PEOPLE ANALYTICS CASE COMPETITION
INCREASE THE PROBABILITY OF INTERVIEWED CANDIDATES
WHO CAN COMPLETE THE PROGRAM

15TH MARCH 2023

TEAM DASARA

About us

Seonyeong (Sara) Park

- University of Southern California
- MS in Business Analytics

Chaiyapuk (KK) Titinanapun

- University of Southern California
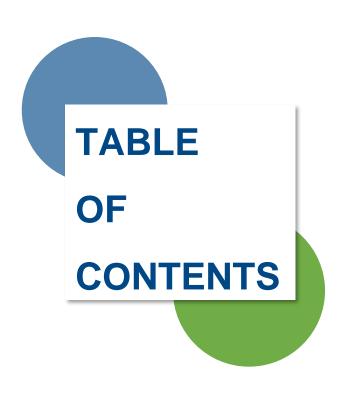- MS in Business Analytics

Pooja Gotur Sathyanarayana

- University of Southern California
- MS in Business Analytics

Prerna Sanjay Kothari

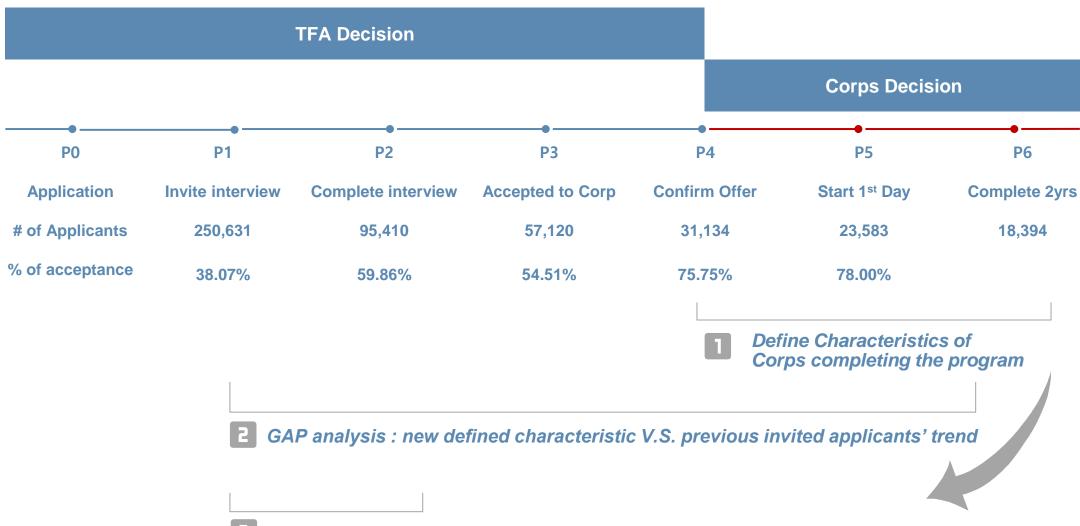- University of Southern California
- MS in Business Analytics

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Overview

TFA Decision					**Corps Decision**	

	P0	P1	P2	P3	P4	P5	P6
	Application	Invite interview	Complete interview	Accepted to Corp	Confirm Offer	Start 1st Day	Complete 2yrs
# of Applicants		250,631	95,410	57,120	31,134	23,583	18,394
% of acceptance		38.07%	59.86%	54.51%	75.75%	78.00%	

