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EXAMINING THE INFLUENCE OF UNIVERSITY ENROLLMENT & ITS IMPACT ON ECONOMIC DYNAMICS

To what extent do university enrollment rates and decreased interest in pursuing a higher level of education affect individual and national prosperity?

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INTRODUCTION

University enrollment levels have become inconsistent over the years in various countries. Some of the main reasons behind this are that students are unable to meet the demands of academics, have limited access to financial resources, or find that the quality of education is poor due to the lack of government expenditure on education. Furthermore, there is a large gap between the skills that educational facilities equip their students with and the attributes that employers are looking for. Hence, they drop out in hopes of pursuing their hobbies as a career or teach themselves the skills employers are looking for without a formal education. To what extent do the enrollment rates and decreased interest in pursuing a higher level of education affect individual and national prosperity?

This study aims to investigate the impact of university enrollment rates on the country's income per person and unemployment rates. It also aims to determine what latent factors may affect the relationships between these variables. The report is split into three main sections which will help identify the correlation between the different variables. The first section examines the relationship between the income per person in each country and the university enrollment rates. The second section analyzes the relationship between the university enrollment rates and the unemployment rates. To further enrich the analysis, the study takes into account gender as a factor to analyze the relationship between male and female university enrollment on male and female unemployment. For the third section, the report will further investigate how factors including government expenditure on education influence enrollment rates. Hence, this will help policymakers and educational institutions recognize the need to develop programs and implement policies that will improve the quality of education, which in turn will positively impact employment rates and GDP Per Capita.

REPORT SPECIFICATIONS

Variable	Specfication	Justification
Years	2005, 2010, 2015	Availability of data
Countries	Germany, Egypt, Ethiopia	Development status: one developed, one developing, and one underdeveloped country to compare how development status might play a role.
Enrollement	Upper Secondary (University)	This is the highest qualification in the dataset that determines employability the most
Labor Force	Unemployment Rate	The percentage of the labor force that is unemployed and it is the variable that we want to correlate with enrollment rates
Expenditure	Public expenditure on education (% of GDP)	It is the main factor that could affect university enrollment.

Please note that for the dataset:

Most of the dataset did not provide data annually, instead, there was usually gaps of 5 years which caused high variability that impacted the reliability of some of the further statistical tests and analyses done. High variability in our variables of interest led us to implement correlation. Correlation could justify and further explain our results.

DESCRIPTION OF THE DATASET

GDP Total, Yearly Growth: Based on Gapminder's GDP per capita that tracks the growth or decline in a nations GDP (1801 to 2013)

Population: Total population annually and also calculates expected future populations (1800 to 2100)

Income per Person (GDP/capita, PPP$ inflation-adjusted): GDP per person in International Dollars adjusted for differences in currencies purchasing power based on 2017 fixed prices and ICP

Enrollment in Primary, Secondary and Upper Secondary Education Levels: Each levels of education is divided into Male, Female, and Total categories with the Total being given as a count while Male and Female is given in the form of a ratio

Labor Force Participation & Unemployment: Gives a count for the number of people in the labor force and the unemployment is the percentage of the labor force that is unemployed

Public Expenditure on Education: Split into two variables, public expenditure on education given as a percentage of the GDP and basic access to computers by the three levels of education mentioned in the enrollment dataset

SECTION 1: ENROLLMENT & INCOME

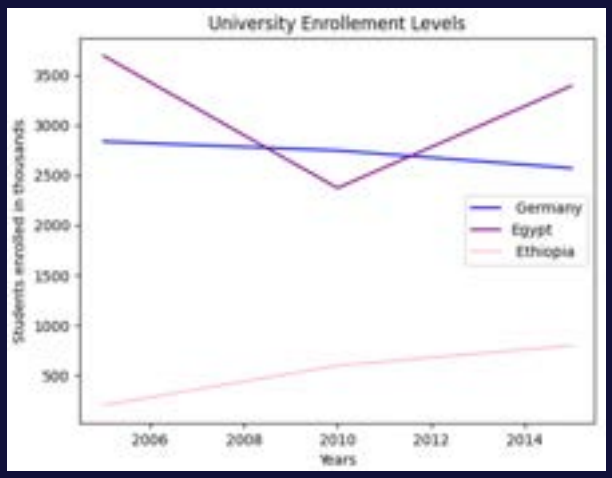
This section examines the relationship between university enrollment rates on income per person. The objective is to understand how variations in education enrollment impact the GDP per capita.

