



Teacher Recruitment: Predictive Factors of STEM University Students Entering the Teaching Profession

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Abstract: This study examines factors that influence science, technology, engineering and math (STEM) university students' willingness to consider teaching as a career. Although very few of these students initially consider this profession, we identified four factors using predictive modeling that are strongly associated with these students' willingness to consider teaching and their belief that teaching might be their best career option. Results indicated that STEM university students were more likely to consider teaching when they believed teaching is something they would be good at, others encouraged them to be a teacher, when family encourages them to teach, and when teachers they know inspire them. Results from this study indicate that small salary bonuses would likely not entice students in STEM subjects to become teachers. Less impactful factors included gender and individual beliefs about the respectability of the profession. Additionally, this study found students less likely to consider work conditions for teachers when making career choices.

Key words: teacher education; teacher recruitment; teacher preparation; teaching profession; teacher shortage; perceptions on the teaching profession; university STEM students

1. INTRODUCTION

For decades, schools in the United States have struggled to retain enough teachers to fully staff their classrooms [1]. Currently; the demand for teachers is much greater than the supply [2]. The increased demand for new teachers is partly due to the growing student populations; however, another factor impacting the shortage is that fewer potential teachers are entering teacher education programs [3]. Enrollments in traditional university teacher preparation programs have declined by 30% between 2010 and 2014 [4]. Even more alarming, nearly half of the graduates from teacher preparation programs do not take a teaching position [5]. Under these current circumstances, the United States will likely continue to experience a shortage of teachers for the foreseeable future [6,7].

Over the last several years, fewer high school graduates have shown interest in pursuing a teacher education major in college. In 2010, 15% of high school students showed interest in the teaching profession compared to only 12% in 2014. Note that these figures only show student interest, and not intent to enroll in a teacher preparation program [8]. This is further supported by the nation-wide 35% decrease in enrollments in teacher preparation programs from 2009 to 2014, and while qualified teachers come from many different candidate pools, the vast majority of new teachers are prepared by university teacher preparation programs [9]. In comparison, overall university enrollments only decreased 3% over the same time period. This suggests that students, despite some interest in the teaching profession, are choosing career paths other than teaching [10]. In short, it has become increasingly challenging to entice new teachers into the profession.

Solutions to the problems of teacher recruitment and retention are difficult and complicated to resolve. Over the years, many solutions have been attempted including early interventions that encourage parents to influence their children to become a teacher and enroll in a teacher preparation program to help increase the supply of qualified teachers [11]. But beyond the challenge of simply having enough teachers, one of the most critical issues schools are facing is the shortage of qualified teachers in science, technology, engineering, and math (STEM) subjects. Schools are subject to state mandates to hire qualified STEM teachers with degrees that match the specific subject area and hold appropriate endorsements. With this need to hire STEM qualified teachers, which are difficult to find, incentives

have been devised and implemented to entice them into the profession. One such program incentivizes STEM university students to become teachers by providing qualified secondary education teachers of mathematics or other specifically identified science areas with a salary supplement [12].

Many factors have been previously identified as having potential import to individuals when considering a teaching career [11,13]. From a study of the literature, Table 1 presents factors that have been found to impact an individual's decision to enter the teaching profession. These factors were used in the development of the survey instrument used in this study to discover which factors are most influential.

While many other studies from the literature have surveyed pre-service and practicing teachers, this study targets non-teaching university students currently studying STEM topics. Given the need to identify workable solutions to incentivize STEM university students to the field of teaching, this study was designed to examine factors believed to have an effect on teacher recruitment. The research questions addressed in this article focus on identifying the most influential factors that predict whether university students pursuing STEM majors might consider teaching as a career, whether they felt teaching was the best career option for them, and the degree to which STEM students might be incentivized to consider teaching as a career by a yearly teaching bonus.

Table 1. General Factors Included in This Analysis Believed to Influence STEM University Students to Become Teachers

Factor	Sources
Respect for teachers / profession	[14, 15]
Teacher compensation	[16]
Student's gender	[14, 15]
Teacher in the family	[14]
Expectations are reasonable	[17, 18]
Self-efficacy/interest	[19]
Work conditions for teachers	[16]
Altruistic motivations	[20, 21]
Encouragement from others	[22, 11]
Teacher's lifestyle	[14, 13]

Note. Multiple sources exist for each general factor. In addition, each factor has various aspects associated with it.

2. RESEARCH QUESTIONS

To better understand the existing teacher recruitment challenge, this study asked which factors best predicted whether STEM university students would consider teaching as a career and whether they felt teaching was their best career option. The study was designed to examine factors identified from previous research that affect teacher recruitment. Three research questions were addressed: (a) which factors predict whether STEM university students are willing to consider teaching as a career? (b) Which factors predict whether STEM university students feel teaching is the best career option for them? and (c) How much of a yearly teaching bonus these university students feel they need to consider teaching as a career? These first two questions while related are important because, as many researchers have found, there are many potential teachers that might be willing to consider teaching as a career, but there are many more who do not feel teaching is the best career option for them. There is a profound difference in just considering a teaching career vs. feeling that teaching is their best career option.