1 *Define Characteristics of Corps completing the program*

2 *GAP analysis : new defined characteristic V.S. previous invited applicants' trend*
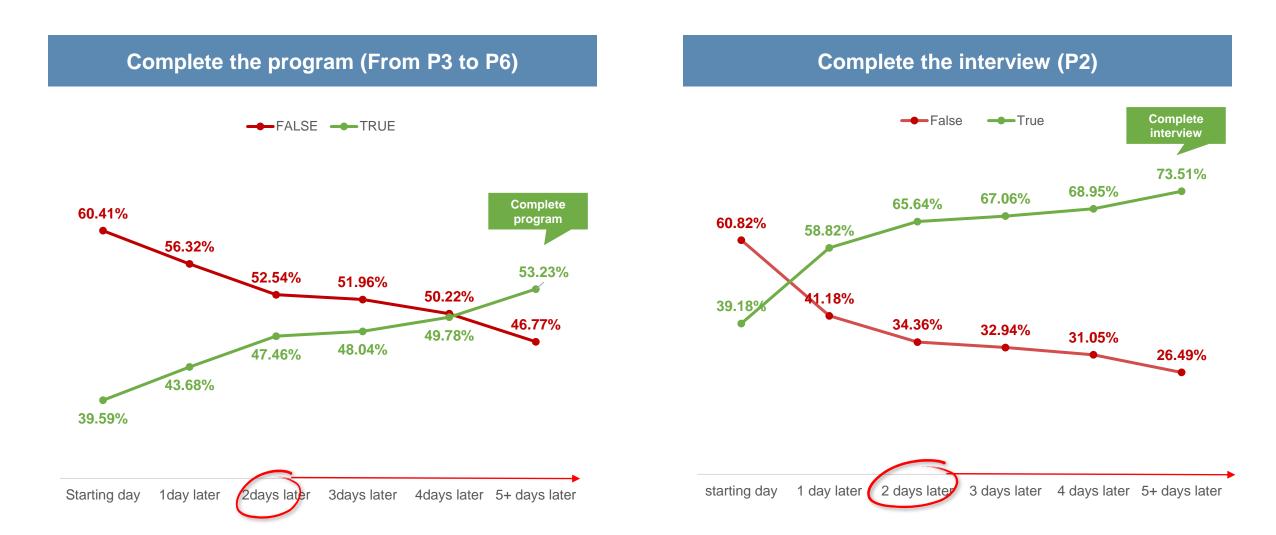
3 *Give recommendations and what if we invite those applicants to the interview*

Key finding 1 – Days before submit ('app-submit – app-start' date)
The more time applicants spent on filling the application, the more likely they were to complete the interview and program.

Complete the program (From P3 to P6)

FALSE / TRUE

Complete program

- 60.41%
- 56.32%
- 52.54%
- 51.96%
- 50.22%
- 46.77%
- 39.59%
- 43.68%
- 47.46%
- 48.04%
- 49.78%
- 53.23%

Starting day | 1day later | 2days later | 3days later | 4days later | 5+ days later

Complete the interview (P2)

False / True

Complete interview

- 60.82%
- 41.18%
- 34.36%
- 32.94%
- 31.05%
- 26.49%
- 39.18%
- 58.82%
- 65.64%
- 67.06%
- 68.95%
- 73.51%

starting day | 1 day later | 2 days later | 3 days later | 4 days later | 5+ days later

Key finding 2 – GPA & School selectivity
Applicants who had low-mid GPA from more and most selective schools were more likely to complete the interview and program.

Complete the program (From P3 to P6)

	2.50 - 2.75	2.75 – 3.00	3.00 – 3.25	3.25 – 3.50	3.50 – 3.75	3.75 – 3.90	3.90 – 4.00
Least Selective	58.82%	54.17%	42.40%	37.21%	47.76%	41.67%	42.22%
Less Selective	58.82%	47.68%	54.27%	47.0?%	50.79%	50.40%	44.22%
Selective	58.39%	53.51%	55.60%	54.55%	49.83%	45.69%	46.12%
More Selective	59.62%	55.01%	53.77%	53.9?%	51.03%	45.93%	44.87%
Most Selective	61.39%	48.67%	51.88%	50.87%	45.29%	40.73%	36.85%

Complete the interview (P2)

