

# A **TRUE LIE** ABOUT REED COLLEGE U.S NEWS RANKING

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Huaying Qiu, Wenxin Du, Bailee Cruger

Have you ***ever***.....

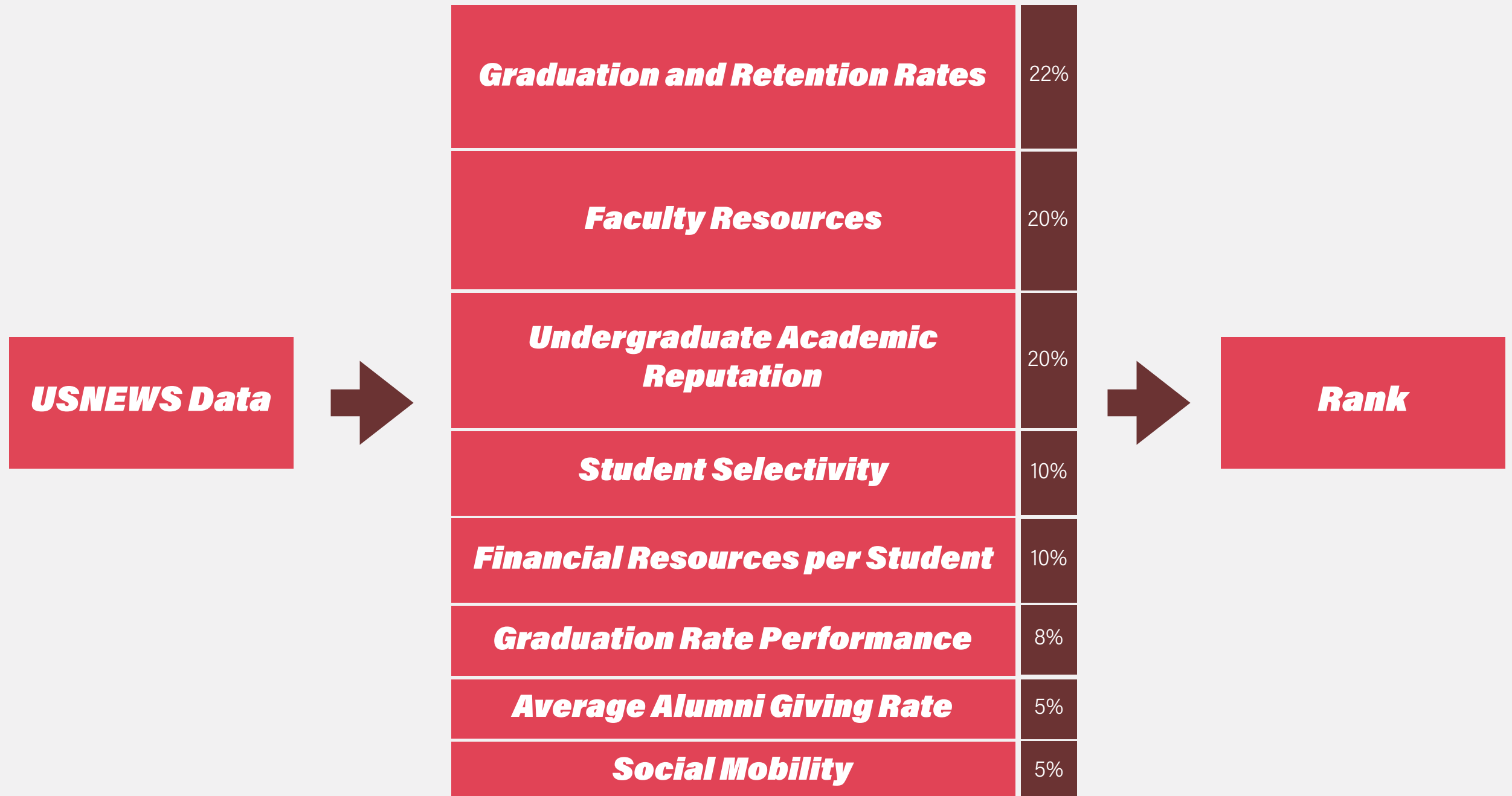
***Rank*** & The ***Penalty*** Rumor



HOBART AND WILLIAM SMITH  
COLLEGES

# U.S News' ***Ranking Methodology***

*All normalized using Z-score*



***Graduation and Retention Rates***



***Average six-year graduation rate***

***Average first-year student  
retention rate***

***Social Mobility***



***Pell Grant graduation rates***

***PG graduation rates compared  
with all other students***

***Undergraduate Academic  
Reputation***



***Peer assessment survey***

***High school counselors' ratings***

***Faculty resources***



***Class size index***

***Faculty compensation***

***Percent faculty with terminal  
degree in their field***

***Full time faculty***

***Student-faculty ratio***

***Student selectivity***



***SAT and ACT score***

***High school class standing in top  
10%***

***High school class standing in top  
25%***

***Acceptance rate***



***Reed College*** is ranked

***52 lower***

***90th to 38th***

But wait..... Something is off with the data  
