forest service are a nightmare to work for	PEP, JM/GSP
study abroad opportunity interfered with rigid course schedule required	LCS
I was a STEM major, but was struggling in one class and had to drop it to keep my scholarship	LCS
They're used as a tool for getting a job at a bogus company to further one's own consumerist needs.	O

Comment Text – other factors discouraging STEM	Themes
I've never heard of STEM before; not a consideration for me.	O
No other reason	O
never heard of it	O
I do not have time to do everything I want to	LCS
Very heavy workload	AS
don't know anything about STEM majors	O

Optional Overall Comments

Comment Text – overall comments	Themes
The major factor in influencing my choice to choose a field other than a STEM field was that it takes too long to go to school to get a lucrative career in a STEM field.	LCS
Another reason I did not major in anything in the STEM area is because I would like to get a job out of college and not spend another 4-10 years in school or in a residency. However, I was at one point, seriously considering becoming a dentist.	LCS
I think STEM majors should also include certain professional degrees such as accounting and actuarial science that are noted by their integration of both complex, field-specific and general, broad knowledge sets.	PC
I choose a biology degree because I am also in the pre-veterinary medicine program and all the classes required for that program are just shy of a biology degree.	PC
One thing that really confused me is that the sciences in my high school were not very good, but I didn't know that until I came to Calvin. In high school I was great at sciences, one of the best in my class, but immediately upon entering science classes at Calvin, I realized I was highly unprepared and didn't have the motivation or desire to catch up and continue studying the sciences. The classes I had were very hard!	PEP
I do not have a STEM major...but my main focus is elementary education with science and math minors (S an M). I do not know if this can somewhat be considered as a STEM major, but I am glad that I will have the chance in my future job to increase focus on science and math--two very important and exciting subjects for life!	PC
I considered architecture to be in STEM, and thus my answers.	PC
I plan to use psychology as a background for other fields including social work and/or ministry.	PC
I believe my major combines both STEM and education, Mathematics Secondary Education. In this way I still have to complete a BA in Math as well as education classes, so I am not far removed from STEM or a BS in Mathematics.	PC
It would have been nice if there were options for double majors. I am doing a theatre and computer science double major, and I had a difficult time answering a few of the questions.	PC
The only reason I put that my major is mathematics is because I am an Elementary Math Education major. It is different than a straight math major though. I just wanted to clarify! Thanks!	PC
I like to think the choice between STEM and the humanities isn't quite so dichotomous. I've combined my interests in both with a second major in geography, which walks the line between science and social science, and I hope to study the history of science in graduate	PC

Comment Text – overall comments	Themes
school. I think there's a lot of value in letting the methodologies and research questions of one field inform those of the field I ultimately choose to study in.	
I am considering a minor in Mathematics education. Minors don't seem to be taken into account in this survey. In the field of education they can be influential.	PC
I am a people person. My first sociology class made me realize how connected with people I would be in any job I chose in that field. I have a passion for helping others. As cliché as that sounds, I mean it with all of my heart.	ASI
I am a very social person and therefore chose a career in which interacting with others is one of the primary focuses.	ASI
I am most looking forward to the one on one interaction with people.	ASI
I am a Math Education Major, so I considered that part of the STEM field.	PC
I think a big part of what people end up doing is their involvement with the subject in high school. Thus I think it is really important to have exceptional high school classes available to all students, no matter their ability.	PEP
I have 2 majors. Biology and English. Although neither are a 'primary' major, I chose English first. I answered the question considering whether or not I considered my major a 'STEM' major. There was no answer that applied but I selected the 'Yes, and my major should be classified there'. This isn't really correct, but my circumstance is interesting. Thanks.	PC
Mathematics professors are much more competent than most engineering professors.	PEP
I seriously considered going into a Pre-Med program in college, but after high school I decided that it wasn't for, so I focused on Theology because it was what interested me at the time. Then I had a couple really good Theology classes and that solidified my decision to focus on Theology.	PEP, AI
I never really was interested in a STEM major because I really do not like Math and Science is pretty hard for me. In high school and even in College I have struggled with Math. I considered a degree in Science, but when I found out that I needed math and chemistry courses, I changed my mind. I choose a major in Spanish because I love the Spanish language. I find that Spanish is easy for me to understand.	AS
The main reason I chose my major is because I wanted to help people, especially teenagers. I was reluctant about deciding until I took an Intro Psychology course with an amazing professor, and now I am in love with my major!	ASI, PEP, AI
I really am interested in biology but I was afraid that my poor math skills would prevent me from doing well in the courses. I was also concerned that I would not be motivated enough to complete the difficult science courses.	AS
Math is my primary choice, but I hate having to leave out my other major in these things. I did choose Spanish for some of the same reasons, but for some different ones too.	PC
I find that teaching and being around children is more appealing to me than anything related with STEM.	ASI, AI
I have never had an interest in STEM because I did not excel in it academically and I found little interest in it. I chose my major because it was intellectually stimulating for myself and I found a natural gift of reading literature and being able to interpret it effectively.	AS, AI
In my opinion my chosen discipline, literature and writing, requires a very different kind of studying and attention than a more scientific discipline. I can do well at math and in classes like biology and it is, to a certain point, enjoyable for me. But my mind is better suited to thinking abstractly and conceptually than matter-of-factly. I crave the creative and, while sciences can be creative, they are not creative enough for me. But I was for a time very interested in biology.	AS, AI