3. METHODOLOGY

Many studies have been conducted that target both pre-service and in-service teachers. In this study, university students enrolled in STEM majors were surveyed to determine their perception of the teaching profession, including (a) whether students were considering teaching as a career and (b) whether they felt teaching was the best career option for them. Then a regression analysis was conducted to separately identify for those two dependent variables which factors best predicted those beliefs. Factors measured through items on the survey were used as independent variables in each regression analysis (see Table 1).

3.1. Participants

After IRB approval was granted for the study, participant recruitment took place in Fall Semester 2019. Participants were recruited from university students pursuing education in STEM-related fields at Brigham Young University in Provo, Utah. Students with declared majors in mathematics, computer science, engineering, chemistry, biology, physics, physical science, and general science were sent an email invitation via the university email system to complete an anonymous online Qualtrics questionnaire. The purpose of the survey was to seek their perceptions about career choices specifically as it related to teaching as a career.

The researchers sent out the survey to 15,127 students and these sampling efforts yielded 4,743 students that completed all of the survey items for a response rate of approximately 31%, with 2920 (62%) of the respondents being male. An examination of the relatively few incomplete surveys (defined as less than 90% complete) revealed that they often contained meager data and that the survey items not answered appeared to be randomly distributed throughout the survey. Therefore, the researchers decided that list-wise deletion was a justifiable approach to take to the surveys missing data, and only surveys with complete data were included in the data analysis. While a response rate of 31% can be considered typical in social science, the researchers understand there is a limitation to the generalizability of these results as we truly don't know if the respondents are biased toward the teaching profession as the greeting announced this was a survey of perceptions about career choices, specifically targeting teaching as a career (Appendix).

3.2. Instrument Development

Survey items were developed, tested, and refined in order to capture respondents' perceptions of teachers and the teaching profession. The instruments used for data collection were validated through a process recommended by Creswell [23]. Based on a review of literature that identified potentially important factors that might affect an individual's decision to choose teaching as a career, draft items were created. These items were tested and revised based on a cognitive think-aloud process and then pilot tested to verify that each item did in fact capture the essence of the factors of interest. Once the items were set, they were entered into an online survey software program to be distributed by the university email system. The invitations to complete the anonymous online questionnaire were sent to all targeted STEM declared majors by university personnel. A typical 6-point Likert continuous scale ranging from *strongly disagree* to *strongly agree* was used. For disaggregation purposes, the 6-point Likert scale was collapsed to three categories for reporting the results in this article, although the full scale was used for the analysis. The final version of the survey was approved by the university teacher preparation program administrators.

3.3. Data Collection and Analysis

In order to answer the research questions concerning (a) the factors that predict whether a STEM university student would consider teaching as a profession, (b) the factors that predict these student's belief that teaching is the best profession for them, and (c) how much of a yearly teaching bonus these university students feel they need to consider teaching as a career, a regression analysis was conducted. The research questions also asked for the student's GPA and gender which were used in the analysis. The regressions were based on an individual's selection of their agreement with the statements, based on the 6 point continuous scale. The independent variables used for the analysis of the first two questions were derived from items regarding students' perceptions of the teaching profession. After determining that the assumptions for the statistical methods used in the study (linearity, independence of observations, normality of residuals, equality of variance, and lack of multicollinearity) were met, the responses for each factor were calculated through regression analysis. These assumptions were checked via (a) residual plots, (b) histograms of residuals, (c) variance inflation factors (VIFs), and (d) data structure for independence. All statistical assumptions were met.

4. RESULTS AND DISCUSSION

4.1. Students' Perception of Teaching

University STEM students' beliefs about teaching from the survey results and the relative importance of those beliefs in their willingness to consider teaching as a career is found in Table 2. The table presents two separate but related perceptions; first, the beliefs about each specific factor, and second,

the importance participants place on each factor. Of the responses collected for the 11 specific perceptions of teachers and the teaching profession examined in this study, the results reveal the factors of most importance show little agreement with the beliefs that would have an effect on whether students believe becoming a teacher is their best career option.

The belief that teachers can be a positive influence in students’ lives, that teaching is a noble profession, was the factor that students (87%) felt was most important in their decision to become a teacher and 96% of students agreed with that belief. However, in the next belief of highest importance, teacher salary (80%), only 5% felt teachers are paid adequately for the job while 60% completely disagreed. We were interested to find that students recognized the importance of good working conditions for teachers (75%) but only 26% agree that these conditions actually exist.

Students mostly agreed with the beliefs; people are supportive of teachers, teachers are well respected in the community, and that you need to have a certain personality to be a good teacher, but these factors were rated lowest in importance so students appear to attribute greater importance to other factors in their decision to become a teacher.