What are those ***Ranks?***

***Graduation Retention Rank***

***Alumni Giving Rank***

***Selectivity Rank***

***Financial Resource Rank***

***Faculty Resource Rank***

***Social Mobility***



**35%** of the weight  
unexplained

***Financial Resource Rank***



***Expenditure per Student***

***Faculty Resource Rank***



***Faculty Compensation***

***Percent of Full-time Faculty***

***Social Mobility***



***Pell Grant recipient  
Graduation Rate***

***Ratio between Pell Grant  
Recipient Graduation Rate  
and Non-recipient  
Graduation Rate***

From ***IPEDS***

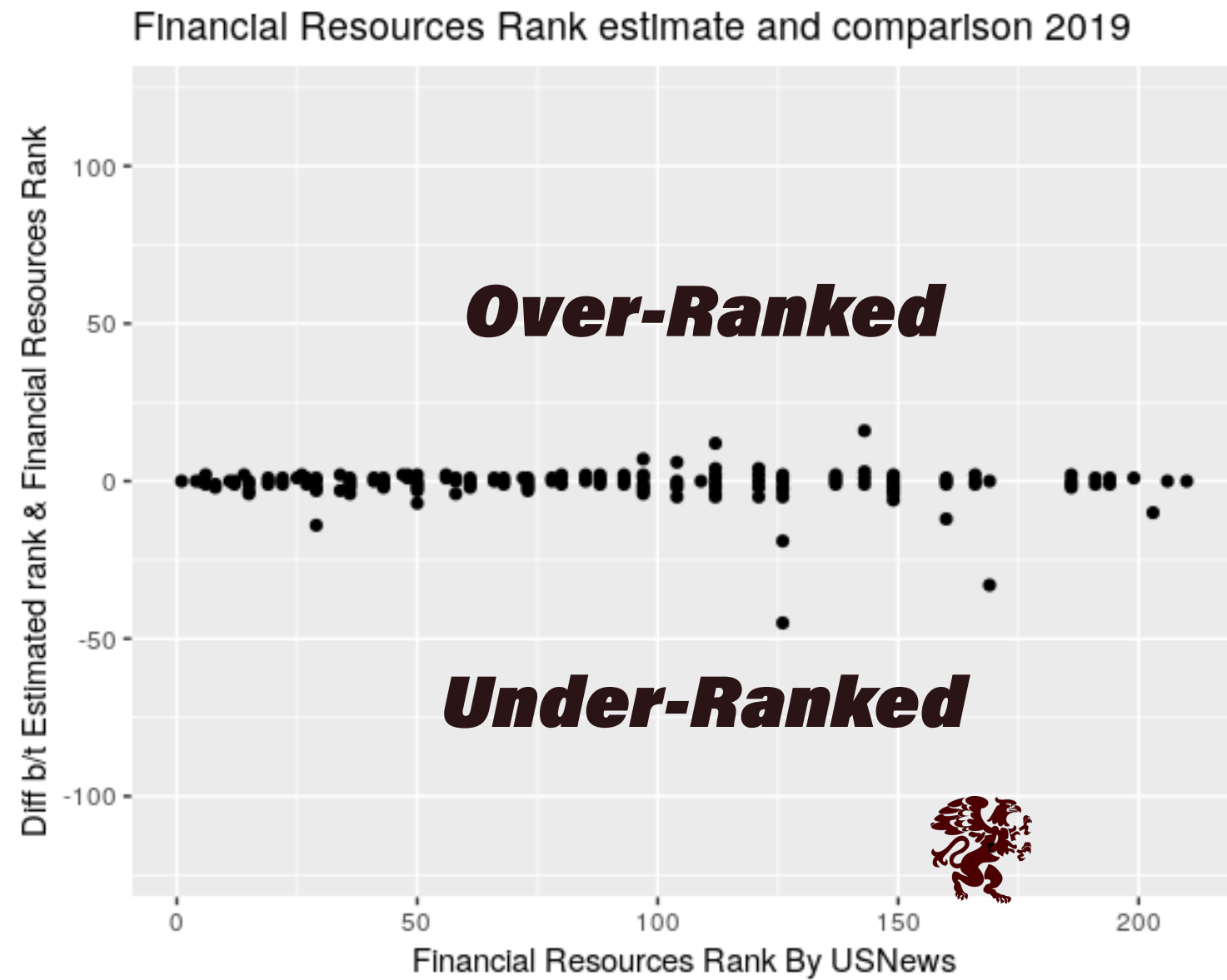
The ***RED*** Flag

<b><i>School</i></b>	<b><i>Financial Resource Rank</i></b>	<b><i>Expenditure per Student</i></b>
<b><i>Earlham College</i></b>	<b><i>50</i></b>	<b><i>47956.31</i></b>
<b><i>*****</i></b>	<b><i>*****</i></b>	<b><i>*****</i></b>
<b><i>Salem College</i></b>	<b><i>169</i></b>	<b><i>30004.51</i></b>
<b><i>Reed College</i></b>	<b><i>169</i></b>	<b><i>54566.76</i></b>

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54566.76 << 47956.31 ?