Comment Text – overall comments	Themes
Sustainable business I feel is the way to go in the future. Current models of business and consumption habits are devastating to the planet as well, they will not last. We need more programs that align the environmental aspect with business to both keep business going and allow the planet to be cleaner.	AI
I feel strongly for the STEM classes because I'm pre-med, and have a math major, and physics and biology minors. I believe they are the most important classes for students to complete to understand their world.	AI
The Sustainable Business major consists of science, ecology and business courses. Therefore in my mind this course of study is a STEM curriculum. I believe with our current climate issues and an increasing demand for limited resources, all majors should have a foundation in STEM/Sustainability. This will allow graduates from all disciplines to understand how their daily activities affect our climate, culture and future.	AI
For me, my worldview was most affected in the areas of history and religion. that mixed with the fact of some extraordinary high school teachers helped to make this career attractive to me	PEP, AI
Nothing wrong with STEM majors I just find my major more interesting.	AI
As I believe there is a concerning gap between the rapid advance of technology in our society and the ethical groundwork that should solidify and qualify the process, I think STEM should not be so seriously endorsed and encouraged in higher academics that the philosophical and religious questions are put on the shelf. Also, STEM is, as all fields of research and praxis go, competitive. But the completive nature of STEM at least in the U.S. goes mostly to creating unneeded consumer products, fueling the cycle of discontent in American materialism, benefiting a new weapons-based cultural imperialism. I think it is dangerous to have a STEM emphasis in our current society where people cannot even think logically or discern the times. The positive fruits of STEM are undeniable in medical health, safety, etc. but much of it is appeasing the 'want-become-needs' mentality of our culture. There needs to be a serious weeding out in the STEM field and intention of indifference to the demands to make a better resolution flat screen TV, or a new blender, or robots to do all your chores. Science becoming a pawn to the selfish disposition of a people living in abundance I think is a perversion of God's command to subdue the earth for the good of society. I would encourage greater STEM research in areas of social justice.	AI
It was a decision I made when I was very young, and it just seemed to fit as time went on and I became more and more sure of what I wanted to do with my life.	AI
Since age 10, I have always wanted to be an astronomer. The natural sciences, and physics in particular, provide the means for me to become an astronomer. This is rather an interesting case for you, I suppose, seeing as how it doesn't quite fit into the normal reasons for choosing a career.	AI
better opportunity for jobs (education), however I was not interested in those classes and they were much too rigorous	AS, AI
My STEM major would still have been within the realm of Education. I considered it seriously during my Sophomore year but had already taken so many courses in English and the Fine Arts that I would have had to stay longer to complete my college experience. Also, I feel like my natural gifts and passions are more with the Fine Arts and English.	LCS, AI
Though I understand the importance of STEM majors to society and I strongly considered being one, I wish that our society as a whole would value a broader spectrum of studies. STEM majors are great for society, but without our history, our religions, and our culture we would be much worse off. These studies (those of the humanities) are what improve our humanity as a nation. We are a nation which looks too far into the future and not far enough into the past. How can we know who to become if we do not know who we were and are now?	AI

Comment Text – overall comments	Themes
I've simply never enjoyed STEM courses, so I never even thought of them as an option. Also, I've always wanted to be a teacher, and majoring in Spanish in order to be a bilingual teacher is where I feel my gifts lie.	AI
I wouldn't be able to live with numbers or the like as a career.	AI
It should be noted that I'm also majoring in Secondary Education, meaning that after I finish schooling, I plan to teach mathematics in a secondary education setting.	PC
I personally found that my interests in areas of STEM fields could be fulfilled for me both in my personal life and in my role as an educator, and so I feel that I can keep myself updated in the fields of mathematics and science while helping students develop interests in them without having to be in the actual fields.	PC, AI
I am in the process of changing from Mathematics to Business. I planned on becoming an actuary but I am taking a statistics course and realized I don't like it very much so I am switching to business.	AI
My choice was very easy, my grandmother and grandfather were both nurses. My mother is a nurse, and since I was twelve I wanted to be a nurse. I knew going into Calvin, that nursing was the profession I was called to be in, and so far I love it.	PEP, RR, AI
To me STEM seemed to be all biology and facts, I love Psychology because it can easily be applied to life. You can help others and learn so much about People. Psychology seems so much more personable.	ASI, AI
I do not think students are discouraged from choosing a STEM major and other majors at all, especially right now when jobs seem to be easier to find in STEM. I think it is just normal, as it always has been, for certain students to like certain subjects. Not everyone like STEM and not everyone likes English or art.	AI, JM/GSP
I was a biology/pre-med major, and I genuinely enjoyed it and was good at it. I did not like chemistry, though, and did not want to go into medicine very much, so when I was in a position where I had to choose between discontinuing chemistry or losing my academic scholarship I opted for the scholarship. I enjoy Greek and Religion, so I opted for those because they are good preparation for seminary and the church, like STEM fields, is running short of educated leaders right now.	LCS, RR, AI, JM/GSP
Though I had originally considered a career in teaching chemistry and biology and coaching, successful experiences in writing and public speaking later in high school urged me to consider career options in the humanities. I am passionate about the worth of the arts, especially literature, and feel that my personal skills can best be used in this area of study. This major also allows for a wide range of career opportunities--from publishing and editing to policy writing and social advocacy.	PEP, AI, JM/GSP
I like the Engineering program here at Calvin.	AI
I never even considered a STEM major. I did not particularly like these classes in high school, and they are challenging for me. Classes within the STEM majors do not come naturally to me, therefore I would choose not to take them.	AS
As I indicated, I am interested in the Truth. I want to know what the world is like. I want an answer to the question, 'What is reality?' I want an answer to the question, 'How should I live?' I felt like answers to these questions will help the world. I felt as though, were I able to provide answers, to find the truth about these matters, then I would be able to truly help the world and benefit other people. In choosing against a STEM line of study, I had guiding me the belief that these were not adequate disciplines to find answers to these questions. In fact, it seemed (and still does) that whether or not those disciplines are or not adequate means for getting at truth is a philosophical matter. So, the first and most important thing I can do is devote my life to the study of philosophy. I felt as if philosophy was the only possible way to get at true beliefs, or at least to know what kinds of beliefs are true. So, I	AI