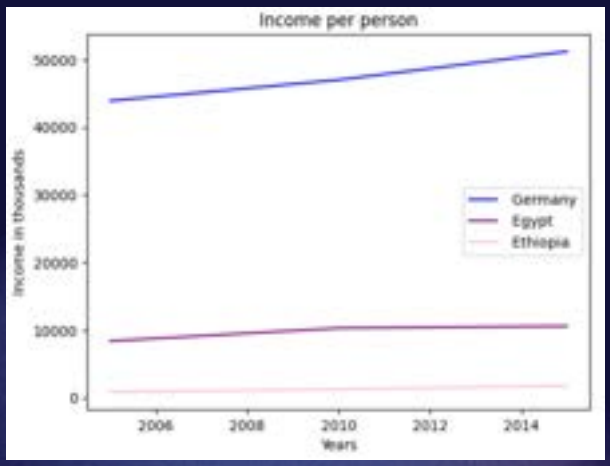
AVG. Upper Secondary Enrollment Levels

2718.0	3153.3	530.6
GERMANY	EGYPT	ETHIOPIA

VAR. Upper Secondary Enrollment Levels

12302.0	320240.8	61601.5
GERMANY	EGYPT	ETHIOPIA





AVG. Income per Person

47366.6	9766.6	1300.6
GERMANY	EGYPT	ETHIOPIA

VAR. Income per Person

8948888.8	948888.8	141280.8
GERMANY	EGYPT	ETHIOPIA

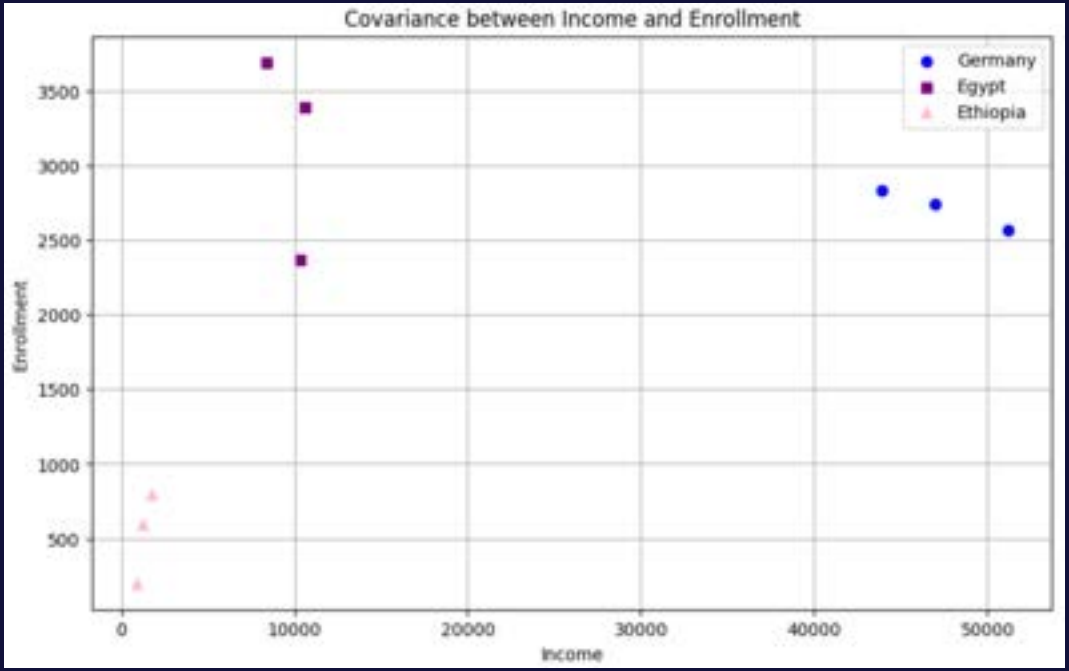
Data Summarization

Germany: Although Germany is the most developed country of the three, it almost consistently had a lower enrollment levels than Egypt despite having much higher levels of income. Variance in enrollment levels suggests that the dataset is moderately varied while the extremely high-income variance suggests great diversity or even inconsistency in the dataset.

Egypt: Egypt boasts the highest average enrollment level out of the three countries despite having a consistent decline for many years before reaching this level. As expected, for income Egypt has the second highest income per person as it is the country being used to represent those that are developing. However, the consistently high variance in both variables indicates that the datasets are extremely spread out.

Ethiopia: As expected since it is the most underdeveloped country of the three, Ethiopia has the lowest average enrollment level and income per person. However, its variance levels are consistently lower than the other two countries making their datasets more stable and predictable.

Correlation & Covariance Insights



With a covariance of -495250 and a correlation coefficient of -0.995086, we can conclude that Germany's university enrollment levels and income per person have a strong inverse relationship since as one variable increases, the other tends to decrease. This suggests that as economic conditions in the country continue to grow, fewer people are pursuing upper secondary education as they may be moving directly into the workforce. Although Egypt has a similar covariance of -477533, the correlation coefficient of -0.577519 shows a moderately negative relationship. While there is still an inverse relationship between the two variables, it is not as strong as in Germany. This could be because of other factors such as recent economic instability or different educational policies. Ethiopia also had a covariance of -45019 but was the only country that displayed the expected correlation coefficient of 0.964645 which signifies a strong positive relationship between the two variables. This shows that as economic conditions in the country continue to improve, more people can pursue higher levels of education, and thus, earn a higher income per person.

```
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```

	Country	Income	Upper_Secondary_Enrollment
0	Germany	[43900.0, 47000.0, 51200.0]	[2837.0, 2747.0, 2570.0]
1	Egypt	[8400.0, 10300.0, 10600.0]	[3694.0, 2372.0, 3394.0]
2	Ethiopia	[862, 1260, 1780]	[199.0, 597.0, 796.0]

	Correlation
0	-0.995086
1	-0.577519
2	0.964645

SECTION 2: ENROLLMENT & UNEMPLOYMENT (PART 1)

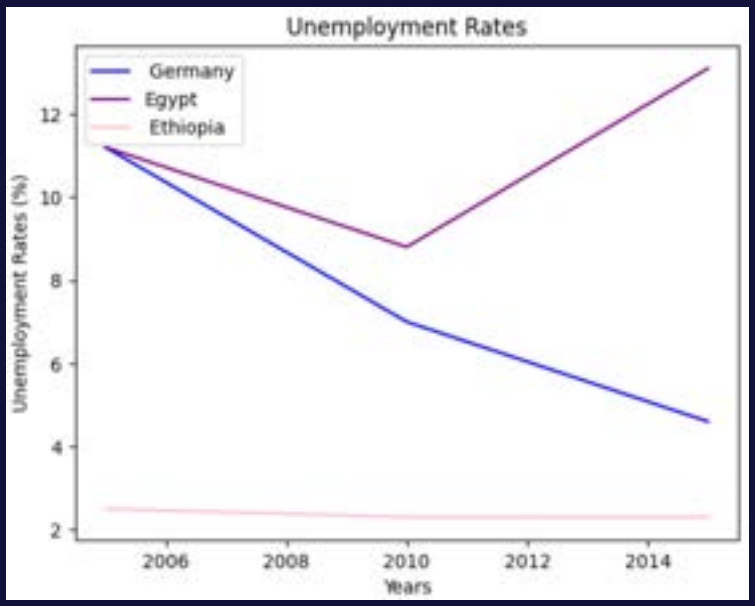
This section examines the relationship between university enrollment rates on unemployment. The objective is to understand how the average and variability of unemployment rates over the years interplays with enrollment levels.

AVG. Unemployment Rates

7.59	11.03	2.36
GERMANY	EGYPT	ETHIOPIA

VAR. Unemployment Rates

7.439	3.095	0.008
GERMANY	EGYPT	ETHIOPIA



Data Summarization

Germany: Surprisingly, Germany had the second-largest unemployment rate despite being the most developed country; however, the graph does show that there has been a steady decline in unemployment rates over the past few years which is a better representation and indicator of the country's current prosperity. Germany displays a higher variability in unemployment rates .

Egypt: Egypt had the highest unemployment rate which is understandable given that it is a developing country, a fact that is represented in the spike in the unemployment rate since 2010. The very low variance in comparison to the average indicates that the data points are not widely spread out from the average value and they instead are more clustered.

Ethiopia: Shockingly, despite being the most underdeveloped country, Ethiopia had a much lower unemployment rate than the other two countries and has had essentially no inconsistencies. Similarly to Egypt, Ethiopia has a small variance in comparison to its average which indicates that the data points are clustered around the average value and not spread out.

Correlation & Covariance Insight