Table2. *University Students’ Beliefs About Teaching and the Importance of These Individual Factors to Students in Considering Teaching as a Career Ordered by Importance (N=4,743).*

Beliefs about Teaching	Disagree*	Somewhat Agree/Disagree	Agree**	Important or Very Important
Teachers can be a positive influence in students’ lives (Teaching is a noble profession)	0 %	4%	96%	87%
Teachers are paid well for doing their job	60%	35%	5%	80%
Working conditions for teachers are good	17%	57%	26%	75%
Teachers have a good lifestyle (working hours, holidays)	11%	48%	41%	70%
Teachers have the resources they need to do their job	37%	51%	12%	67%
Expectations of teachers (class sizes, responsibilities) are reasonable	18%	57%	25%	64%
Students are well behaved and care about learning	25%	61%	14%	63%
Most of the teachers I know are good teachers	9%	54%	37%	45%
People I know are very supportive of teachers	3%	37%	60%	45%
Teachers are well respected in the community	7%	45%	48%	42%
You need to have a certain personality to be a good teacher	10%	44%	46%	42%

*percentage of university students in the group who disagreed or strongly disagreed with each statement.

** percentage of university students in the group who agreed or strongly agreed with each statement.

4.2. Factors Predicting Student Career Decisions for Teaching

The survey data representing students’ perceptions and beliefs of teaching on a 6 point continuous scale were used to conduct a predictive regression analysis to determine which factors best predicted whether students were willing to consider teaching as a career and whether they believed teaching was the best career option for them. Table 3 provides a list of the factors that were found to be predictive of students’ willingness to consider teaching as a career. Table 4 lists the factors found to be predictive of students’ belief that becoming a teacher is their best career option. Table 5 lists those factors found not to be highly predictive in either regression. Statistical significance as well as the standardized beta value for the regression, along with a descriptive label representing the influence of each factor, are included in each table. Those factors with a standardized beta above 0.1 were

considered to be of high influence and those below that threshold were considered to be of low influence.

The most important factors that predicted whether a participant would consider teaching as a career centered around the degree to which students feel teaching is something that they would be good at and encouragement from those around them. It is interesting to note that encouragement from others is actually more predictive than the encouragement from their own families.

Table3. *Factors Predictive of University Students Considering Teaching as a Career (N=4,743).*

Factor or Perception	Significance	Standardized Beta	Influence
Teaching is something I would be good at.	<0.001	.403	High
Others encourage them to be a teacher.	<0.001	.202	High
Family encourages them to teach.	<0.001	.170	High
Teacher is in my immediate family.	<0.001	.078	Low
Student’s gender	0.002	-0.070	Low
Teachers I know inspire me.	<0.001	.069	Low
Students are well behaved in the classroom.	0.001	-0.050	Low
Teachers have a good lifestyle.	<0.001	.046	Low
Expectations of teachers are reasonable.	0.001	-0.045	Low

Table4. *Factors Predictive of STEM University Students’ Belief That Becoming a Teacher is Their Best Career Option (N=4,743).*

Factor or Perception	Significance	Standardized Beta	Influence
Teaching is something I would be good at.	<0.001	.228	High
Others encourage them to be a teacher.	<0.001	.175	High
Family encourages them to teach.	<0.001	.176	High

Factors highly predictive of STEM university students’ belief that becoming a teacher is their best career option greatly mirrored those factors highly predictive of university students considering teaching as a career as displayed (see Table 4). While potential teachers (especially females) might be willing to consider teaching as a career, they may not feel teaching is the best career option for them. In both cases, they needed to believe they would be a good teacher and they needed to be encouraged primarily by others.

Several factors were not predictive of either dependent variable. Of note is the fact that the belief that teaching is a noble profession, teacher working conditions, and pay were not primary indicators as indicated in Table 5. These factors are commonly believed to be important. In fact, many teacher preparation colleges attempt to recruit individuals based on the fact that teaching is a noble profession. Yet, almost all the participants’ felt teaching was an important profession, even those who choose not to teach. Likewise, teacher pay was not predictive of the dependent variables as most everyone seemed to feel teachers are not paid well. Still some choose to teach. Given that work conditions are considered to be an extremely important factor in teacher retention, these findings reveal that STEM university students generally do not understand the true working conditions of teachers and therefore this factor did not have greater predictive value. Only about half of those participating in this study (57%) felt teachers work condition were OK, with 75% indicating this factor was important (see Table 2).

Table5. *Factors Found Not to Be Highly Predictive in Any of the Regressions (N=4,743).*

Factor or Perception	Significance	Standardized Beta	Influence
Teachers are provided with needed resources.	0.046	.028	Low/None
Teachers need to have a teacher personality.	0.057	-0.025	Low/None
Working conditions for teachers are good	0.463	.013	Low/None
Teaching is a noble profession	0.671	-0.005	Low/None
Teachers are paid well for doing their job.	0.694	-0.006	Low/None

4.3. Analysis of Highly Influential Factors Predicting Students’ Decisions

4.3.1. Self-efficacy

A students’ belief that they would be a good teacher (self-efficacy) was the most important predictive factor they considered when deciding about teaching as a career and believing they could be a teacher (see Tables 6 & 7). Students needed to believe they would be good at teaching before considering

going into the profession and believing it to be their best option; 47% felt they could be a good teacher.