Comment Text – overall comments	Themes
decided to devote my life to the study of philosophy.	
I'm just not as good at science. I like biology and I'm OK at physics, but I'm terrible at chemistry. Math, I'm not bad at. However, I've always been much better at history, which has always been my best subject in school. Maybe if I had applied myself better in my science classes in high school and gotten better grades in those subjects I would have given a 'STEM' major more consideration. But I still believe I would have chosen a history major in the end.	PEP, AS
I did not choose a STEM major because I am much better at reading and writing than I am at science and math.	AS
I personally don't see anything wrong with this field and have a good number of good friends going into an aspect of STEM. It seems to me however that people who choose one of these fields do so for the potential financial incentives rather than out of a joy in the subject which I think is kind of sad.	AI
I've been sure I want to be a high school religion teacher since midway through high school. I don't think there is anything wrong with a STEM major; I just am not gifted in those areas at all. I can see why a lot of people love those fields, but they are just not for me. I never did well in them in high school and just have never had an interest in them.	AS, AI
I was sick in high school, and through those two years I came into contact with many nurses and decided I wanted to be like them	PEP
Don't enjoy science or technology and especially not mathematics. It's important to get a degree in something you enjoy if you are going to do it long term. Recreation and my specific concentration are enjoyable for me so that is where the difference lies for me	AI
I could never major in anything that has to do with math. I hate algebra, statistics, and basically all things related to numbers.	AI
I really have no interest in other fields besides special education. Special Ed was my goal for my chosen career. I looked into Social Work and Counseling, but I am more concerned about working with people than finding ways to improve life through STEM.	ASI, AI
Math is not my strongest subject, which in turn makes me shy away from programs that are heavy into that subject.	AS
Note that I worked in this field for 16 years with an associate's degree which greatly affected my choice of major.	PEP
Although, I was always enrolled in advanced math and science classes, I did poorly in them. I am good at math and science and I particularly enjoy biology, but my high school math teacher really turned me off to it. I went to a public school but [high school teacher] constantly preached his religious and political views and his love for hunting---all of which conflicted with my own. I passed both of his classes with D's because I hated doing work for him or going to his class. I only took the two required years of math because I feared having another class with him. I considered a biomedical degree and pursued it by taking AP science classes in high school and by declaring it my major in college before switching to writing. The classes were very large and I didn't get any individual attention. I prefer English and writing because my voice can be heard in class. I like discussions and talking about themes that can relate to everyone's everyday lives. I'm naturally talented when it comes to writing but I would have had to study for math and science.	PEP, AS, AI
For the first 3 year of college I was an architecture major. I switched majors because I couldn't handle the design part of the program. I feel that advertising is in close relation to design type fields. So I can still be involved in design type things but not do it as my career.	AS
I picked nursing because of the profession's ability to help people, not because of its relevance to science. It is a hands on and direct way to do this in comparison to other humanitarian careers (social work, legal system, etc.)	ASI, AI

Comment Text – overall comments	Themes
I have some basic interests in science and I know that there are advances made every day, but it's not for me. I like interacting with different people all the time, and I've never been the best with the subjects STEM is comprised of.	ASI, AS
Selecting a science major is very challenging, but also rewarding. Being able to work with great professors, and conduct field work is an experience most will never have.	AS, AI
I actually applied and was accepted to an engineering school just because I was really good at math, meaning it came easily to me and I could comprehend what I was doing. Two older siblings graduated with some degree of engineering as well. The school that I visited however bragged about themselves WAY too much and I found it annoying. I think they really wanted me to attend the school just because I was a woman as well. I felt that advertising and PR, or something along those lines would be beneficial to me and I really wanted to work with people. I know that I like the sciences though, so I am actually thinking of focusing my major towards health communications specifically.	PC, ASI, PEP, AI
Based on my own severe health problems in the past, I've found it very important for me to know and teach the importance of practicing a healthy lifestyle. I hope one day to be able to improve people's lives physically, mentally and spiritually via teaching the benefits and practice of good health and physical fitness.	PEP, AI
The thing that dissuaded me the most from choosing a STEM major is that I was afraid I would fail. I thought that language and culture studies were my strong point, so I should go with that. However, I feel that, to a certain degree, a STEM major would have been more rewarding because it is a challenge.	AS
Although I enjoy science, I just don't see the amount of money that I want to make in that field	JM/GSP
I'm wondering why you are so interested in STEM majors, because I think Michigan's extreme focus on math in high school and now also in college is unfair to those who are not smart in that area. My major isn't even listed in this survey, so knowing my major must not be part of your interest at all nor an important major to you.	AS
I avoided taking math classes my first year of college but then I took calc 1 in the summer and have been wondering ever since why I had avoided it before	PEP, AI
English and Education just came more naturally to me and I liked them better.	AI
With my experience I have not had good science or technology professors that were able to connect with the students and engage them in learning.	PEP
My only reasoning for a STEM degree was to make loads of money, but I matured and now don't care too much about lots of money--I just want to be able to support myself and teach.	AI
I dabbled around in different areas when deciding on my major. The main reason I chose my major in English was because someone told me that I should do what I liked in college and not what was going to get me far, because I might never have the chance to do that again. So I did-- and I love to write.	PEP, AI
I actually started in the sciences and was planning on going into med school but I soon found out that my calling did not lay in the sciences but in religious studies. This would not have been my first pick of a major but now that I am studying it I love it and I know this is what I am meant to study.	RR, AI
I just chose a chemistry major because I really enjoy the mindset of chemistry. I probably won't use chemistry directly in my field of work since I am going on to become a Physician's Assistant. I really enjoy the sciences.	AI
My major is exercise science. A few role models have exercise science related careers and may have sparked my interest in exercise science, but I mainly chose it because I have always been an athlete and have a great interest in learning the structures of the body and	PEP, AI