```
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 [4.2750e+02 1.8453e+04]]
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 [5.40666667e+01 4.80361333e+05]]
```
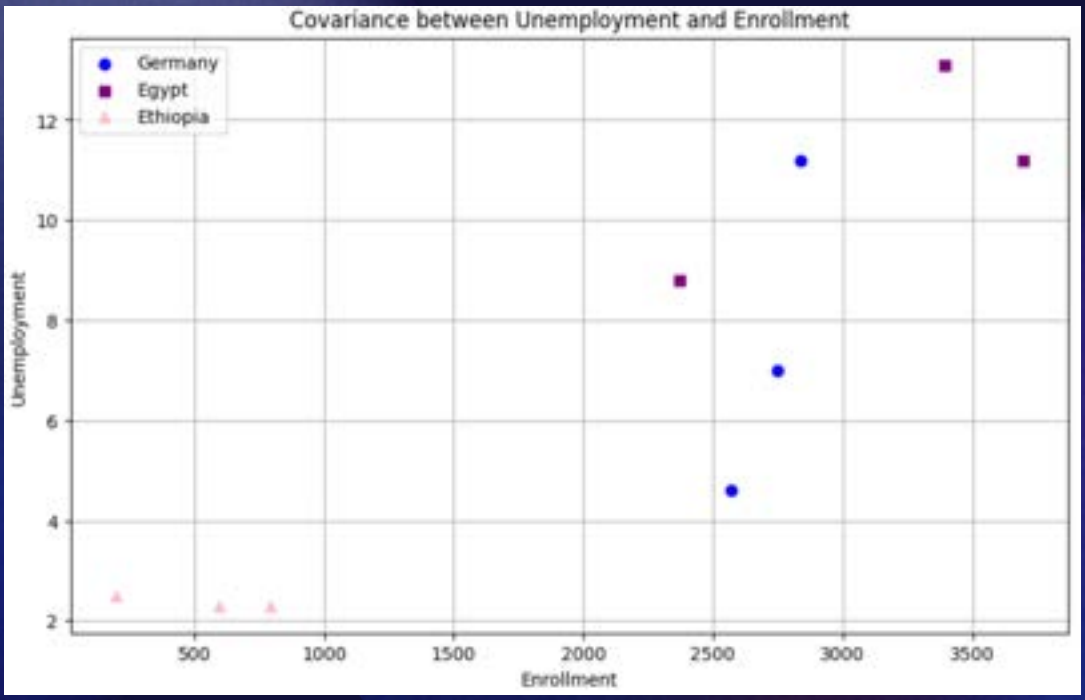

	Country	Unemployment	Upper_Secondary_Enrollment	Correlation
0	Germany	[11.2, 7.0, 4.6]	[2837.0, 2747.0, 2570.0]	-0.973035
1	Egypt	[11.2, 8.8, 13.1]	[3694.0, 2372.0, 3394.0]	0.508244
2	Ethiopia	[2.5, 2.3, 2.3]	[199.0, 597.0, 796.0]	-0.825236

Germany displayed a strong and positive covariance of 427.5 with a strong and negative correlation coefficient of -0.973035 which indicates that the unemployment rates and enrollment levels in the country tend to move together in the same direction due to the positive covariance; however, the tendency for them to move in an opposite direction due to the negative correlation is even stronger. This indicates that the data has a nonlinear relationship where, initially, both variables increase or decrease together and then after a certain point they begin to move in opposite directions. Egypt's results are slightly more consistent as a covariance of 1166 and a correlation coefficient of 0.508244 indicates a moderately positive linear relationship between the two variables since as one increases the other increases, and vice versa. Ethiopia's results displayed a covariance of 54.06 and a correlation coefficient of -0.825236 indicates a strong negative linear relationship between the two variables since as one increases the other decreases, and vice versa. A common reason for this, which was mentioned earlier, is that there is typically a gap between the skills acquired at educational institutions and the ones that employers are looking for which explains why higher enrollment levels do not always guarantee employment.

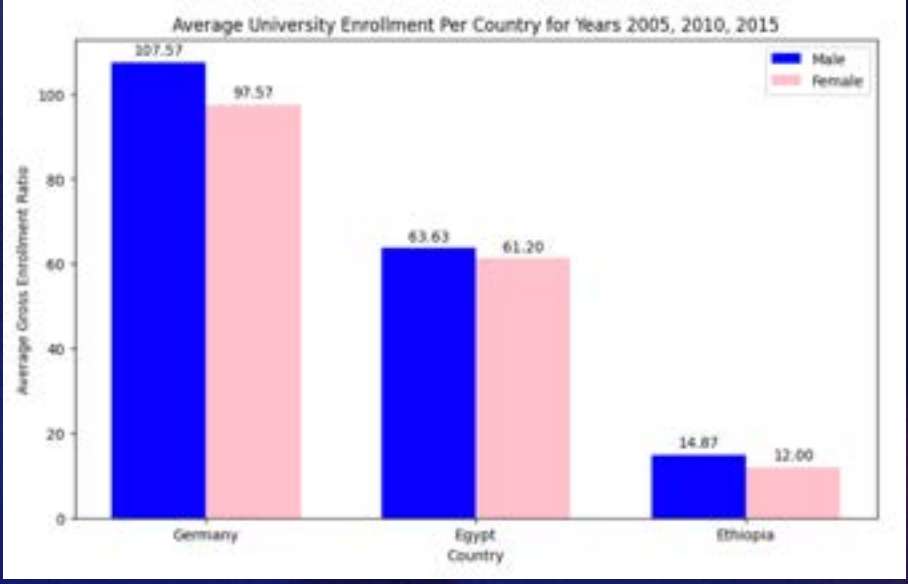


SECTION 2: ENROLLMENT & UNEMPLOYMENT IN RELATION TO GENDER (PART 2)

This section focuses on the relationship between university enrollment rates and unemployment rates, specifically comparing gender dynamics using covariance, correlation, factor analysis, and a regression model to investigate potential gender disparities in the labor force

University Enrollment by Gender Ratio

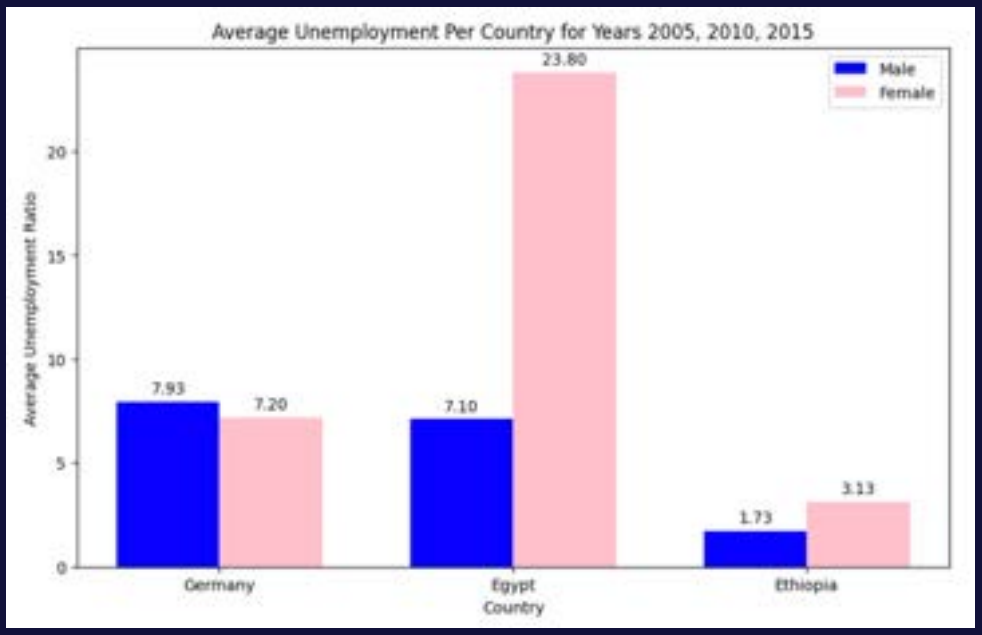
	Year	2005	2010	2015
1.	Germany			
	Male	102.1	113.9	106.7
	Female	95.9	100.8	96.
2.	Egypt			
	Male	73.2	49.7	68.
	Female	70.5	46.6	66.5
3.	Ethiopia			
	Male	7.8	19.1	17.7
	Female	5.2	13.4	17.4



The enrollment rates represent the gross enrollment ratio at the upper secondary (university) level between both genders. The graph compares the average enrollment percentages across the three years for males and females in Germany, Egypt, and Ethiopia. Although the difference is small, females tend to have an average enrollment rate slightly lower than males. In Germany, there is about an average of 107 males enrolled for every 97 females enrolled in university. In Egypt, for every 63 males, 61 females are enrolled. In Ethiopia, for every 14 males, 12 females are enrolled.

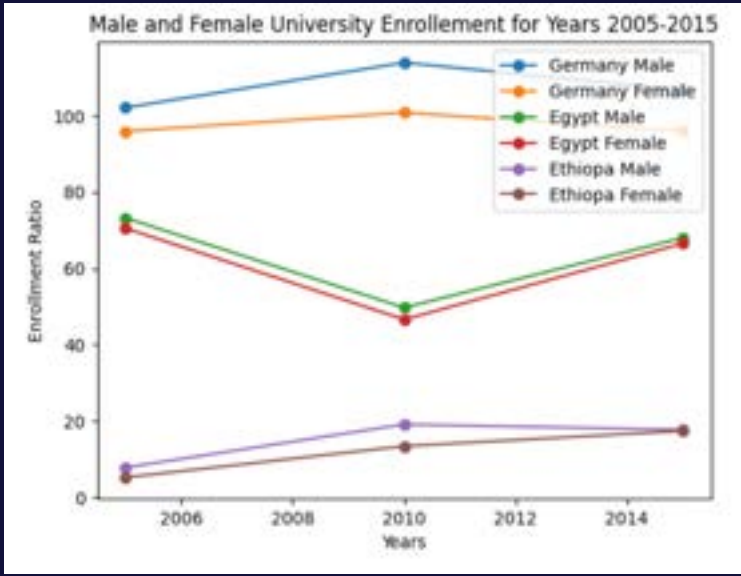
Unemployment Rates by Gender

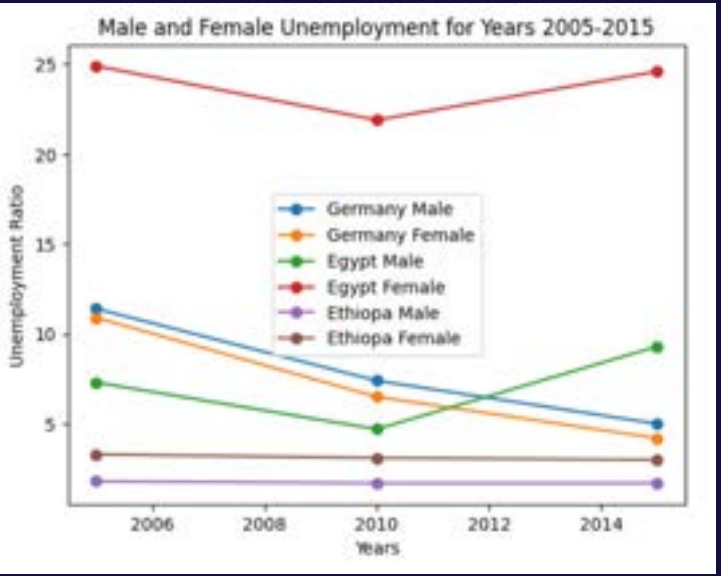
	Year	2005	2010	2015
1.	Germany			
	Male	11.4	7.4	5.
	Female	10.9	6.5	4.2
2.	Egypt			
	Male	7.3	4.7	9.3
	Female	24.9	21.9	24.6
3.	Ethiopia			
	Male	1.8	1.7	17
	Female	3.3	3.1	3.



The heights of the bar graph highlight significant gender disparities in unemployment rates. In Germany, the average unemployment ratio for males and females is relatively close. Hence, it indicates that there isn't significant gender inequality in unemployment rates in Germany. Similarly, in Ethiopia, there is a small, but noticeable difference between male and female unemployment rates. However, Egypt's female height of average unemployment ratio triples the average unemployment ratio of males. According to Constant (2020), education disparities between men and women in Egypt have decreased, however, women still face challenges when searching for employment and continue to earn less than men. Several other factors and challenges that cause high unemployment rates for women include, but not limited to, negative attitudes toward women in the workplace, household responsibilities, childcare, lack of mobility, sexual harassment in the workplace, and persistent wage gaps (Constant, 2020). Despite increasing educational opportunities for women, their employment rates remain low.

Overview of University Enrollment vs. Unemployment During 2005-2015 Regarding Gender





Overall, the graphs of university enrollment between males and females over the years 2005-2015 showed that each country's male enrollment was slightly higher than females'. Additionally, Germany's University enrollment sits at the top, indicating that they have the highest enrollment rates, than Egypt and Ethiopia. Coincidently, this matches with the fact that Germany is the third world's largest developed country and strongest economy. Egypt is categorized as developing, and supports its placement on the graph of in between Germany and Ethiopia. Hence, Ethiopia comes last as it's considered an underdeveloped nation. These enrollment trends highlight the correlation between a country's economic status and its university enrollment rates. Hence, the data shows the impact of a nation's development level on access to higher education, suggesting that more developed economies can support higher enrollment rates, and encourage policymakers and governments to invest in education and resources.

However, the graph of male and female unemployment throughout the years 2005-2010 show that there is no correlation between the variables. It can be said, however, that female employment rates are always lower than male's for Egypt and Ethiopia, while Germany shows the opposite. Furthermore, the height of female unemployment in Egypt raises concerns about gender equality. Overall, the graph shows that the development status of a country does not determine gender employment rates.

Variance & Covariance Between Enrollment & Unemployment for Males and Females

Variance and covariance was conducted to examine how gender influences the relationship between university enrollment and unemployment rates in three different countries depending on their development status, to assess the strength and direction of the relationships.

Male Variance & Covariance