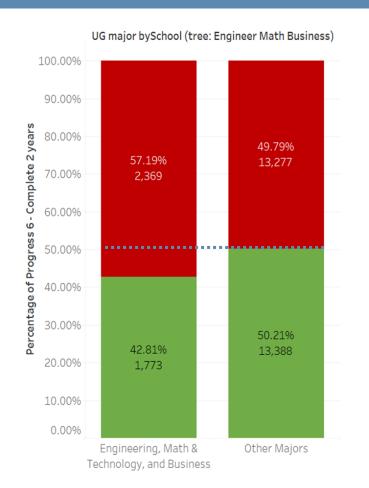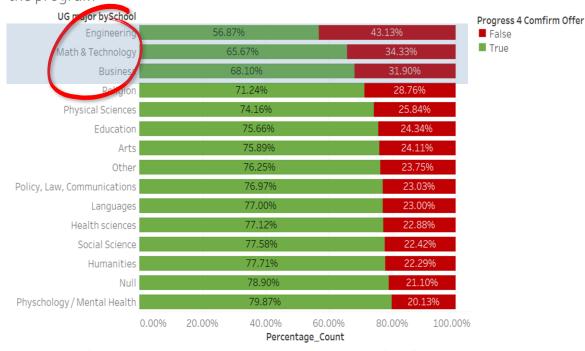|	2.50 - 2.75	2.75 – 3.00	3.00 – 3.25	3.25 – 3.50	3.50 – 3.75	3.75 – 3.90	3.90 – 4.00
Least Selective	63.76%	61.54%	52.17%	51.62%	40.09%	36.77%	40.79%
Less Selective	63.03%	62.94%	52.16%	52.92%	46.59%	47.23%	45.33%
Selective	63.29%	69.03%	58.24%	57.63%	51.60%	51.51%	53.80%
More Selective	70.37%	70.86%	64.77%	64.00%	61.55%	61.82%	61.58%
Most Selective	72.85%	74.46%	70.71%	71.00%	67.19%	69.11%	6?.?6%

Key finding 3 – Major

Corps from Business, Engineering, and Math & Technology majors were less likely to confirm to join the program(P4) and also had higher dropout rate as compared to corps in other majors.

Complete the program (From P3 to P6)

UG major bySchool (tree: Engineer Math Business)

Engineering, Math & Technology, and Business: 57.19% / 2,369 (False), 42.81% / 1,773 (True)
Other Majors: 49.79% / 13,277 (False), 50.21% / 13,388 (True)

Confirm offer (P4)

Applicants from math-related degree are less likely to complete the program

UG major bySchool	True	False
Engineering	56.87%	43.13%
Math & Technology	65.67%	34.33%
Business	68.10%	31.90%
Religion	71.24%	28.76%
Physical Sciences	74.16%	25.84%
Education	75.66%	24.34%
Arts	75.89%	24.11%
Other	76.25%	23.75%
Policy, Law, Communications	76.97%	23.03%
Languages	77.00%	23.00%
Health sciences	77.12%	22.88%
Social Science	77.58%	22.42%
Humanities	77.71%	22.29%
Null	78.90%	21.10%
Physchology / Mental Health	79.87%	20.13%

Progress 4 Comfirm Offer: False (red), True (green)

Percentage_Count for each UG major bySchool. Color shows details about Progress 4 Comfirm Offer. The marks are labeled by Percentage_Count. The data is filtered on Progress 3 Accepted toCorp, which keeps True.