The response distribution for the factor of self-efficacy disaggregated by respondents indicating whether they would consider becoming a teacher and whether they felt teaching was the best career option for them are presenting in tables 6 and 7. Of those who said they definitely were not considering teaching as a career, 11% likely did so because they felt they would not be good at teaching. In contrast, 23% of those who said they were considering a teaching career reported that they felt they would do well in teaching. Yet, while positive self-efficacy is important, it is not sufficiently predictive by itself: 30% of those who did not think teaching was a good career option for them felt they would be good at teaching, and 0% percent of respondents who said teaching was their best career option did not think they would be good teachers.

Table6. *Disaggregation of Students’ Belief They Would Be Good Teachers by Their Willingness to Consider Teaching.*

I would consider teaching as a career	I would be a good teacher		
	Disagree	Somewhat Agree	Agree
Agreed (28% of all respondents)	0%	5%	23%
Maybe (36%)	3%	17%	16%
Disagree (37%)	11%	18%	8%
All respondents	14%	30%	47%

Note. Response distributions statistically different ($\chi^2(4) = 1395.5, p < .000$)

Table7. *Disaggregation of Students’ Belief They Would Be Good Teachers by Their Belief That Teaching was Their Best Career Option.*

Teaching is my best career option	I would be a good teacher		
	Disagree	Somewhat Agree	Agree
Agreed (3% of all respondents)	0%	0%	3%
Maybe (21%)	1%	6%	14%
Disagree (76%)	14%	32%	30%
All respondents	15%	38%	47%

Note. Response distributions statistically different ($\chi^2(4) = 407.9, p < .000$)

4.4. Encouragement from Others

The factor of encouragement from others as displayed in Table 8 was the second most important predictive factor of students indicating they would consider teaching as a career. Encouragement from people outside of their family seemed to have greater influence than encouragement from parents or relatives. Results from these factors are disaggregated by the dependent variables in Tables 8 and 9. Of the 28% of those who indicated they would consider teaching as a career (see Table 8), only 10 of the 28% indicated that others had encouraged them to consider the profession (13 of the 28% somewhat agreed).

Table8. *Disaggregation of Students’ Others Encouragement by Their Willingness to Consider Teaching.*

I would consider teaching as a career	Encouragement from those outside family		
	Disagree	Somewhat Agree	Agree
Agreed (28% of all respondents)	5%	13%	10%
Maybe (36%)	14%	17%	4%
Disagree (36%)	26%	26%	2%
All respondents	45%	39%	16%

Note. Response distributions statistically different ($\chi^2(10) = 1331.3, p < .000$)

Table9. *Disaggregation of Students’ Others Encouragement by Their Belief That Teaching was Their Best Career Option.*

Teaching is my best career option	Encouragement from those outside family		
	Disagree	Somewhat Agree	Agree
Agreed (3% of all respondents)	0%	1%	2%
Maybe (21%)	5%	10%	6%
Disagree (76%)	40%	27%	8%
All respondents	45%	39%	16%

Note. Response distributions statistically different ($\chi^2(10) = 676.9, p < .000$)

More important to this result is this data trend suggesting that of those who would not consider teacher (36%), only 2 of the 36% said they were encourage to consider teaching from someone outside their family. And while very few respondents felt teaching was the best career for them (3%, see Table 7) each of these respondents indicated they were encouraged to teach to some degree. Of the 76% of respondents who felt teaching was not a viable career option form them, very few (8 of the 76%) said they were encouraged to teach from others not in their family.

4.5. Encouragement from Parents or Relatives

Another indicator of students’ willingness to consider teaching and belief that teaching would be their best career option involves encouragement from parents or relatives. Results from these factors are disaggregated by the dependent variables in Tables 10 and 11. These findings support the importance of encouragement. Overall, 28% of STEM students would consider teaching as a career and 11 of the 28% of these respondents agreed that family had encouraged them to teach. Few of those who would not consider teaching felt they were encouraged to consider teaching and felt that teaching was a viable career option.

Table10. *Disaggregation of Students’ Family Encouragement by Their Willingness to Consider Teaching.*

I would consider teaching as a career	Encouragement from family members		
	Disagree	Somewhat Agree	Agree
Agreed (28% of all respondents)	6%	11%	11%
Maybe (36%)	13%	17%	6%
Disagree (36%)	24%	10%	2%
All respondents	42%	39%	20%

Note. Response distributions statistically different ($\chi^2(10) = 1099.6, p < .000$)

Of relevance to this analysis are the results from a recent parent survey conducted by the authors [11].In that study, only 36% of the 495 high school parents surveyed indicated they would encourage their child to become a teacher, and just 25% of these parents felt teaching would be a good career option for their child. Of note, 45% of those parents who were or had been teachers said they would not encourage their child to consider becoming a teacher.