```
Germany_Male_covariance_Enrollement_Unemp: [[10.45333333 -9.89333333]
 [-9.89333333 35.37333333]]
Egypt_Male_covariance_Enrollement_Unemp: [[  5.32        22.48      ]
 [ 22.48       152.36333333]]
Ethiopia_Male_covariance_Enrollement_Unemp: [[ 3.33333333e-03 -3.53333333e-01]
 [-3.53333333e-01  3.79433333e+01]]
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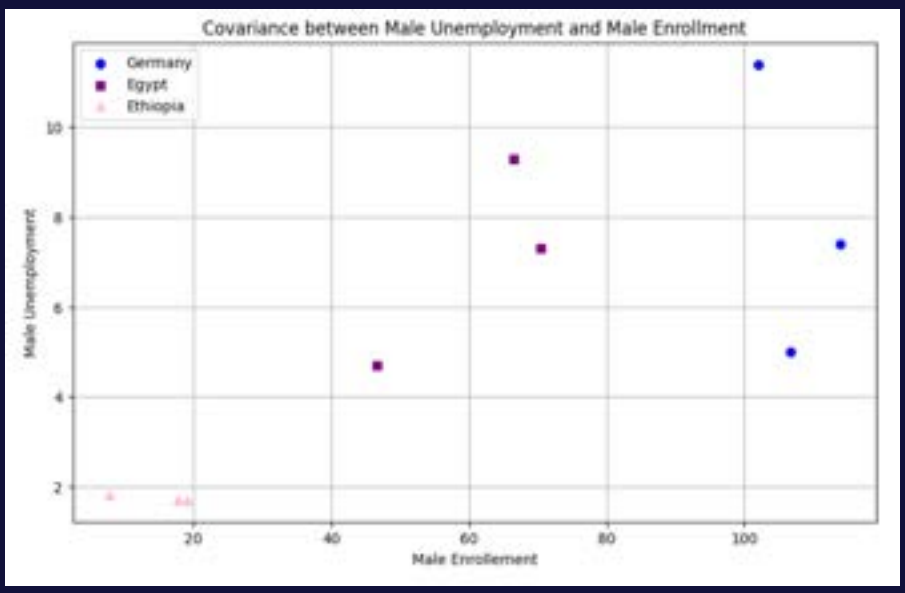