Modeling– Decision tree
Based on the key findings, modeled the decision tree to refine recruiting initiatives.
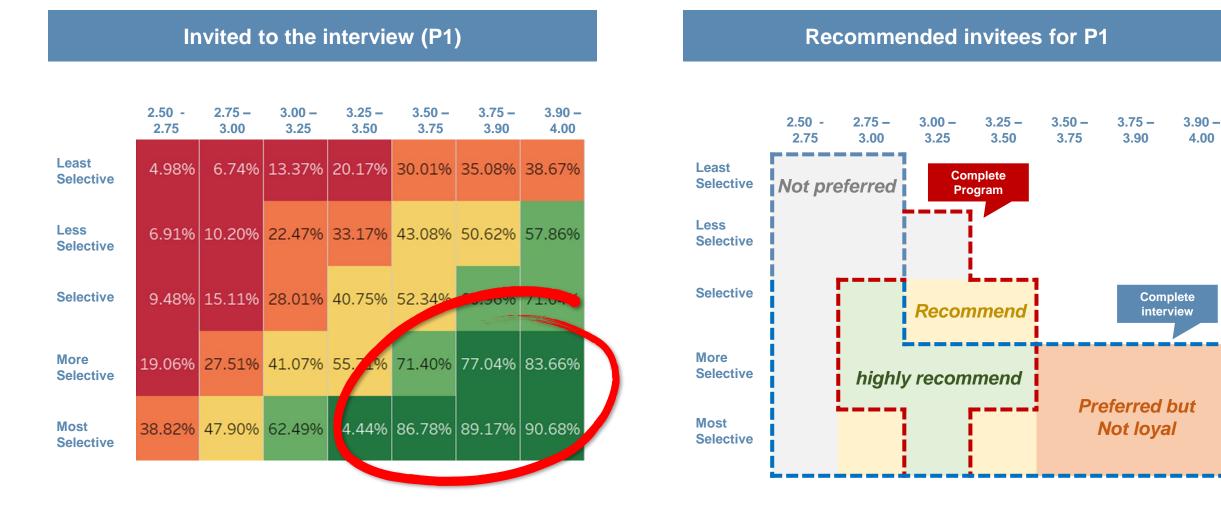
Suggestions Overview

Insights 🔍		Suggestions 💡
Data Analysis	Days before submit	New criteria when approaching or inviting applicants
	GPA & School selectivity	Mid GPA from Selective, More Selective, and Most Selective Schools
	Major	Physical Sciences Major as a Math Teacher
External Research	Shortage in Subjects and Regions	New Recruitment Process for Teacher Shortage Regions

※ Round can not exclude applicants based on our career level and major criteria as the schools have different needs on major and other things that are not included in our dataset.

Suggestion 1 – GPA & School selectivity
Invite and hire more applicants who have GPA from 2.75 to 3.50 studying in selective, more selective, and most selective schools → they are the most loyal group of people in TFA program.
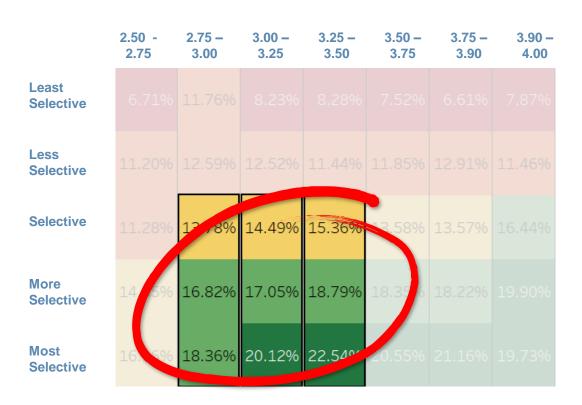
Invited to the interview (P1)

	2.50 - 2.75	2.75 – 3.00	3.00 – 3.25	3.25 – 3.50	3.50 – 3.75	3.75 – 3.90	3.90 – 4.00
Least Selective	4.98%	6.74%	13.37%	20.17%	30.01%	35.08%	38.67%
Less Selective	6.91%	10.20%	22.47%	33.17%	43.08%	50.62%	57.86%
Selective	9.48%	15.11%	28.01%	40.75%	52.34%	63.96%	71.04%
More Selective	19.06%	27.51%	41.07%	55.71%	71.40%	77.04%	83.66%
Most Selective	38.82%	47.90%	62.49%	74.44%	86.78%	89.17%	90.68%