Table11. *Disaggregation of Students’ Family Encouragement by Their Belief That Teaching was Their Best Career Option.*

Teaching is my best career option	Encouragement from family members	
	Disagree	Somewhat Agree
Agreed (3% of all respondents)	0%	1%
Maybe (21%)	4%	10%
Disagree (76%)	37%	28%
All respondents	42%	39%

Note. Response distributions statistically different ($\chi^2(10) = 682.4, p < .000$)

4.6. Gender

A student’s gender was a predictive factor only for the dependent variable of whether the individual believed that they had better career options than teaching (see Table 13).Of those few (3%) who said they would definitely consider teaching as a career, 2 of the 3% were female.In general, this finding supports the fact that most people who consider teaching are female however, while the trend exists, given the small number of individuals who felt teaching was a viable career, the result should be considered carefully.

Table12. *Disaggregation of Students’ Gender by Their Willingness to Consider Teaching.*

I would consider teaching as a career	Male	Female
Agreed (28% of all respondents)	15%	12%
Maybe (36%)	22%	13%
Disagree (36%)	24%	13%
All respondents	61%	38%

Table13. *Disaggregation of Students’ Gender by Their Belief That Teaching was Their Best Career Option.*

Teaching is my best career option	Male	Female
Agreed (3% of all respondents)	1%	2%
Maybe (21%)	11%	10%
Disagree (76%)	49%	27%
All respondents	61%	39%

5. ANALYSIS OF COMPENSATION FACTORS

Most teacher retention and recruitment studies have indicated that teacher compensation is an important issue [16]. One factor in which respondents were in general agreement is that teachers are not paid well. No other factor reached a 60% disagreement as did this factor. In this study, over 80% of the respondents (3,834) agreed to some degree with the question, “Getting a salary bonus to become a teacher because I have a science degree would influence my decision to become a teacher.” Clearly, pay is a factor individuals consider when making a career choice.

Many states have implemented programs similar to Utah’s The Teacher Salary Supplement Program (TSSP) to draw qualified individuals into education for specific subject areas that have been identified as a priority because of staffing shortages and/or for assistance with the fees associated with obtaining and maintaining certification with the National Board for Professional Teaching Standards (NBPTS). Currently the TSSP offers a yearly \$4,100 salary supplement for qualifying STEM teachers. In addition to the salary adjustment, the TSSP also covers the additional employer paid benefit costs associated with retirement, worker’s compensation, Social Security, and Medicare [12].

To better understand the expectation of student’s salary levels to seriously consider becoming a teacher, the final question in this survey asked, “If a typical starting teacher salary was \$50K, how much of a bonus salary would you need for you to seriously consider teaching as a career?” Table 14 shows the bonus amount needed to seriously consider becoming a teacher. For those students that are seriously considering becoming a teacher, the bonus amount indicated was \$15,060 on average. For those who are not seriously considering this career, the average amount needed was \$20,870 (see Table 14). The average responses for these three groups of students indicated there was a statistically significant difference between the groups. Each group however, seemed to indicate the amount offered by the TSSP program would be an insufficient incentive. The result was similar for those who considered teaching as a viable option. While those who felt teaching was a good career option indicated the bonus could be less than those who felt teaching was not an option, this result suggests that a small bonus in salary was not a strong enticement (see Table 15).

Table 14. Bonus Amount Needed to Seriously Consider Becoming a Teacher.

I have seriously considered becoming a teacher	N	%	Amount
Students – Agree/Strongly Agree	1245	28.1	\$15,060
Students – Somewhat Disagree/Somewhat Agree	1587	35.9	\$18,100
Students – Disagree/Strongly Disagree	1593	36.0	\$20,870

Table 15. Bonus Amount Needed for Those Believe That There are Better Career Options Than Teaching.

There are better career options for me other than becoming a teacher.	N	%	Amount
Students – Agree/Strongly Agree	3594	81.2	\$19,290
Students – Somewhat Disagree/Somewhat Agree	774	17.5	\$13,890
Students – Disagree/Strongly Disagree	58	1.3	\$11,190

In a previous related study of teachers by the investigators of this study, even for current teachers, 93% of them agreed that they were not paid adequately [11]. Although that was not the most important factor to continue to remain a teacher, compensation became a big factor as soon as teachers perceive that work expectations have become less reasonable and/or their school environment was no longer trusting and supportive as it once was [24].

The data trend presented in Table 16 shows that while those who consider teaching as a viable option might be enticed by a smaller pay bonus than those who do not feel teaching is a viable career option, few respondents would be enticed by a \$4,000 bonus. One interpretation of these data is that most STEM students are seeking career options that have much higher starting salaries without properly considering other important benefits such as job satisfaction and a job’s time commitments. More research needs to be done to compare total compensation packages of teachers with other STEM careers so that instead of students just comparing initial salaries, they could review all compensation

benefits such as health insurance costs, retirement plans, and other perks that teachers typically receive such as time off in the summer over an extended period of time.