Comment Text – overall comments	Themes
<p>how it functions. Although I have some new interest in other fields, I feel that STEM are fields best suited for me.</p>	
<p>I really like science and math, and I seriously considered either minoring in Chemistry or Math, but I love Spanish and I think I would like teaching Social Studies better than Chemistry or Math. Plus, Social Studies gives me more opportunities to learn about different cultures and regions of the world, which I love.</p>	AI
<p>My management simulation class was the direct contributor to me choosing a management major. If it was not for that class I would not have been as sure I was fit for a management major. Prayer was also a big help in the discovery process. STEM never interested me. My academic skills are not in those areas.</p>	PEP, RR, AS
<p>I undeclared a math major because I could not see how what I was learning could be useful in real life. I found Religion and History (my two majors now) to be much more applicable. Taking classes in Religion and History changes me and makes me a better and better informed person. Learning abstract math concepts did not.</p>	AI
<p>I initially intended to double major in history and chemistry when I first came to college. However, after taking the first semester of organic chemistry, I knew that it was just not my thing. Granted, the professor told us at the beginning of the course that it was designed to force people to leave the major. I still found it to be not as interesting as high school chemistry, though, and I was quickly becoming disenchanted with a chemistry major. I was still very happy with history, and all my classes were going swimmingly, so I decided on a single history major instead.</p>	PEP, AI
<p>I think the STEM is great but it is just not something I am personally interested in and I am not passionate about math or sciences, except for psychology.</p>	AI
<p>I participated in an internship with Ferris State University and CVS Pharmacies in high school. The pharmacy field turned out to be really boring, and I decided I didn't want to spend the rest of my life doing that. In addition, the lead pharmacist at the location I was working at told me I should consider other, more creative options, rather than spend the rest of my life counting pills. I tended to agree, and decided to get into Marketing. I also have a Business Economics major, which is mostly because GVSU makes it easy to double major in business.</p>	PC, PEP, AI
<p>I loved science and especially math my whole life. I took anatomy on top of AP Bio and AP calc my senior year (both of which I passed out of) and attended college with the intent of going into some sort of science for a profession. Shortly after arriving my freshman year, I realized that though math and science are interesting, they are not very social careers and I am a very social person. But more importantly they don't really make a difference in the everyday lives of people. They do to a certain extent, of course, (technology is amazing) but I wanted to influence people in the matters of things that are eternally important. Nothing is more important in life than having those sort of things thought about and figured.</p>	ASI, AI
<p>I wanted to graduate early and a stem degree would take too long. Also, I am interested in agriscience and the option was not available.</p>	LCS
<p>I find that the pressure to choose a major during high school so as to apply to colleges or universities that offer the best opportunities for that field of study places unrealistic expectations on young people who have not yet had the experience they need to discern what field of study best encompasses their interests and utilizes their skills. I became interested in the field of psychology after I applied to Aquinas (initially to study special ed/conductive education, a program with a basis in neuroscience) and have been disappointed in its lack of resources for scientific research. I also believe that gifted students may be pressured into fields like pre-med during high school simply because they have the ability to compete in this type of field and it is something 'smart people' do, rather than because they truly have interest and passion for this type of work. Fields in the arts and humanities are considered</p>	AS, AI