Recommended invitees for P1

	2.50 - 2.75	2.75 – 3.00	3.00 – 3.25	3.25 – 3.50	3.50 – 3.75	3.75 – 3.90	3.90 – 4.00
Least Selective	Not preferred			Complete Program			
Less Selective							
Selective				Recommend			Complete interview
More Selective		highly recommend				Preferred but Not loyal	
Most Selective							

Expected result of suggestion 1 – GPA & School selectivity
If we invite these groups of applicants to the interview, potentially we can increase the number of invited candidates by 15.52%

Complete the interview (estimation)

Days before submit	App start round	UG school selectivity	Ug GPA	Rejected Count	Percentage Rejected from all applications	% from Total interview
2+ days	Round 01	Selective	2.75 - 3.00	572	76.78%	0.60%
			3.00 - 3.25	566	59.33%	0.59%
			3.25 - 3.50	361	43.81%	0.38%
		More Selective	2.75 - 3.00	445	61.13%	0.47%
			3.00 - 3.25	531	46.09%	0.56%
			3.25 - 3.50	355	32.78%	0.37%
		Most Selective	2.75 - 3.00	91	44.61%	0.10%
			3.00 - 3.25	117	29.25%	0.12%
			3.25 - 3.50	101	20.12%	0.11%
	Round 01	Selective	2.75 - 3.00	538	72.12%	0.56%
			3.00 - 3.25	545	57.79%	0.57%
			3.25 - 3.50	381	43.10%	0.40%
		More Selective	2.75 - 3.00	605	58.17%	0.63%
			3.00 - 3.25	710	43.96%	0.74%
			3.25 - 3.50	623	33.64%	0.65%
		Most Selective	2.75 - 3.00	174	44.62%	0.18%
			3.00 - 3.25	203	28.67%	0.21%
			3.25 - 3.50	170	17.69%	0.18%
	Round 01	Selective	2.75 - 3.00	1,122	75.10%	1.18%
			3.00 - 3.25	1,253	60.53%	1.31%
			3.25 - 3.50	838	46.95%	0.88%
		More Selective	2.75 - 3.00	1,093	62.96%	1.15%
			3.00 - 3.25	1,347	48.21%	1.41%
			3.25 - 3.50	1,053	35.30%	1.10%
		Most Selective	2.75 - 3.00	299	46.65%	0.31%
			3.00 - 3.25	383	33.19%	0.40%
			3.25 - 3.50	334	21.48%	0.35%
Grand Total				14,810	46.36%	**15.52%**

Complete the program (From P1 to P6)

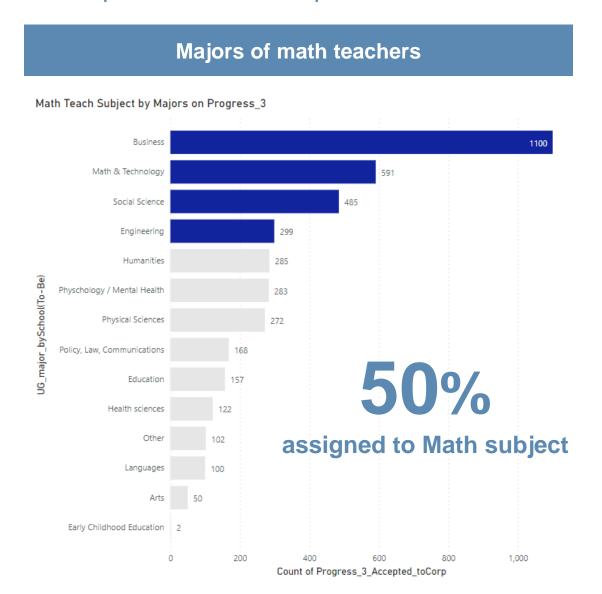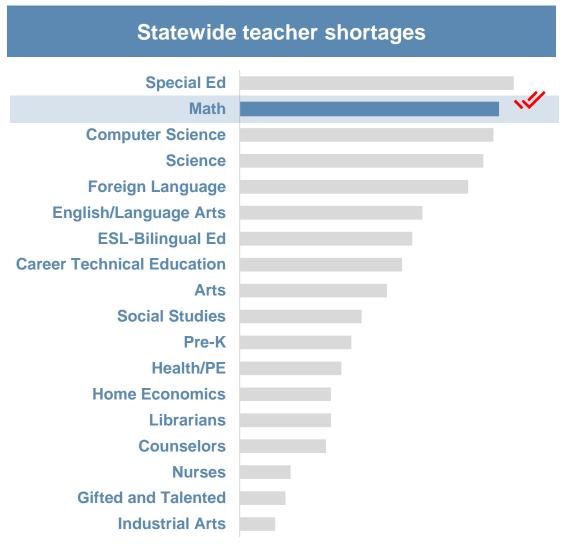|	2.50 - 2.75	2.75 – 3.00	3.00 – 3.25	3.25 – 3.50	3.50 – 3.75	3.75 – 3.90	3.90 – 4.00
Least Selective	6.71%	11.76%	8.23%	8.28%	7.52%	6.61%	7.87%
Less Selective	11.20%	12.59%	12.52%	11.44%	11.85%	12.91%	11.46%
Selective	11.28%	13.78%	14.49%	15.36%	13.58%	13.57%	16.44%
More Selective	14.15%	16.82%	17.05%	18.79%	18.35%	18.22%	19.90%
Most Selective	16.16%	18.36%	20.12%	22.54%	20.55%	21.16%	19.73%