Table16. Bonus Amount Needed for Those Believing Becoming a Teacher is My Best Option.

Becoming a teacher is my best career option.	N	%	Amount
Students –Agree/Strongly Agree	133	3.0	\$9,340
Students – Somewhat Disagree/Somewhat Agree	940	21.2	\$14,650
Students – Disagree/Strongly Disagree	3351	75.8	\$19,600

From the analysis results present in Table 17, we see that those students who performed academically higher than their peers were much less likely to consider teaching as a career and would require a higher bonus to their salary if they were to consider teaching. However, regardless of an individual’s GPA, few would be satisfied with a small bonus incentive. While these data do not indicate a reason for the trend, many have pointed out that the best teachers are not always the highest academic achievers and that non-academic attributes are more important [25].Others speculate that high-achieving students might make good teachers but considering their potential and interests, many see more attractive opportunities for themselves in STEM careers other than teaching [26].

Table17. Bonus Amount Needed by GPA Groupings to Seriously Consider Teaching.

GPA	N	%	Amount
< 2.5	144	3.3	\$16,150
2.6 – 3.0	375	8.5	\$16,850
3.1 – 3.5	1145	25.9	\$17,600
3.6 – 4.0	2753	62.3	\$18,810

We also see differences when looking at Gender and bonus pay expectations. In general, males would require a considerable larger bonus incentive than females (see Table 18). This may be due the stereotype held by many that teaching is by large a female profession [2]. It may also be based on the expectation that males must be able to provide for a family, and the perception that a female’s salary would be supplementary.

Table18. Bonus Amount Needed by Gender to Seriously Consider Teaching.

Gender	N	%	Amount
Male	2745	62.3	\$20,280
Female	1660	37.7	\$14,870

6. CONCLUSION

Teacher recruitment remains a serious and complicated problem for public school districts and institutes of higher learning especially in the STEM subjects [27, 28, 17].As policymakers respond by trying to increase the supply of teachers and by offering various incentives, these recruitment efforts may be worthwhile to a point but little evidence exists that these current efforts will solve the teacher recruitment problem. Simultaneous efforts to address other factors associated with teacher attrition such as the working conditions of teachers must also be resolved [11, 29].

Numerous studies have identified factors that affect teacher recruitment. Each of the 11 beliefs about teaching factors that appeared on Table 2 can be generalized to all areas of teacher recruitment. What was found to be unique in this study of university STEM students was the more pronounced demand for a significant salary bonus. These students typically believe there are many other more lucrative career opportunities, such as being a Chemist, for them as they have unique skills and abilities. Using students’ willingness to consider teaching and their belief that teaching was their best career option as dependent variables, the data revealed that only 3% of these students believe that teaching is their best career option.

The primary driving factors of whether these students would seriously consider teaching were revealed to be whether they believed they would be good at it, others encouraged them to be a teacher and that their own family encourages them to teach. Therefore, teacher preparation programs must provide compelling information about the overall lifestyle and total compensation package of a STEM teacher. This support is highly critical in helping them make the decision to pursue a teaching career. Another factor, having teachers that inspired them was also found to be predictive and important.

While factors of gender, respectability of the profession, and teacher working conditions also exist, these didn't have as much predictive influence as other factors.

University STEM students consider many factors when making career decisions. As evidenced by this study, the importance of a competitive starting salary is important. In a 2010 study by McKinsey & Company, market research of 1,600 high-performing college students relating to a teaching career and salaries found that only 10-17 percent of those surveyed believed that teaching rated well in the following characteristics of salary:

- If they did well, would they be paid appropriately?
- Could they support a family on their salary?
- Does the career pay appropriately for the skills and effort they would bring?
- Are starting salaries competitive?
- Would salaries increase appropriately over time?

In contrast, 65-81% believed their chosen (non-teaching) profession rated well on the above characteristics. Compared with the characteristics associated with other factors, these salary discrepancies between teaching and their chosen career were the largest. This suggests that teacher salaries are indeed an important factor in the equation when high academically able students, such as STEM students, are choosing a career. However in the same survey, more than half of the survey respondents underestimated the average teacher starting salary and the average maximum salary. In addition, in a survey of students from the top-third of their college class who did enter teaching, only 30% believed that they could financially support a family with their teaching career [30]. This study found that salaries have a greater impact on teachers of math and science than other teachers, likely reflecting the opportunities, including opportunities for higher pay, open to them outside the teaching profession.

In a study by Milanowski [31], he explored the amount by which starting teacher salaries would have to increase in order for STEM students to be willing to consider teaching. He found a somewhat linear relationship between the amount that starting teacher salaries would have to improve and the percent of STEM students who would teach (e.g., a 23% increase in starting salary would attract about 18-23% of the participants and a 45% increase would attract 37-48% of the participants).