The first number for every list of the outcome represents the variance of unemployment, which determines the variability within each country. The second and third numbers (or the two similar numbers) represent the covariance of unemployment rates and university enrollment rates, indicating how the two variables change together. Lastly, the final number represents the variance/variability of university enrollment rates, for each country as well.

For males, Germany had a moderate variance of 10.453 for unemployment rates and a high variance of 35.373 for university enrollment rates. This suggests that Germany had a wide range of enrollment over the years, as well as for their unemployment rates. Their covariance of -9.89 indicates a relatively strong inverse relationship between unemployment and enrollment. Logically, this makes no sense as it suggests that as enrollment increases, unemployment increases. However, this could be due to the fact that since Germany is a developed country, they give their citizens options to freelance, find jobs without degrees, etc. Hence, it allows for non-university students to participate in the labor force, by providing them with employment opportunities.

Egypt has a low variance of 5.32 for male unemployment indicating that there hasn't been much change over the years in terms of increase or decrease in unemployment rates. The very high variance of 152.36 indicates that the male enrollment rates in Egypt has faced significant shifts and changes in 2005-2015. Their covariance of 22.48 indicates a positive relationship and implies that higher university enrollment rates among males are associated with higher male unemployment rates. This could mean that more males are pursuing higher education instead of entering the workforce immediately like Germany.

Ethiopia has a very small variance for both male unemployment rates and enrollment rates. This pattern aligns with the label of Ethiopia's underdeveloped status, as any economical progress, whether positive or negative, in such countries tends to be notably gradual. Its very small and negative covariance indicates a weak, but inverse relationship between the two variables. As unemployment for males increases, enrollment levels decreases.