Maybe USNEWS doesn't do rank by ***Real Number?***

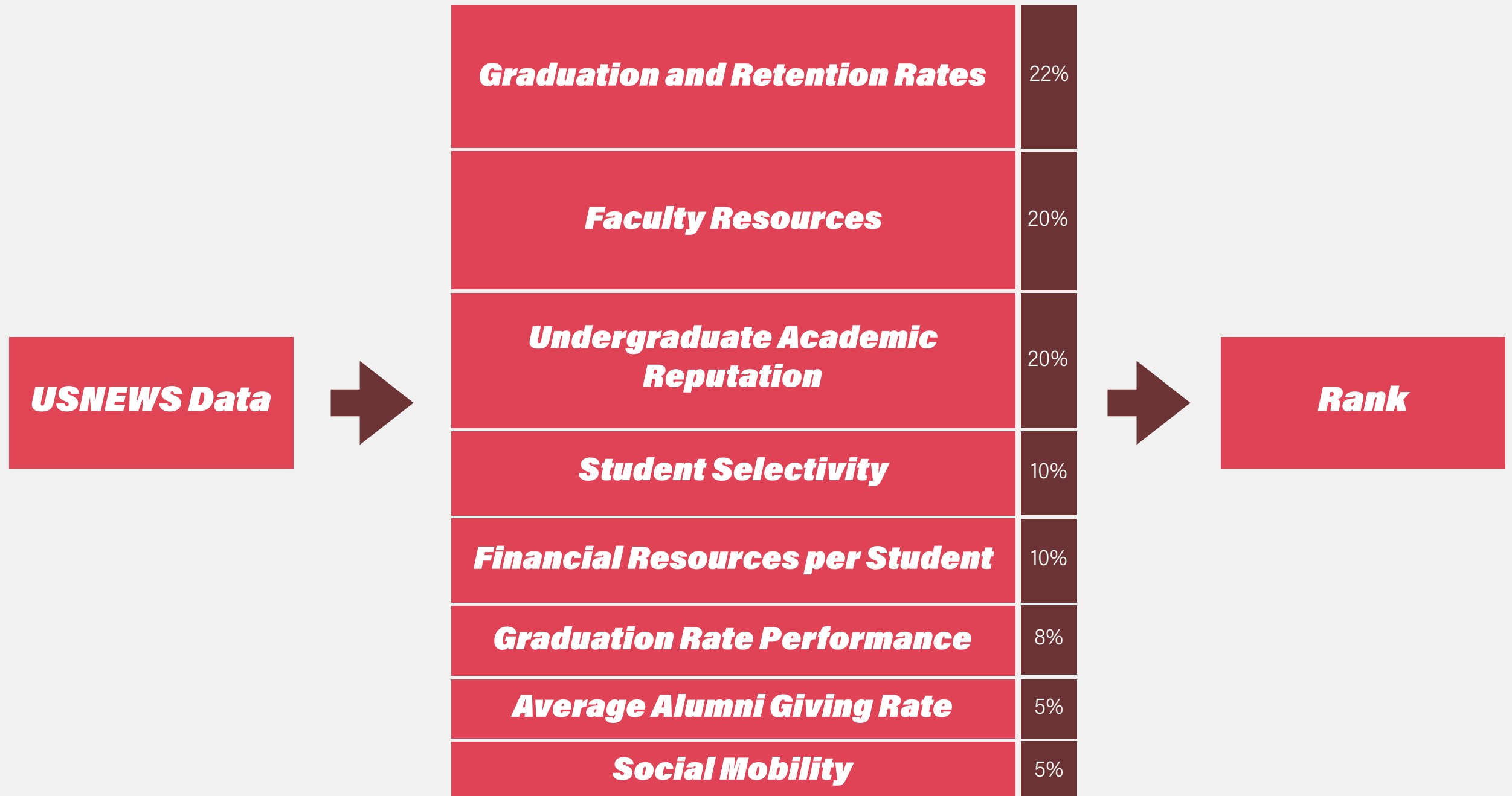


Guess which one is **Reed**



Enough said about the data. What about USNEWS' ***model?***

*All normalized using Z-score*



# ***Linear Regression***

$$y = \beta_0 + \sum_{i=1}^n \beta_i x_i + \varepsilon$$

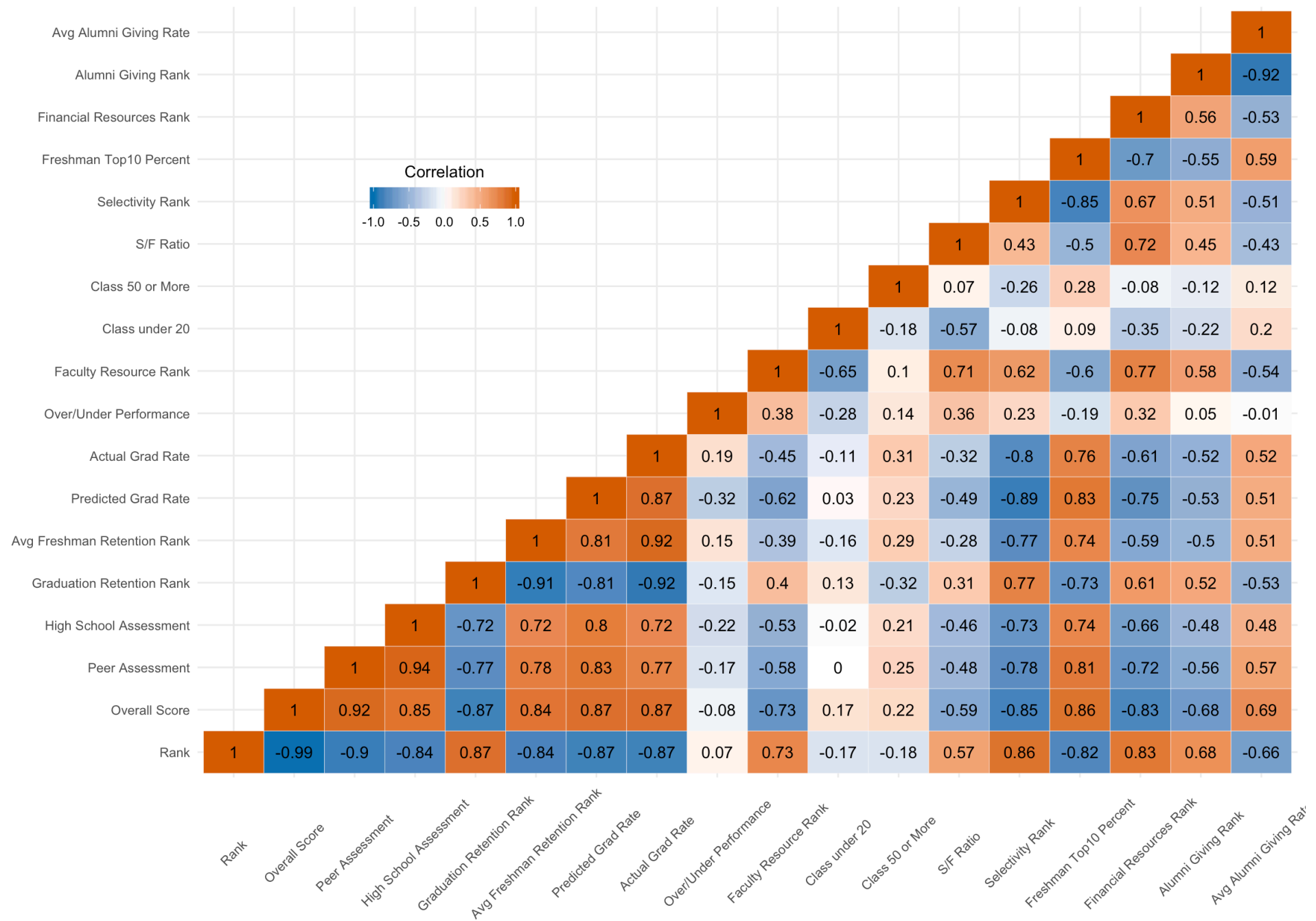
# ***Linear Regression***

$$y = \beta_0 + \sum_{i=1}^n \beta_i x_i + \varepsilon$$

Effect of variable

Error/Residual

# Correlation Heatmap



Alright. Time for ***new models.***

# ***Elastic Net***

Ordinary Least Squares Regression

$$\sum_{i=1}^n \left( y_i - \beta_0 - \sum_{j=1}^p \beta_j x_{ij} \right)^2$$

## ***Elastic Net***

Ordinary Least Squares Regression

$$\sum_{i=1}^n \left( y_i - \beta_0 - \sum_{j=1}^p \beta_j x_{ij} \right)^2$$

***Multicollinearity***

***Over-fitting***



## ***Elastic Net***

$$\sum_{i=1}^n \left( y_i - \beta_0 - \sum_{j=1}^p \beta_j x_{ij} \right)^2 + \alpha \lambda_1 \sum_{j=1}^n \beta_j^2 + (1 - \alpha) \lambda_2 \sum_{j=1}^n |\beta_j|, \quad \lambda_1, \lambda_2 \geq 0$$

***Multicollinearity  
Fixed***

***Variable Selection***

***PCR***

***PCA***



***Model  
Selection***



***Prediction***

***PCR***

***PCA***

$$Z_i = \sum_{j=1}^n \phi_{ji} x_j, \text{ where } \sum_{j=1}^m \phi_{ji}^2 = 1$$