This current study demonstrated that significant salary bonuses would need to be in place for most of these students to seriously consider becoming a teacher. For those currently not considering a career in teaching, a salary bonus of over \$20,000 would likely be required to entice them into the profession. Even those currently willing to consider a teaching career have indicated they would need \$15,000 in additional salary to change their career path. Future research on comparing overall teacher compensation benefits to those in careers commonly pursued by science and mathematics majors could demonstrate more parity than starting salary amounts. Benefits that could be compared could include work satisfaction, vacation and other time off such as summers and holidays, pension plans, and health insurance plans. This type of research could likely influence STEM students to take a closer look at choosing a teaching career.

For successful recruitment of this critical STEM segment of teachers a concerted focus on helping influencers to offer this encouragement to become a teacher will be needed; especially for those with an perceived aptitude for teaching. Thus, it is imperative to take good care of existing teachers and expend every effort possible to make their working conditions as hospitable as possible so they will, in fact, offer that critical encouragement to the future generation of teachers.

7. IMPLICATIONS FROM THIS RESEARCH

One possible interpretation of these results is that past approaches to recruiting teachers, especially those with a STEM background, may need to be updated and improved. We might be asking the wrong questions in our teacher recruitment research. Clearly, compensation is an issue, but other misconceptions are likely causing individuals to dismiss teaching as a viable career.

The results of this study support the conclusions of other research regarding teacher compensation. There is a widely held perception that teachers are not paid well. Everyone seems to agree that this is

a fact. However, recruitment research might need to verify this perception aligns with reality by conducting side by side comparisons of overall teacher compensation with a variety of STEM career compensation packages at different points in a career. Compensation is clearly an issue for potential STEM teachers, yet many do not seem to have an accurate perception of the issue. The McKinsey [31] study cited found that more than half of the survey respondents underestimated the average teacher starting salary and the average maximum salary. This prevalent perception of the teaching profession as a low compensation career needs to change if teacher recruitment is to improve. An accurate comparison of total compensation of different STEM career tracks with teaching at beginning, mid-career, and end of career would be needed. Additionally, these comparison studies should include statistics related to job satisfaction. Some STEM related careers could be considered to be repetitious and boring and so for those that enjoy more social interaction by working with others on a daily basis, teaching could be a better career fit.

While teacher compensation is typically cited as a concern, there are other implications for teacher recruitment from this study. For example, many recruitment techniques for teacher preparation programs appeal to individuals' belief that teaching is a noble profession. This is based on the fact that many teacher retention studies have found that those individuals who choose to remain in the teaching profession tend to have this perception. However, most everyone agrees with this sentiment even those who choose to leave the profession. From the results of this survey we found that 96% of the STEM university students agreed with that teaching is a noble profession. This factor may have been considered for retention but it does not seem to be a critical factor in recruitment. In this study 28% of STEM students indicated that they would consider teaching as a career and 47% of them felt that they would be a good teacher but only 3% believed that teaching was their best career option. Perhaps a better strategy for recruitment would be to intentionally encourage those individuals who feel they have an aptitude for teaching. This along with the selling factor of job satisfaction and salary comparisons may have a greater impact on teacher recruitment.

One last implication coming from this study is that of work conditions for teachers. It is likely that those considering teaching have faulty perceptions about teaching when it comes to work conditions. A major objection that STEM university students did have in their consideration of the teaching profession is the current less than ideal working conditions of teachers. They likely have some understanding of the many expectations placed upon teachers and the nature of the students among other challenges. In this study the two lowest ranking factors in their beliefs about teaching, besides pay, were teachers have the resources they need to do their job (12%) and students are well behaved and care about learning (14%) as shown in Table 2. These concerns highlight the importance of better training principals so they can mitigate the real challenges teachers face every day in their workplace.

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Appendix

Teacher Retention Study 2019 - Undergrads

Q1

Greeting We would like to get your perceptions about career choices for a research study. Specifically targeting teaching as a career. Those participating in the study are undergraduates age 18 or older.

What are you being asked to do? If you decide to be in the study you will be asked to complete a short survey and give your honest answers. **What are the benefits to me for taking part in the study?**

Taking part in this study will not help you directly (you won't receive any reward or compensation), but it will help us understand what students think about the teaching profession and help us better understand the current teacher shortage in public education. **Can anything bad happen if I am in this study?**

There is minimal risk to you by being in the study. It will take a few minutes of your time and you don't have to answer any of the questions you don't want to answer. Your participation in this survey will in no way affect your grade or your relationship with your teachers. **Who will know that I am in the study?**

You won't put your name on the survey so your answers will be completely private. When we analyze the results of the survey it will be done as a group not individually. All data will be stored without names on a secure computer for the duration of the study and will be deleted afterwards. Only those involved with the study will have access to the data. **Do I have to be in the study?** No, you don't, we really want to know what you think but if you don't want to take the survey, simply indicate you don't want to participate. Also, If you start the survey, you can change your mind at anytime and simply stop answering questions. **What if I have questions?** If you want to ask us questions about the study, contact Professor Randall Davies at randy.davies@byu.edu, Scott Harris at Scott.Harris@byu.edu, or the IRB office at irb@byu.edu – (801) 422-1461.