Female Variance & Covariance

```
Germany_Female_covariance_Enrollement_Unemp: [[11.59       -1.865     ]
 [-1.865       7.84333333]]
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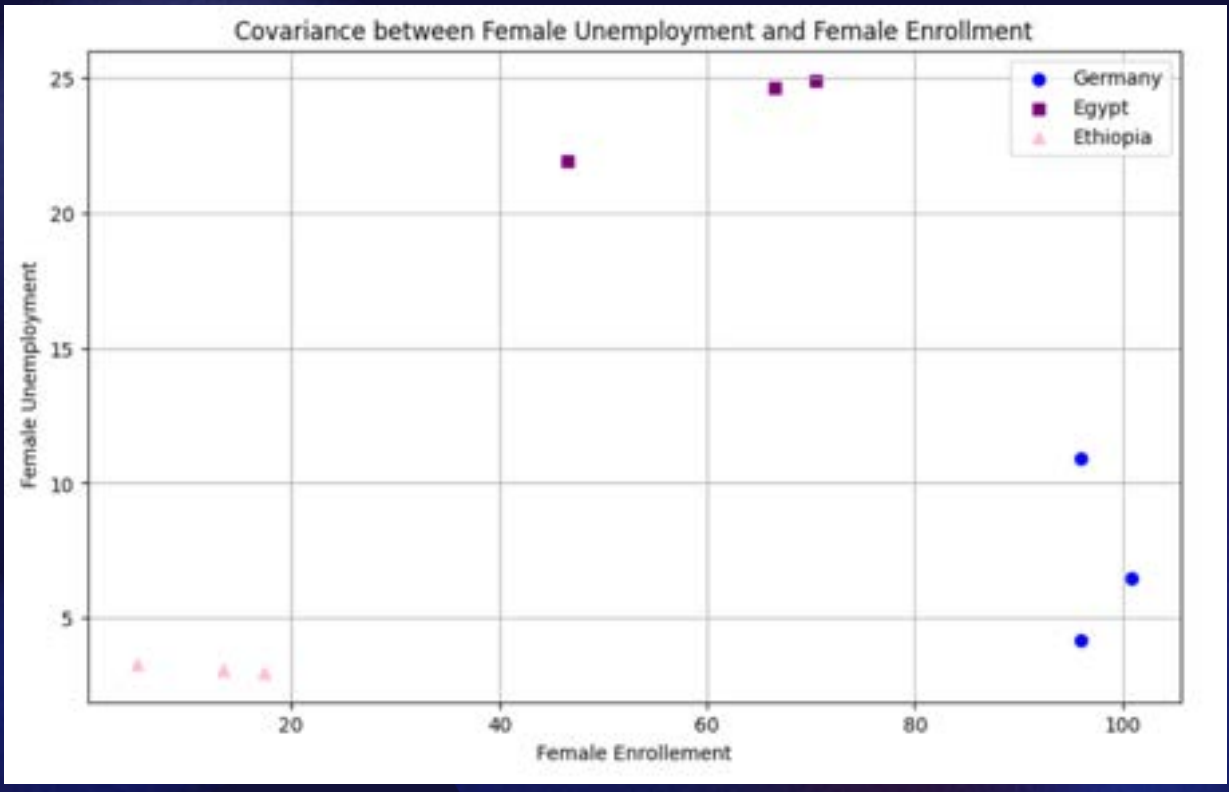
 [ 21.105 163.87 ]]
Ethiopia_Female_covariance_Enrollement_Unemp: [[ 2.33333333e-02 -9.50000000e-01]
 [-9.50000000e-01  3.86800000e+01]]
```

Germany had a moderate variance of 11.59 for female unemployment rates, and a relatively low variance of 7.843 for female university enrollment rates. The low variance in female university enrollment rates may suggest relatively consistent opportunities for women to access higher education in Germany, indicating stability in educational policies and efforts to promote gender equality in education. Their covariance of -1.865 suggest a weak and inverse relationship between female unemployment rates and enrollment in Germany.

Egypt has a very low variance of 2.73 for female unemployment, indicating that there also hasn't been much change over the years in terms of increase or decrease in unemployment rates, similar to males. Egypt also has a very high variance of 163.87, similar to males, indicating that the female enrollment rates in Egypt in has faced significant shifts in 2005-2015. Their covariance of 21.105, also similar to males, indicates a positive relationship and implies that higher university enrollment rates among females are associated with higher female unemployment rates.

Lastly, Ethiopia has a very small variance for both female unemployment rates and enrollment rates. This indicates that not much change has happened, as their economic and social progress is slow due to their development status. Additionally, their negative and low covariance indicates a weak and inverse relationship between enrollment rates and unemployment rates.



Correlation Between University Enrollment and Unemployment

Analyzing correlation is crucial to enhance our understanding of the relationships of enrollment and unemployment. This will provide a quantitative understanding of this relationship and gender disparities in different countries, to address gender inequalities in education and employment. If the correlation is close to 1, it implies there is a strong positive relationship between the two variables. If the calculated correlation was closer to -1, it would imply a strong inverse relationship.

Male Correlation

	Country	Male_Unemployment	Male_Upper_Secondary_Enrollment	Correlation
0	Germany	[11.4, 7.4, 5.0]	[102.1, 113.9, 106.7]	-0.514490
1	Egypt	[7.3, 4.7, 9.3]	[102.1, 113.9, 106.7]	-0.663357
2	Ethiopia	[1.8, 1.7, 1.7]	[102.1, 113.9, 106.7]	-0.796004

Female Correlation

	Country	Female_Unemployment	Female_Upper_Secondary_Enrollment	Correlation
0	Germany	[10.9, 6.5, 4.2]	[95.9, 100.8, 96.0]	-0.195608
1	Egypt	[24.9, 21.9, 24.6]	[95.9, 100.8, 96.0]	-0.997333
2	Ethiopia	[3.3, 3.1, 3.0]	[95.9, 100.8, 96.0]	-0.206484