Comment Text – overall comments	Themes
<p>less rigorous. Education, a field that requires high levels of creativity, organization, flexibility, and knowledge is often touted as a last choice for those who might not 'cut it' in other programs or who aren't sure what they want to do. I disagree with this implied relationship between intelligence and 'STEM' fields. STEM requires one type of intelligence. Genius musicianship or insightful historic research requires another. Perhaps this assumption relates to a residual association between males and science vs. females and liberal arts. In the past, these associations were clearly demarcated and the study of science barred in many ways from females. However, many females excel in the type of creative thinking that lends itself to the arts or to education and are drawn to these types of fields. Not long ago, widespread assumption held that females were less intelligent than males. Could it be that because many of us harbor implicit beliefs that the liberal arts are less worthy fields for intelligent people who wish to contribute to the improvement of our society and world?</p>	
<p>I have a job with no potential growth and I wanted a field with various opportunities for many years. I love problem solving and program analysis seems a good fit. I wish there were more intern and job shadowing opportunities. I plan to try to use my degree as support for the medical field.</p>	AI, JM/GSP
<p>I've never seriously considered a STEM field major (though perhaps Geography would count as one), because I've never really felt inclined or pulled in that direction. While I do find the knowledge and information of those fields highly interesting, I lose interest when it comes to having to learn them through a classroom setting. The social sciences, in general, stimulate my interest far more than any other science or technology-based learning.</p>	AI
<p>As I stated in the survey I've been working with special needs children for a while. I wanted to finish college and I thought education would be a good fit. I have interest in STEM fields, however, since I have been out of school for 20yrs I felt I should major in something I have experience in.</p>	PEP, AI
<p>I never had a problem understanding math, science, or technology. In fact, I do find myself drawn to those studies. However, English and literature I believe to be much more invigorating and a much more cerebral experience for me personally. Had I gone through with my biology major, I might be in Veterinary school right now. But I found that writing, my natural predilection, called me instead.</p>	AI
<p>Science was never of interest to me and I don't think I received much exposure in high school relating to technology or engineering.</p>	PEP, AI
<p>I spent a great amount of time deciding what to major in. I wanted something I felt that I would stay interested in for the long term, something that would be important and meaningful, and that wasn't too narrowly defined so as to limit my options for future employment and region of living.</p>	AI, JM/GSP
<p>I've never liked science and math, even though I always did well in those classes. I think God just wired me with something else in mind :-)</p>	RR, AI
<p>I'm not very good at math or science, I have nothing against STEM fields. I shouldn't be an art major, but it's too late to change it. I should be a psychology major, that is where my passions lay.</p>	AS
<p>I prefer science to any other field in my education. Within the sciences I prefer biology. I've been interested in the intricacies of biology for my entire life. With a better understanding of biology comes a greater appreciation for everything in life.</p>	AI
<p>I never seriously considered a STEM major simply because I am not passionate about those subject areas and did not feel that I would be able to live a fulfilling life for me in a career that that major would lead me to.</p>	AI
<p>I enjoy math like algebra and calculus, but I did not like the professors once I got into college and was less interested by higher math. I was never really a science person, but I did enjoy</p>	PEP, AS, AI

Comment Text – overall comments	Themes
chemistry in high school, I just had to work harder to get the grade I wanted and didn't think it was something I'd want to do for the rest of my life.	
I originally wanted to be a robotics engineer, however-- I have many, many interests and I chose the one I did best; Japanese.	AS, AI
I will have a BA in mathematics, so I believe that that is a STEM major. I chose my major because I want to help others, because I love math, and because I love to teach.	ASI, AI
I did not choose STEM because I am not good at math. I chose my major based on my God given gifts.	RR, AS
My selection for my major was primarily based on what I am interested in. I could major in a STEM major and be successful in a career, but I would not be happy. English and writing is what I am naturally talented with and something that I know I could do every day and have no regrets.	AI
I was actually deciding between business and nursing, but I loved science, and thought that if I was choosing nursing I should start right away because of all the requirements. I ended up enjoying the science classes a lot, and now that I am in the nursing classes, I miss the science, and part of me longs to become a doctor. Nonetheless, I think nursing was the right choice, and I will be able to continue my education and get a PhD or DNR in the nursing field if I'd like.	LCS, AI
My natural gifts and way of thinking does not line up with the STEM field.	AS
I think the choice between STEM and other fields just comes from my areas of things that I enjoy studying and applying.	AI
It comes down to my personal interests and talents. I'm fine at math and science but way more interested in PE	AI
I am a Business major and am not interested in the science fields. I am more of a strategic thinker, solving overall big problems. I very much enjoy math, but not science, engineering, or computer science.	AI
I have always struggled with subjects involved in STEM majors. I was never encouraged to participate, beyond minimal requirements, in math or science courses previous to coming to college. Therefore, my strengths are in areas I was encouraged in (social sciences) and have been given the most opportunity in (internships, experiences, etc).	PEP, AS
I have a large degree of interests; I took AP classes in, and thoroughly enjoyed, both math and science. However, my love of writing and journalism outweighed these considerations, so I chose a major in the humanities instead.	PEP, AI
About the STEM choice, I am a mathematics and integrated science major because that is what is needed most in the elementary ed. field but if it were up to me I would have chosen English or language arts because that is what I am better at.	JM/GSP
It was difficult for me to choose which one factor most greatly affected my choice of a major. It has just been really broadly my life experience that has led me into my field of study, not one specific thing. I enjoy science, and considered a concentration in nursing, however I didn't think about it until it was really too late for me to pursue it and finish my schooling in 4 years (important for financial reasons)and because I decided that I liked what I was doing now better.	LCS, AI
As an education major/minor science and mathematics are common majors. I have always liked math and been interested in the sciences, however, there is no program that integrates the two or that is specified to a student's likings or curiosities. For example, I would major in science if I wasn't required to take so much chem/physics. I am going to be an elementary teacher, not a researcher or everyday scientist and have no interest or real ability to do well in high level chem classes. This is why I say there is nothing wrong with STEM majors	PC, AI, JM/GSP

