**Factors Correlated to Student Enrollment in STEM Degrees**

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**What Is STEM?**

STEM stands for Science, Technology, Engineering, and Mathematics. STEM programs. There are courses, activities, and events that are related to one of the four areas of STEM. These programs are meant to help teach, increase interest, and show the world the importance of the four related topics. With help from the government, these programs are meant to increase the amount of exposure that STEM topics get, in hopes of bringing more people into these fields. Overall, STEM programs are a tool used to help build up America’s Science, Technology, Engineering, and Mathematics departments by increasing candidates in these fields.

The success of STEM programs is extremely important for America. The reason for this can be summed up perfectly in this quote taken from the official government STEM website “ In an ever-changing, increasingly complex world, it's more important than ever that our nation's youth are prepared to bring knowledge and skills to solve problems, make sense of information, and know how to gather and evaluate evidence to make decisions *(*Science, Technology, Engineering, and Nath, including Computer Science, 2022).” In a world that is ever-changing with advancements in Science and technology happing at lightning speeds, it is more important than ever to keep up in this race. That is what makes STEM programs so crucial since they are a way to help give next the generation of American youth the upper hand in this ever-evolving world. The U.S. has recognized the importance of STEM and has given the finical backing needed to make all these STEM programs happen. But still, that is not enough to get the American youth interested; Coordination and encouragement are needed through precise planning and investigation to see what causes someone to be interested in a STEM program or career. Only by looking at the causes of STEM engagement can we increase and better our workforce in STEM departments.

**Factors Correlated to STEM Enrollment**

For this paper, the enrollment of college students into STEM college programs, and ultimately careers in STEM will be the main point of interest. As discussed above, it is important to help increase STEM enrollment and the first step in doing so would be to look at some factors that lead to enrollment. Most of the conducted research so far has been about general college enrollment and although that is not what this paper is looking at it is a very good place to start. According to Hanson (2023), enrollment has been going down in the last ten years from the enrollment number lowering from 21.0 million in 2010 to 19.0 million in 2022, a 9.6% drop. While it would be easy to blame covid, this thread started way before with COVID doing nothing to help the situation. This makes it more important than ever to look at what factors are causing people to enroll.

When looking at college enrollment there are quite a few different factors that can affect enrollment. The most common one is that of financial support; does a potential student have the funds to pay for school, to begin with, do they know about possible grants or financial aid available that can help them? These are just a few ways personal finance can affect someone’s enrollment. Other factors to look at are race, ethnicity, and sex. Do colleges seem to be more favorable in supporting, or offering programs that attract, or recruit certain race or gender specic students by offering grants to some, but not others who are both in similar in education and financial backgrounds? Of course, many other possible factors can be at play when it comes to if a person enrolls in college, but before they are looked at it is important to focus on the more general factors like the ones listed above and then go from there.

**Literature Review**

The point of this paper is to help determine what factors might lead to students enrolling in STEM courses, from the standpoint of data that is public, and easily available on government databases. Although an investigation is being conducted through this paper it will be impossible to be able to look at all the possible factors that affect STEM enrollment. To remedy this issue this report will be looking at some conclusions and observations that have been made by others.

**Humanities versus STEM**

One of the databases available is based on an investigation conducted at Duke University in North Carolina. This particular study looked at the decline in Humanities degrees and compared them to STEM degrees, in particular computer science(CS). This report looked at the rise of the computer sciences degree, with it going from being one of the university’s least popular degrees in 2010 to being it’s most popular in 2022. The article by the Digest of Education Statistics (2022) looked at a 2022 Duke survey of CS students, it found that 40% of the students listed the pay range as being the reason they decided to pursue CS while the other 62% enrolled due to a promising job market. This rise in CS enrollment could be due to the influence of STEM programs helping to show the public how much potential there is in these career areas. It seems that knowledge of the possibilities that STEM degrees can be determining factor in STEM enrollment. It seems like degrees in STEM seem to be more highly valued than those in humanities as measured in numbers of students enrolled.

**Funding not Reaching where it needs to go.**

When government funding is discussed, the question of if it is being distributed equally tends to come up, that is something that this article looks at. It was found that marginalized and poor areas are behind when it comes to STEM subjects at school, in particular math. The article by Yahoo! (n.d.), then goes on to discuss how this can be a major problem for STEM college enrollment because, if a student has trouble in a certain subject or falls too far behind it becomes more and more unlikely that they will not choose a career path related to that subject; due to the fear of it being too hard to accomplish. This is very apparent in STEM classes since most of them rely on a good foundation of the principles of the subject to be able to achieve success later. Without a solid foundation, it becomes nay impossible to keep up leading students to fall behind and quit. The importance of resource management for these funds is a key player here and is something that this research project is trying to help make easier. It is doing this by looking at what factors and areas are lacking so that government funds can be distributed to these areas in hopes of increasing STEM courses' success.

**Methodology**

To help pinpoint what area should be focused on, multiple datasets were used all focusing on the enrollment statistics for the years 2019-2021.

**State and Enrollment** Science & Engineering State Indicators(n.d.)

To start two official STEM datasets looked at state enrollment in STEM associate degrees for students ages 18-24 (one looking at technology enrollment and the other looking at Science and engineering) were used to see what the top 5 states for enrollment numbers were. The variables used were the States column and the Year columns for 2019-2021. The two datasets were then both joined by the state Column to make one dataset. The dataset was then cleaned so that only the factors listed above were present. Then using Tableau the data was worked with and visualizations were created to see which of the states had the highest enrollment.