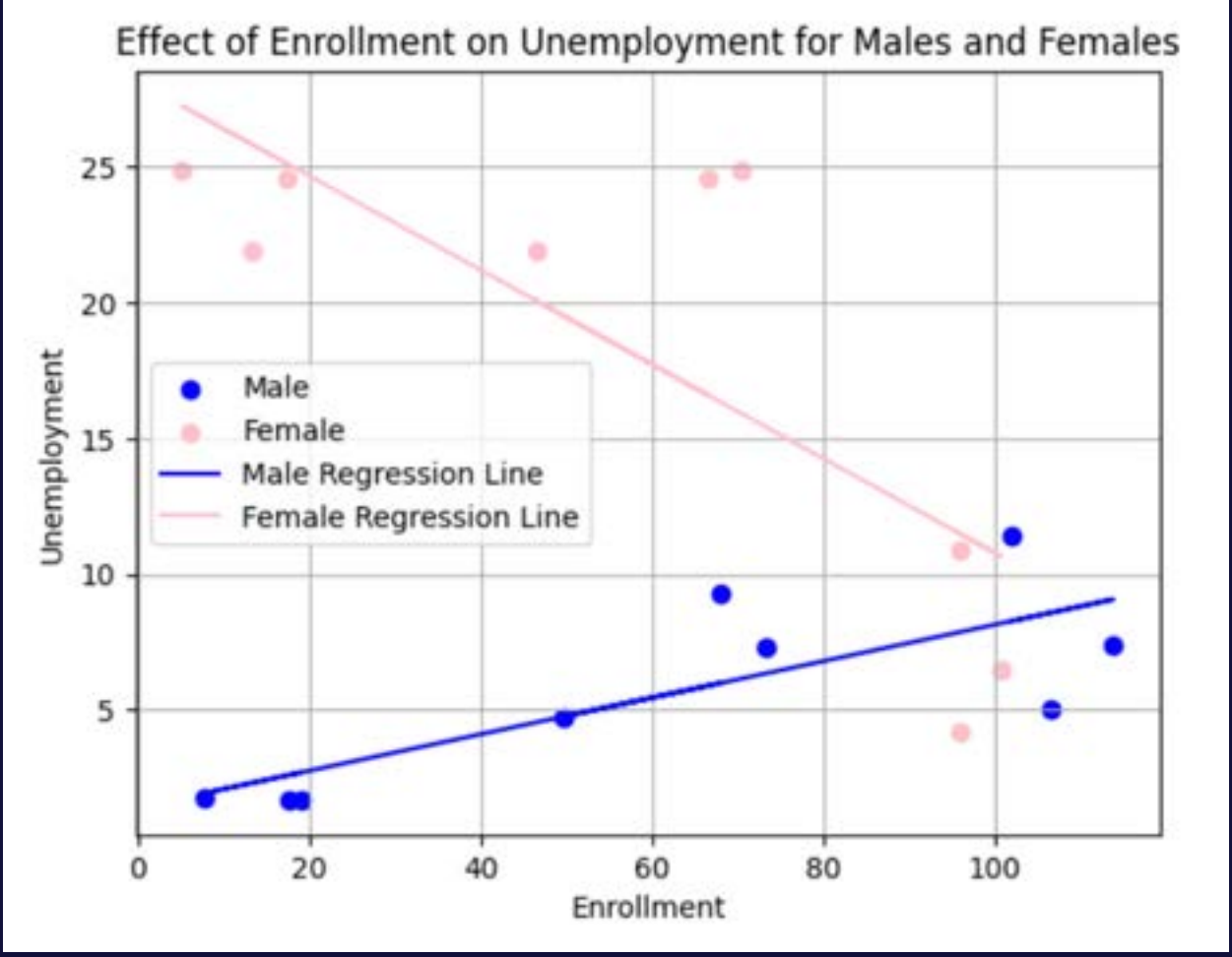
Germany had a correlation of -0.51449 for male, indicating that there is a moderate negative correlation between male enrollment and unemployment. In other words, as male enrollment increases, male unemployment decreases which contradicts with the previously gained insights. In terms of females, the -0.195608 indicates that there is a weak inverse relationship between female enrollment and unemployment.

Egypt has a correlation of -0.663357, indicating that there is an moderately inverse relationship between male enrollment and unemployment. This is a stronger correlation than Germany however, although Germany is a developed country. Egypt's female correlation of -0.997333 stands out, as it suggests there is an extremely strong negative correlation between female university enrollment rates and female unemployment rates. This implies an almost perfect relationship, where a decrease in female enrollment will lead to an increase female unemployment and vice versa.

Ethiopia has a -0.796004 correlation for male. This strong and negative correlation indicates that as more males enroll in university, unemployment rates decrease. On the other hand, their correlation of -0.206484 for female suggests there is a weak correlation between female enrollment and unemployment.

Overall, all three countries show that there is a negative correlation between male enrollment and unemployment, implying that male employment opportunities are generally associated with increased university enrollment rates and participation. Similarly, the correlation between female enrollment and unemployment in Egypt shows a strong negative relationship, much stronger than the male relationship, suggesting that female education has an affect on unemployment rates. Therefore, Egypt must implement initiatives and plans to reduce gender disparities in female unemployment, and provide an equal opportunity for both genders.

Regression Model



This is a visualization of the previous data using a regression model. For males, there is a positive slope in the regression line, suggesting a positive relationship between male university enrollment and unemployment. Additionally, there is a negative slope in the regression line for females, suggesting a negative relationship between female education enrollment and unemployment. The regression line is saying that if males don't enroll, it won't make a difference to their employment. On the contrary, females must enroll, to decrease their chances of unemployment. These findings align with the previous observations, indicating that when females enroll in education, there is no guarantee of employment after graduation. Thus, the regression model suggests that females are more impacted by enrollment than males, as it can play a big role in their employability later on.

SECTION 3: ENROLLMENT & EXPENDITURE

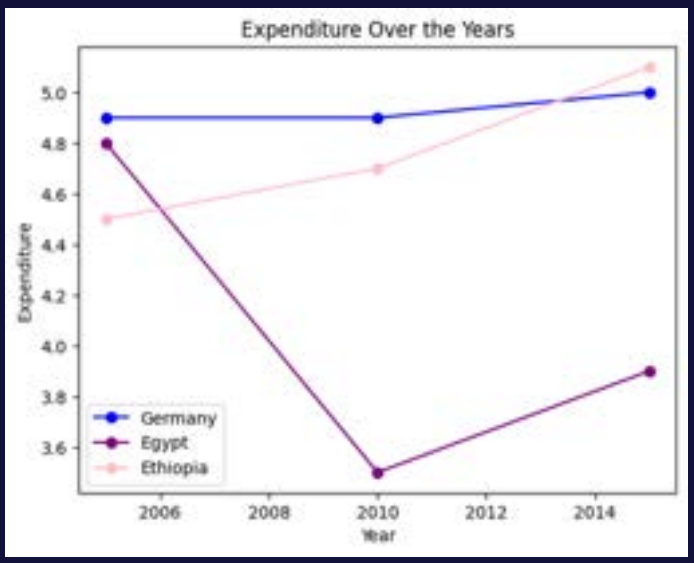
This section examines the relationship between government expenditure on education and enrollment levels in university. The objective is to understand how variations in educational spending impact student enrollment rates.