Comment Text – overall comments	Themes
technically, I just feel mine is all around more tailored to me.	
I think that perhaps I would have been more open to studying a subject in the STEM area, but I just dove right into college with a single-minded view of what I wanted to do. I took general ed courses that were somehow related to my major, even if in a small way. Perhaps, I was never exposed to the subjects.	PEP
I chose health professions because it was the major that would best prepare me for applying to graduate school. I enjoy the sciences but most specifically health sciences so the choice for Health Professions to become an occupational therapist seemed the most direct route.	AI, JM/GSP
I have always found the sciences interesting, but mathematics does not interest me.	AI
I wasn't sure if I wanted to be a nursing major originally, but I went for it anyways, because it is hard to get into the major later on. I'm glad I did!	LCS, AI
I really enjoy mathematics, but have no idea what I would do with a career in math. The medical field has always been my number one interest.	AI, JM/GSP
I was drawn to this field not only because of the factors previously identified, but also because I have always loved science. I am intrigued by the improvements in the scientific field; I knew going into the field of health professions, I would always have the opportunity to learn new things and that I would be engaged in a dynamic career.	AI, JM/GSP
I choose accounting because I love numbers. I hate science with a passion, engineering is way too complex for me, I'm not a super technical person. I love math and with accounting I am able to use mathematics everyday but am not limited to JUST math. I get to experience many areas like management decisions and so forth.	AI
I chose my major based on my interest in classes in high school. I enjoy classes that challenge me and science classes have always been a challenge, therefore I chose a science major.	PEP, AI
I honestly think it just boils down to my natural gifts/interests. I'm just more inclined to the arts rather than the sciences... I don't really harbor any grudge or resentment to the field.	AS, AI
I went to every department of the slightest interest and talked with each leading Professor about the major. I asked what are possible job options with the major, what types of things we learn in class, what types of interest students usually hold in this area. I found that communications best fit my interests and also left the door open for a future impacting career.	PEP, AI, JM/GSP
I don't understand how Chemistry is part of the 'communication, journalism' category. These subjects should not be categorized together. Part of my decision to major in chemistry was also due to the fact that, as part of a pre-professional program (pre-pharmacy), I was required to take two chemistry classes. When I discovered my interest in Chemistry, the subject seemed to fit well into the pre-professional curriculum as well, which was a bonus.	PC, AI
I liked math and science in high school, but did not feel that I was smart enough to major in one and I wasn't really interested in having a degree in it. I would have rather double majored in Psychology and dance, but I am just a psychology major.	PEP, AS, AI
I would like to go into earth sciences but I didn't do well in science so I choose to go a different route.	AS
It is not that I don't like science, technology, engineering and mathematics. I just find that it does not let me express myself creatively as much as other fields.	AI
I am taking math for liberal arts majors only because it is required. I am however taking an environmental Science course which is extremely interesting but I am not interested in pursuing a degree. I may take further classes just out of interest. Just don't love any of the STEM majors	AI

Comment Text – overall comments	Themes
I've never felt like I was good at mathematics or technology. For awhile, I felt that I had adequate skills in science, but as I grew older (probably around early high school), I felt that I was wrong about that, too. Maybe I am just better at other things, or maybe I'm just fulfilling the social expectation that females are better at 'social, humanitarian'-type studies and less skilled at STEM studies.	AS
I never considered choosing a STEM major because the abilities necessary to succeed in such majors were not natural to me, and I didn't ever enjoy mathematics, science, or technology classes. Although I do love working with my hands and creating, I prefer to do so on a smaller scale with a different purpose than one that is entirely functional, like in engineering. The careers involved with those majors did not seem at all interesting to me.	AS, AI
My major used to be Education with an emphasis in Mathematics, but I wanted to work somewhere besides a school for the rest of my life. I was scared to just be in a school setting forever. I changed to Exercise Science, so I could learn about the body and do something in the medical field.	AI, JM/GSP
I've been taking classes in both chemistry and chemical engineering for a few semesters, since I've always been interested in chemistry but also enjoy math and thought I'd give engineering a try. However, I realized that I enjoy chemistry more and will focus primarily on this in the future. I prefer chemistry to other non-scientific fields because it is logical, personally challenging, and provides the possibility for discovery of entirely new information.	AI
I tried out engineering my first semester but determined that the type of math I enjoyed was statistics and business math rather than calculus.	AI
Some people are math/science people, other people do not enjoy those subjects. I would not chose a major in a subject area that I do not enjoy. Often, those are gender biased toward men also.	AI
I wanted to go into a STEM major but then I got my ACT results back and that helped me decide--in a hurry--that my talents do not lie within those areas...	AS
I have never really been that interested in a career in science, engineering or mathematics because the academic work is challenging for me. However, a degree in technology is something I might be interested in. I would like to take at least one class in something like computer science.	AS
most students who enter STEM fields seem materialistic in their goals and seem to want to live comfortably. I study history because I love the subject, I believe that it has intrinsic value, I know I will more deeply enjoy my career if it is history related than if I were stuck in a cubicle.	AI
I wish I had more confidence to pursue a degree in something like engineering, but I had very low math & science scores all throughout school, which is primarily why I chose communications. I think my low scores in those areas were a combination of inadequate teaching as well as my own inability to focus on those areas for any length of time.	PEP, AS
The main reason I have never enjoyed or considered STEM is because those classes are hard for me. I am very intelligent in other areas, but I have always found STEM classes to be contrary to my learning styles.	AS
I had originally declared an engineering major, but I was turned off to it because of the large amount of math classes that have to be taken as part of the course work.	AI
I do have a mathematics minor, for the reasons that I both enjoy it and find it to be an important area of study.	PC, AI
I have wanted to be a veterinarian since I was in 7th grade which is why I chose to major in biology. Once I started college I realized math came more easily for me than it did for others and one of my professors convinced me to major in that as well.	AS