**Race and Enrollment**

From here a government dataset that looked at the enrollment by race and degree was used to see what race had the highest and lowest enrollment in STEM degrees. The variables looked at was the Field of study and the races Asians, Native American, pathic islander, Hispanic, Black, and White. This dataset was then cleaned and used to create a new dataset that calculated the percentage of students for each race in each STEM field (this new dataset can be seen in figure 1). From here tableau was once again used to help create visualizations that show the total percentage of each race enrolled in STEM course.

**Figure 1. Percent of race enrolled in STEM related courses: new dataset that adds the percentage category**

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**Future methods**

This is as far as the researchers was able to explore in the short period of time (one semester). If provided more time the following steps would be enacted. After finding what states of the United States with the highest enrollments a search for datasets in those states will be conducted. These datasets will then be used to conduct a statistics correlation test between these colleges’ enrollment. The reason why the datasets from states with high enrollment will be used over those with low enrollment is that higher enrollment means more data to look at. Then if there was a correlation between race and enrollment the datasets from the colleges would be cleaned to focus on the specific race. Finally, a statical significance test would be conducted to see which factors had the smallest p-value (according to Beers (2023.)“ p-value is a statistical measurement used to validate a hypothesis against observed data” and “The lower the p-value, the greater the statistical significance of the observed difference” the factors with a p-value lower than or equal to 0.5) will be the ones that are then considered the most important for enrollment.

**Results**

**Which States had the highest STEM Enrollment?**

The first thing that was looked at was the percentage of enrollment to associate degrees in the STEM fields of Technology, Science, and Engineering in the years 2019-2021 out of every 1,000 students. After cleaning the dataset, connecting it, and conducting some visualizations the top 5 states with the highest enrollment for Science/Engineering and Technology were found. For Science and Engineering, the ranking was First in California with a 15.002% enrollment rate in 2021(the rest of the percentages will be for 2021 but the rank is based on the highest average enrollment out of the 3 years{ The data for this and the rest of the years can be found in Figure 2}), Second was Wyoming with 8.990%, Third was Virginia with 5.885%, Fourth was Oklahoma with 5.307% and Fifth was New Mexico with 5.462%. For Technology the ranking was First Nevada with a 4.325% enrollment rate in 2021, Second was North Dakota with 4.242%, Third was South Dakota with 2.647%, Fourth was Puerto Rico with 1.968% and fifth was Louisiana with 2.178%.

**Figure 2. Enrollment For associate degrees in STEM courses (2019-2021): This figure looks at the top five states with the highest enrollment percentage for the the STEM careers Science/Engineering and Technology.**

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**Race and Enrollment**

Next, the relationship between STEM enrollment and race was looked at. It was found that Asians were the largest racial group enrolled with 36.72% enrolled in STEM courses (All of the information referred to in this paragraph can be found in Figure 3). It was also found that Native Americans were the lowest with only 14.24% enrolled. Even though the difference between the race with the highest enrollment and the race with the lowest enrollment had a 22.48 percent difference, the paper did not believe that race should be looked at when deciding which dataset to look at. The reason, for this, is that the rest of the race’s enrollment was very close to that of the Native Americans with whites coming in second place, with a 19.84% enrollment. That means that the other races all have less than a 5.7% difference from one another which is very small and is not significant enough to look at. If all the races had a very different percentage in enrolment, then it could be concluded that race plays a big factor in STEM enrollment. But since it is only Asians that have high enrollment, it is most likely that cultural elements may play a role and not a lack of STEM opportunities for some races rather than others.

**Figure 3. Percentage of Enrollment in STEM Courses By Race (2019-2021): This figure shows the percentage of STEM enrollment for the races of Native American, Blacks, White, Hispanic, Pacific islander and Asian in American colleges**

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**Discussion**

The findings, while not complete, can still be used to help get closer to finding the most important factors for stem enrollment. When it comes to what States should be looked at California, Wyoming (for Science and Engineering) Nevada, and North Dakota (for technology) should be the centers of attention for future analysis. The reason for this is simply that these states were not only the highest ranking but also had a very clear gap in enrollment numbers from second to third place. When enrollment for stem based on race was looked at; the paper found there was no significant correlation between enrollment to STEM degrees and race with only Asians holding a significant lead in percentages of enrollment. The rest of the races were very close together in the percentage number of students enrolled in Stem courses out of all other degrees with only a 5.6% difference between the race in second place “Whites” to the race in last place “Native Americans”. With these findings, the next step would be to investigate colleges that are in the above states and find datasets for these colleges. These data sets can be looked over to find more factors and their correlation to enrollment.

**Conclusion**

Due to the complexity and lack of time needed to get the clearance for the proper datasets, the latter half of this project was not able to be completed. Last, while it may seem like a loss at first that is not the case. Through this project, it was possible to see where STEM enrollment was excelling at. With this information, it is now possible to start an investigation, based on data from these locations. Helping to see what they are doing correctly, which is leading to such high STEM enrollment. This paper was also able to look at STEM enrollment based on race showing race should not be focused on since there was no clear correlation between race and STEM enrollment. Overall although no exact conclusion was able to be This paper can be used as a starting point for a deeper analysis of STEM college enrollment which should be considered a success.

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