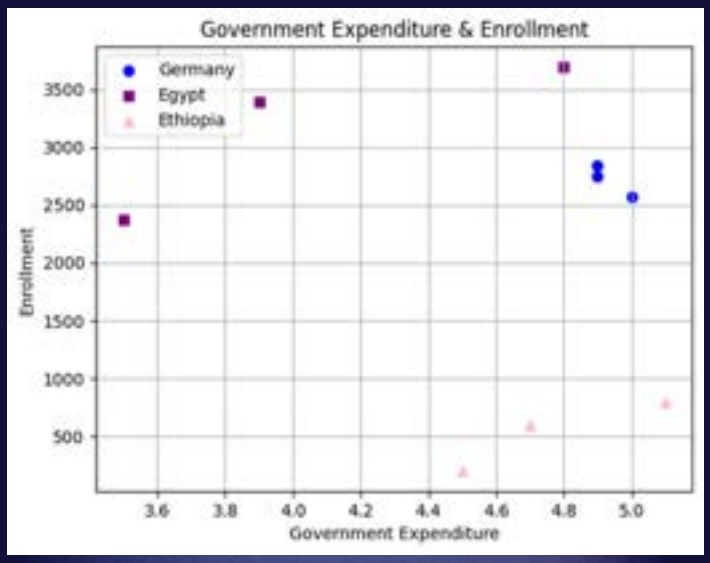
AVG. Expenditure on Education

4.93	4.06	4.76
GERMANY	EGYPT	ETHIOPIA

Variability of Expenditure on Education

0.02	0.295	0.062
GERMANY	EGYPT	ETHIOPIA



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 [3.99566667e+02 4.80361333e+05]]
Ethiopia_covariance_Enrollement_Expenditure:
[[ 9.33333333e-02 -5.93333333e+00]
 [-5.93333333e+00  4.80361333e+05]]
```

Insights

Germany: Despite having a low variance in expenditure, there's a negative covariance with enrollment, indicating potential inefficiencies in how educational funds are used

Egypt: With a higher variance in expenditure and positive covariance with enrollment, there seems to be a direct relationship between increased expenditure and increased enrollment. This suggests effective use of educational expenditure and the positive impact of financial investment on education.

Ethiopia: Similar to Germany, despite a low variance in expenditure, the negative covariance points towards a possible mismatch between expenditure patterns and educational outcomes. As Ethiopia is an underdeveloped country, there could also be socio-economic challenges that prevent increased spending from translating into higher enrollment rates.

CONCLUSION & INSIGHTS

The study analyzed the relationship between university enrollment rates and economic dynamics, encompassing individual and national prosperity. It takes three countries into account that have varying development statuses—Germany, Egypt, and Ethiopia. This is used to highlight the influence of education and economic indicators such as GDP per capita and unemployment rates.

The study analyzes the relationship between university enrollment rates and economic dynamics, encompassing individual and national prosperity. It takes three countries into account that have varying development statuses—Germany, Egypt, and Ethiopia. This is used to highlight the influence of education and economic indicators such as GDP per capita and unemployment rates.The investigation into the relationship between university enrollment rates and income per person reveals a complex dynamic that is contradicting to common beliefs. Germany, despite being the most developed nation among the three, shows a strong inverse relationship between enrollment levels and income per person. This suggests that as Germany's economic conditions improve, fewer individuals pursue higher education, possibly due to immediate employment opportunities in a strong economy. Conversely, Ethiopia exhibits a strong positive relationship, indicating that as economic conditions improve, more individuals can afford to pursue higher education, which in turn boosts income levels. Egypt presents a moderately negative relationship, implying other influencing factors such as economic instability.

The analysis of the relationship between university enrollment rates and unemployment unveils varied outcomes across the three nations. Germany, while showing a decline in unemployment over recent years, shows a strong negative correlation, indicating that higher enrollment rates initially increase unemployment, but beyond a certain point, the trend reverses. This nonlinear relationship might reflect the complex way these two factors interact suggesting that there's a point where the benefits of higher education (such as getting a job) start to change. Initially, more education might lead to better job opportunities, but as more people achieve higher levels of education, the job market might become saturated, and the advantage of having more education could diminish or change in unexpected ways.

CONCLUSION & INSIGHTS

Egypt shows a moderately positive correlation, suggesting that higher enrollment rates correlate with higher unemployment, possibly due to a skills mismatch between education and labor market needs. Essentially, this might happen because the skills people are learning in their education are not the same skills that are needed for the available jobs, resulting in unemployment despite education. Ethiopia, despite being underdeveloped, has a strong negative correlation, indicating that higher enrollment rates effectively reduce unemployment. This implies that education is having a positive impact on employment opportunities, even in a country that is still in the process of development.

In Germany, gender disparities in both enrollment and unemployment are minimal, indicating a relatively balanced approach to gender equality in education and employment. In Egypt, significant disparities exist, with female unemployment rates tripling those of males despite increasing educational opportunities. Ethiopia, while showing lower overall enrollment, shows consistent gender gaps, reflecting broader socio-economic challenges. When all of the data was combined into a regression model, female's data points had a negative slope while male's had a positive one. One significant insight from this observation is the critical role of education, particularly for females, in influencing their employment outcomes. It could suggest that women are less likely to be hired without formal education while males do not necessarily face the same issue.

The relationship between government expenditure on education and enrollment rates underscores the critical role of effective financial investment in education. Germany, despite consistent expenditure, shows a negative covariance with enrollment, suggesting potential inefficiencies in fund utilization. Egypt, with higher expenditure variance and positive covariance, demonstrates the positive impact of financial investment on increasing enrollment rates. Ethiopia's low variance and negative covariance highlight socio-economic barriers that hinder the translation of increased spending into higher enrollment rates.

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