Comment Text – overall comments	Themes
Science, math and such were not appealing to me in grade school--it scared me to enjoy learning in high school and college, which is the reason why I don't want to go into that field as a major. I have enjoyed studying Science and math at Calvin though...but still not an interest to continue in study. I desire to be the teacher who allows students to enjoy all subject areas as much as possible without being tortured by the stressful tests and hard to understand subject material. The US needs more teachers who care about their students' self esteem--I believe that to have a huge effect on student motivation.	PEP, AI
In a way I did choose science as a major (I am integrated science in education) so the second half of the survey did not apply too much to me. I did not choose to actually go into the science as a profession though because I always wanted to be a teacher and I want to influence/inspire others to go on and do that work. If education does not work out though, I would love to finish another degree in strictly science and do work that way, but I feel as though research is not my cup of tea though. Besides research and teaching (elem, hs, or college) I'm not sure what else you can do.	PC, AI
My choice in German as a major came primarily from the year that I spent in Germany as an exchange student in high school. Since being in college, I have rejected the idea of working with German vocationally, but have taken additional linguistics and speech pathology courses in an effort to prepare myself for the job market. I did not feel for practical purposes that it was very wise for me to change programs so late in my college career. I do not think that my gender has any bearing on whether or not I will work in my field.	PEP, JM/GSP
I chose nursing because nurses are in high demand and it is a great way to be able to help people while also making a living for yourself.	AI, JM/GSP
I really enjoy working with children with special needs and children who have illnesses. I have never been really good in Math or Science so I knew that was something that would not interest me at all.	AS, AI
To choose the science field I looked at which way the job opportunities are heading in the future, and what I could do to be a more helpful person in God's kingdom.	RR, JM/GSP
I am double-majoring in business and in math/econ. I am interested in finance. I chose this major because it would allow me to apply my quantitative (STEM) skills to the business world, where I hope to hold a management position.	AI, JM/GSP
My uncle was an engineer and I wrote my junior research paper on engineering. I also came into my first semester as an exercise science major. I am now a sports management and business communications major, and I think this is where my talents and aspirations lie.	PEP, AI
I was interested in a major in statistics but was torn between following through with my original plan of occupational therapy school or graduate work in statistical research. For my final decision, I stayed with what I was familiar with.	O
The STEM fields are by far the most advancing in our current world. Every single day more knowledge in a subject is gained and used to advance society as a whole. What better profession to be in that encourages people to learn new things every day, advances technologies to new unforeseen heights, and provides a constant challenge to better oneself.	AI, JM/GSP
I am a returning college student - work full time, adult. Lib Studies allows me flexibility and it interests me. I do not plan on changing jobs when I am done.	AI
I also decided to double major in psychology to support my exercise science major. I also wanted to work directly with people to help better their lives instead of indirectly, which is usually the case for STEM.	PC, ASI
I want to work with animals, not computers	AI
There are still many times when I'm not sure about my major.	O
I majored in chemistry for a year and because I still did not know what I wanted to do for a	AS, JM/GSP

Comment Text – overall comments	Themes
career, decided it was too limiting. Majoring in communications opens up many options, and as good as I was at chemistry, I am even better in this subject area. My previous science experience also gives me an advantage in the research area of communications.	
I always liked sciences even if I didn't always get good grades but that was due to lack of effort. I was thinking about engineering but I found freshmen year that I like doing my chemistry homework and didn't like the others... that kinda led me to the chem major. about your survey though my H.S. had a GPA out of 4.0 even though I took 9 AP classes so that would be much higher if we had had weighted grades.	AS, AI
I have never felt talented in STEM classes. My gifts are in the social sciences I understand people better than equations.	AS
I plan to pursue STEM programs at the graduate level. Hopefully public health.	JM/GSP
I'm a science major math minor, I am good at math and I can see patterns easily, so it wanted to know more about how to teach that to future students, and science was always a given, I love biology and geography and just science on all levels to a certain extent.	AS, AI
I was never interested in STEM fields and my skills and abilities are not primarily focused on them.	AS, AI
I'm really good at understanding math, but I'm not very good at calculating it. All of the fields here make it sound like I'm going to be in a lab or working on data sheets or doing stuff like that that sounds boring. I'd much rather talk to people all day.	ASI, AS
I am seeking a teaching certificate. And while I very easily could have majored in Group Social Studies or Science for the education program, I have always excelled in and enjoyed English more.	PC, AI
I was very interested in forensic pathology, which I believe would be classified as a STEM major, but I didn't want to spend 14 more years in school.	LCS
I very much dislike the subject matter of STEM - except the technology part as it relates to media production. But I still really don't enjoy it...it just comes with what I do enjoy. My brain is not science and math minded...	AI
I have a math minor, but chose to follow economics. Science doesn't interest me.	PC, AI
Could not find anything close to what my major is (Business Communications for Event/Wedding Planning)	O
I am applying to a science program for grad school, however I needed the highest GPA possible to not only get accepted, but have a shot at funding. I have an interest in the sciences but was not willing to risk my future over a lower GPA to undergrad major in the sciences.	LCS, JM/GSP
I have always loved being outdoors as a child and always knew I wanted to do something medical. I was always gathering animals and dissecting what I found. It was something that I really enjoyed doing as a kid and still do!	PEP, AI
I have 6 years of natural resources experience and I have found that anyone can get a natural science degree and be successful, which is why the wages are so low. Also jobs in the natural sciences are very competitive which is very unsettling because your position can be easily replaced at any time due to the large applicant pool. For one position I held, I was one of 324 applicants and on my first day of work they showed me the stack of applications to let me know how easily I could lose my job and not be missed... The field also requires a large amount of personal sacrifice of time and talent which is a huge drain on family relations. The largest determining factor why I chose to get out of the natural sciences field was because the field is too competitive and unfortunately, having a 'rewarding job' does not pay the mortgage.	PEP, JM/GSP
I am disappointed in the perceived gap between 'science people' and 'humanities people'. I	PEP, AI