Implied consent: If you want to be in this study simply complete the survey; it should take about 15 minutes or less of your time. If not, that's Ok, just indicate below and don't complete the survey.

I would like to take the survey, begin the study(1)

I do not wish to participate(2)

Q2 Please indicate your sex?

Male(1)

Female(2)

Prefer not to say(4)

Q3 How successful are you as a student?

Not Really(1)

Below Average(2)

Average(3)

Above Average(4)

Well above average(5)

Q4 Please indicate your current GPA range.

2.5 or lower(4)

2.6 to 3.0(3)

3.1 to 3.5(2)

3.6 to 4.0(1)

Q6 Is anyone in your immediate family a teacher?

Yes(1)

No(2)

Q7 What is your current major?

I have not yet decided (not declared)(1)

Education(2)

Science (chemistry, biology, physics, math, computer science)(4)

Social Science (English, History, Foreign language)(6)

Other, Please indicate your declared major (3)

Q8 Please indicate how strongly you agree with each of the statements below. *With regards to teaching as a career:*

	Strongly Disagree (1)	Disagree (2)	Somewhat disagree (3)	Somewhat agree (4)	Agree (5)	Strongly agree (6)
I have seriously considered becoming a teacher. (6)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I think teaching is something I would be good at. (5)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
There are better career options for me other than being a teacher. (7)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Becoming a teacher is my best career option. (10)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Q9 Please indicate how strongly you agree with each of the statements below. *With regards to people encouraging you to consider teaching as a career:*

	Strongly Disagree (1)	Disagree (2)	Somewhat disagree (3)	Somewhat agree (4)	Agree (5)	Strongly agree (6)
My parents or relatives have encouraged me to consider becoming a teacher if I want to. (2)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
People outside my family have encouraged me to consider becoming a teacher. (1)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Teachers I know inspire me. (4)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Being a teacher is a respectable profession. (11)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Q10 Please indicate the degree to which you agree with each of these statements

Teacher Recruitment: Predictive Factors of STEM University Students Entering the Teaching Profession

Perceptions of Teachers and the Teaching profession	Strongly Disagree (1)	Disagree (2)	Somewhat Disagree (3)	Somewhat Agree (4)	Agree (5)	Strongly Agree (6)
Teachers are well respected in the community. (2)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
People I know are very supportive of teachers. (1)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Teachers can be a positive influence in their students lives. (Teaching is a noble profession.) (11)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Teachers are provided with all the resources they need to do their job well. (3)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
You need to have a certain personality to be a good teacher. (4)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Most the teachers I know are good teachers. (5)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Teachers have a good lifestyle (working hours, holidays). (6)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Expectations of teachers (teaching loads, class sizes, and responsibilities) are reasonable. (7)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Working conditions for teachers are good. (8)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Students are well behaved, respect teachers, and care about learning. (9)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Teachers are paid well for doing their job. (10)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Q11 How important are each of these in terms of you considering teaching as a career?	Very Unimportant (1)	Unimportant (2)	Somewhat Unimportant (3)	Somewhat Important (4)	Important (5)	Very Important (6)
Teachers are well respected in the community. (2)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Teacher Recruitment: Predictive Factors of STEM University Students Entering the Teaching Profession

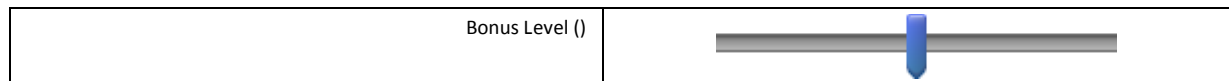
People I know are very supportive of teachers. (1)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Teachers can be a positive influence in their students lives. (Teaching is a noble profession.) (11)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Teachers are provided with all the resources they need to do their job well. (3)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
You need to have a certain personality to be a good teacher. (4)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Most the teachers I know are good teachers. (5)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Teachers have a good lifestyle (working hours, holidays). (6)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Expectations of teachers (teaching loads, class sizes, and responsibilities) are reasonable. (7)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Working conditions for teachers are good. (8)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Students are well behaved, respect teachers, and care about learning. (9)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Teachers are paid well for doing their job. (10)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Q17 Receiving a salary bonus to become a teacher because I have a science degree would positively influence my decision to become a teacher.

- Strongly disagree(1)
- Disagree(2)
- Somewhat disagree(3)
- Somewhat agree(4)
- Agree(5)
- Strongly agree(6)

Q18 If a typical starting teacher salary was \$50K, How much of a bonus salary would you need for your to seriously consider teaching as a career? (in thousands of dollars e.g., 1 = 1K = 1000 dollar bonus)

	0	3	6	9	12	15	18	21	24	27	30
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