$$y = \beta_0 + \sum_{i=1}^n \beta_i Z_i + \varepsilon$$

***PCR***

***PCA***



***Model  
Selection***

**8** principle components  
that explain **93.57%** of  
the variance in all the data  
used by USNEWS is used

***PCR***

***PCA***



***Model  
Selection***

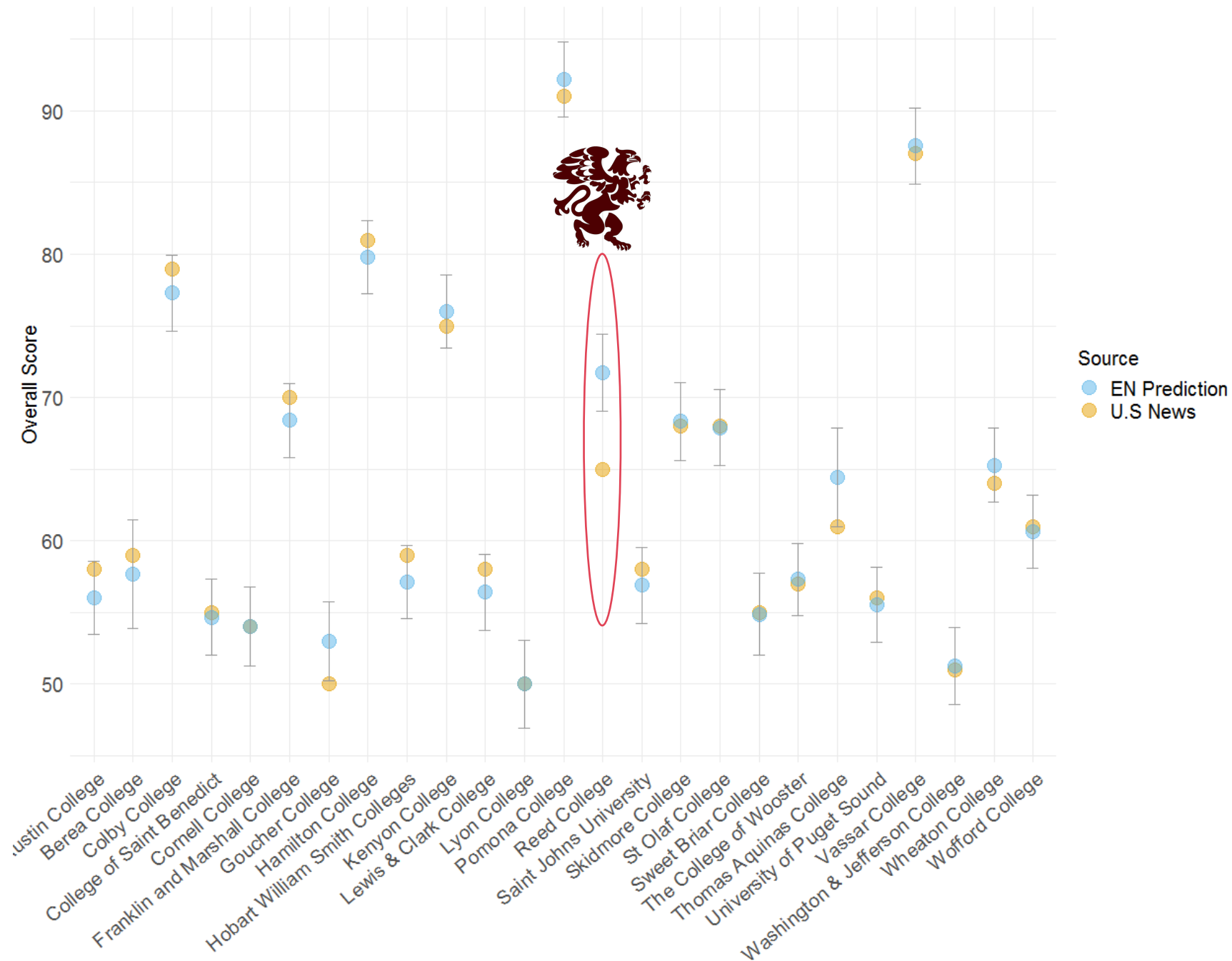


***Prediction***

Keep the estimated  $\beta$ 's and  