Comment Text – overall comments	Themes
hate being categorized by my field of study. I considered both marine biology as I was graduating from high school and geology here at Calvin before settling on art history. This choice was not because I dislike science or think it's too difficult, it's just that college (unfortunately) forces students to narrow their focus to just a small fragment of their overall interests. Rather than expanding you as a person, I feel college in many ways shrinks you and places you in categories of study that (in my case) do not define you very much at all.	
My major was largely chosen by my mom. She wanted me to enter into a field with a lot of job opportunities. Seeing as I didn't have a passion for any of the STEM fields she told me I should do Business Communications. By the time I found something else I might like, International Development, I didn't have time to switch because I am trying to finish in three years.	LCS, PEP, JM/GSP
I am much more interested in people than science or technology or math, so social work is a better fit for me.	ASI, AI
This survey was very well drawn up. The choices for the reason one chose the particular field were very broad, yet specific enough for almost everyone to qualify under. Good job...	O
Religion was not an option for chosen major; I am double-majoring in religion and of late, something in that field seems to be the path I will be taking (i.e., seminary over grad school).	RR, JM/GSP
I disagree with the questions of this survey. They represent the overall consensus on why people choose fields that they do. My argument is not that I personally chose this field - my beliefs and faith cause me to recognize that I am not my own - I am God's. I seek His will for me, testing the passions he has given me and the passions or interests I have created on my own. Nowhere does this study compensate for that. I would argue my answers do not reflect my beliefs because they are not created to account for what I have written above.	RR, AI
My field is a lot of science...	O
I am not confident in my math skills. I believe it is rooted in my high school tracking.	PEP, AS
I think Accounting is a STEM field....as it is a professional degree and also uses math and technology heavily.	PC
My main consideration in choosing education over another field was that I love working with kids and had a lot of experience working with younger kids/mentoring during my high school years.	ASI, PEP
They are too narrow focused.	JM/GSP
I had a bad science teacher that made me dislike science. I decided to do business since it is a good general major that can be very applicable to a great variety of jobs.	PEP, JM/GSP
If data on race/ethnicity is going to be collected, people must be able to choose more than one. To not do this completely negates the people who do not identify with only one racial experience or do not identify with one more than the other. I am very disappointed to see this on an academic study.	O
My decision not to pursue a STEM major really came down to the lack of people. I realized that spending all that time in the lab and studying for extremely difficult exams was stopping me from spending time with friends and involved in organizations that I loved. I didn't want that to be the rest of my life. I just like people too much not to work with them directly.	ASI, PEP
I am mostly unaware of STEM programs, and so cannot answer questions related to such choices very accurately.	O
Anthropology was not listed and so I picked Social Sciences which is close but doesn't begin to describe what an Anthropologist does. In the past I have not been interested in STEM fields, but I may change my mind because of the lack of jobs in the Anthropology department.	JM/GSP

Comment Text – overall comments	Themes
Close your eyes. Are you scared? Now open them. (It occurs to me that you can't read with your eyes close, so I do hope that you opened them eventually. It would be rather a shame if you did not.) Look around. Now think to yourself, 'Why am I doing this?' However, do not question. Accept it and move on, like so many before you.	0
The possible options given for why one might not choose a STEM major are limited and insufficient.	0
What really matters? I know my major doesn't.	0
I don't know exactly how I chose my major, but the time came to decide and I just went with Communications.	0
I considered the pre-med program and a possible chemistry or biology major my freshman year of college. It was a combination of practical work experiences, job shadow experiences, and personal goals (wanting a family, wanting to participate in missions work, desiring less debt) that led me to nursing. I am extremely happy that I made the switch.	PEP, RR, JM/GSP

References

- Adelman, Clifford. 1998. *Women and men of the engineering path : a model for analyses of undergraduate careers*. Washington, DC: U.S. Dept. of Education : National Institute for Science Education.
- Mendez, Guillermo, Trent D. Buskirk, Sharon Lohr, and Susan Haag. 2008. "Factors associated with persistence in science and engineering majors: an exploratory study using classification trees and random forests." *Journal of Engineering Education* (January 2008):57-70.
- Nicholls, Gillian M., Harvey Wolfe, Mary Besterfield-Sacre, Larry Shuman, and Siripen Larpiattaworn. 2006. "Identifying Variables That Predict a STEM Major for Female Students." In *Women in Engineering Programs and Advocates Network (WEPAN)*. Pittsburgh, Pennsylvania.
- RAND Corporation. 2003. The U.S. Scientific and Technical Workforce: Improving Data for Decisionmaking. Paper read at How will we recognize a shortage or surplus in the scientific and technical workforce? Improving the data system for decisionmaking, June, at RAND Corporation, Santa Monica, CA.
- Teitelbaum, Michael S. 2003. "Do We Need More Scientists?" *The Public Interest* 153 (Fall 2003).
- Zhang, Guili, Timothy J. Anderson, Matthew W. Ohland, and Brian R. Thorndyke. 2004. "Identifying Factors Influencing Engineering Student Graduation: A Longitudinal and Cross-Institutional Study." *Journal of Engineering Education* 93 (4):313-20.