calculate Z's for new data

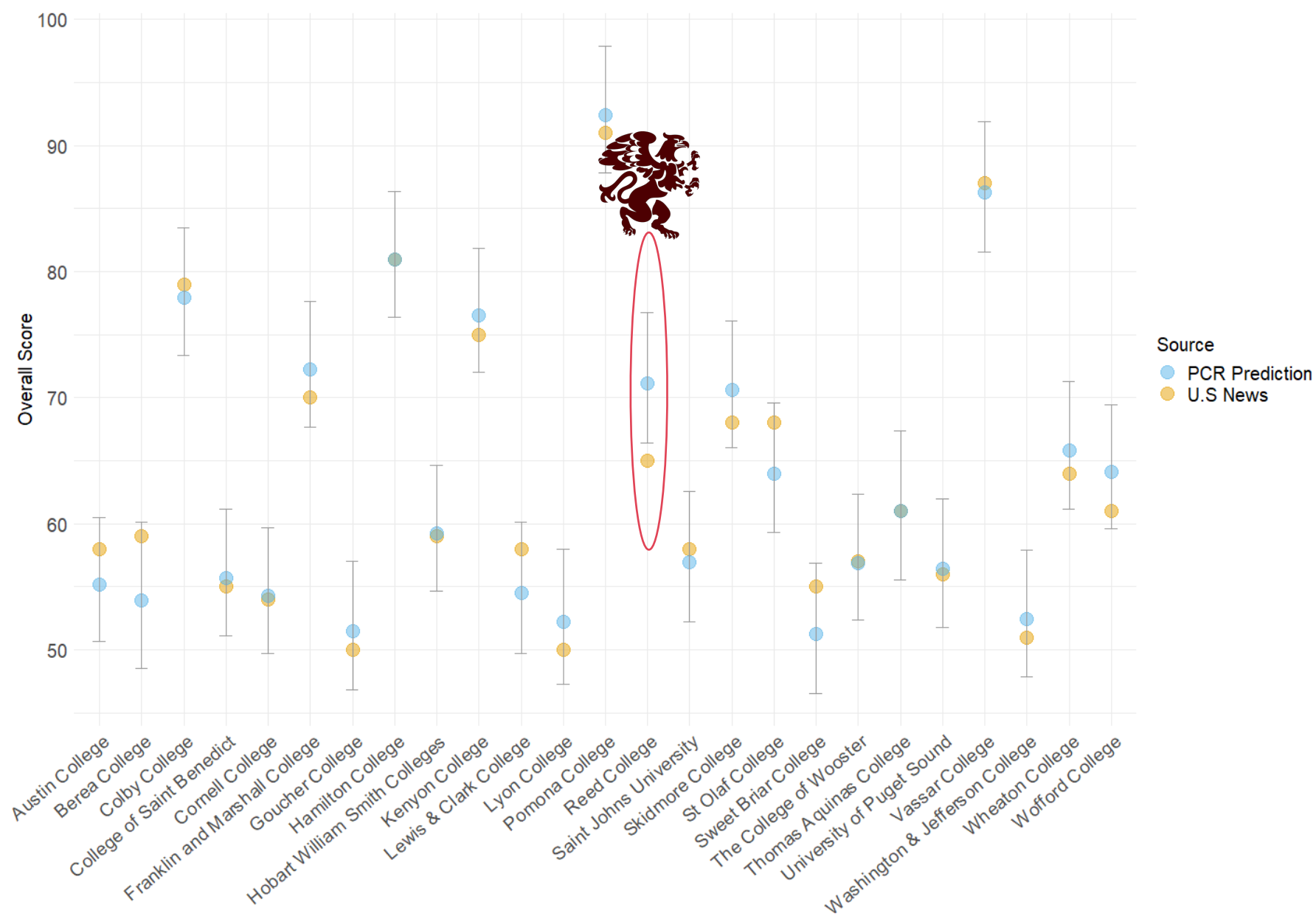
The results are ***SHOCKING...***

**2009**



The estimated score for **Reed** is **72** instead of **65**. Which would place **Reed** at the **37th**. Instead of the **54th** among the 124 liberal arts colleges in 2009. The U.S News overall score is outside of the prediction interval **[69,74]**

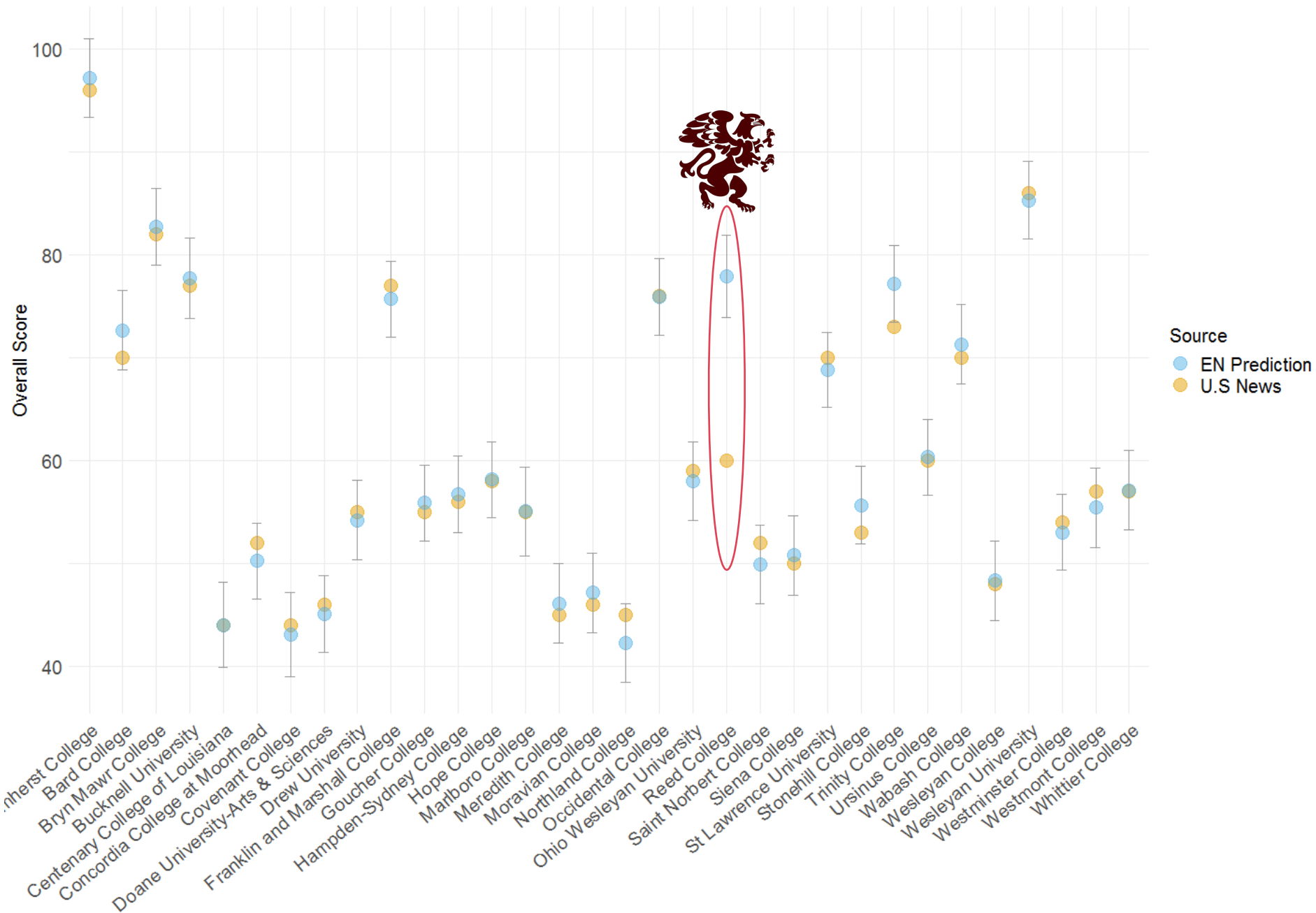
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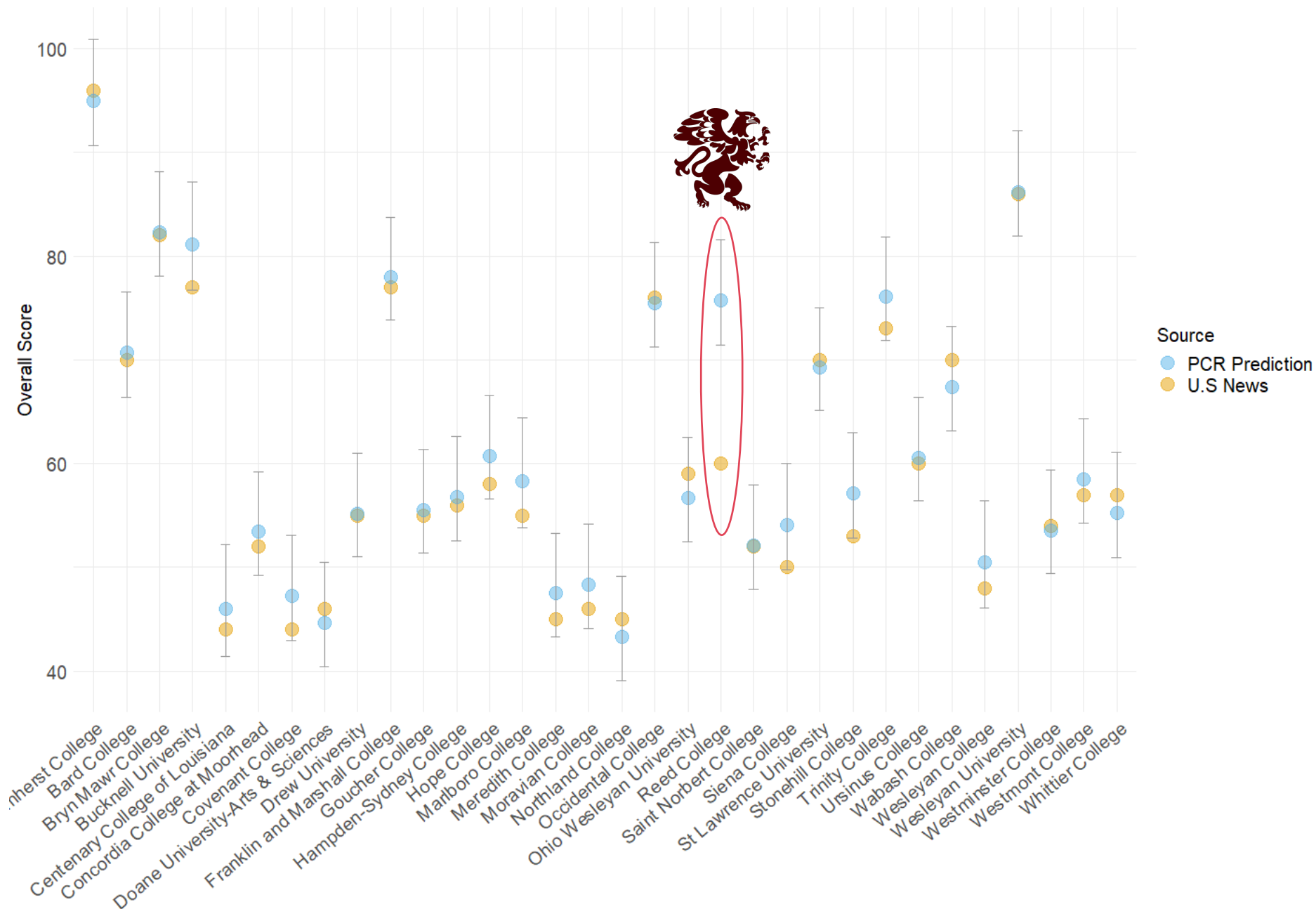


**2019**



The estimated score for **Reed** is **77** instead of **60**. Which would place **Reed** at the **36th**. Instead of the **90th** among the 173 liberal arts colleges in 2019. The U.S News overall score is outside of the prediction interval **[73,81]**

**2019**



The estimated score for **Reed** is **77** instead of **60**. Which would place **Reed** at the **36th**. Instead of the **90th** among the 173 liberal arts colleges in 2019. The U.S News overall score is outside of the prediction interval **[71,82]**

But there are still ***issues***.....

## **NA's**

We dropped 10 schools who don't have data on expenditure

***United States Military Academy***

***St Mary's College of Maryland***

***United States Naval Academy***

***University of North Carolina at  
Asheville***

***United States Air Force Academy***

***University of Minnesota-Morris***

***Virginia Military Institute***

***Massachusetts College of  
Liberal Arts***

***New College of Florida***

***SUNY at Purchase College***

Another 2 schools who don't have data on Pell Grant

***Principia College***

***Hillsdale College***

***Unobtainable  
Variables***

***Peer Assessment Score***

***High School Counselor  
Assessment Score***

***Percent of Faculty with a  
Doctoral Degree***

***Regional Cost of Living***

Fin

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