Suggestion 2 – Math Subject

Three majors (Business, Engineering, and Math & Technology) were assigned to Math subject which was reported as second place of statewide teacher shortage.
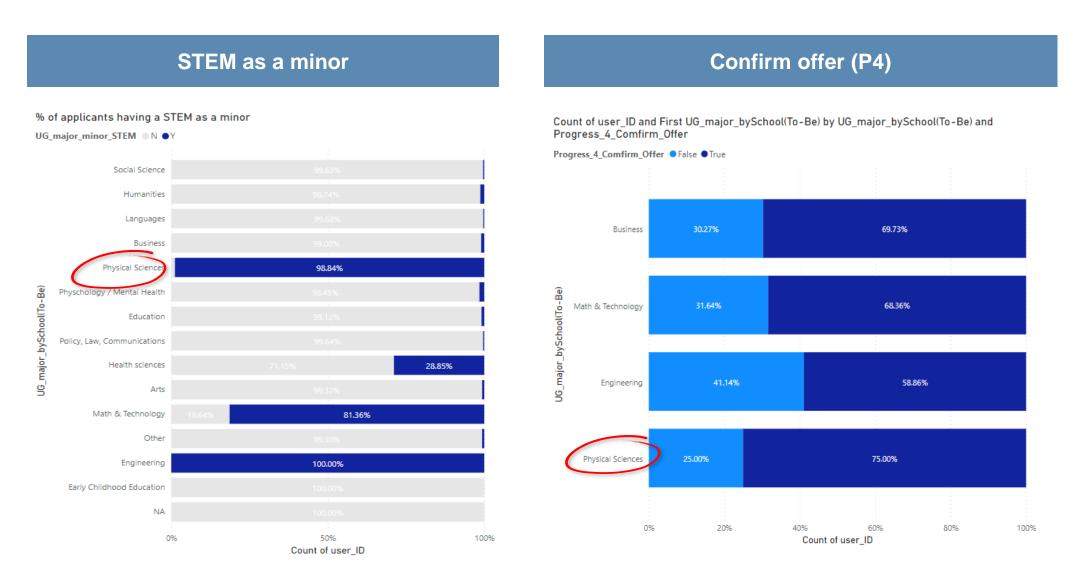
Majors of math teachers

Math Teach Subject by Majors on Progress_3

Major	Count
Business	1100
Math & Technology	591
Social Science	485
Engineering	299
Humanities	285
Physcology / Mental Health	283
Physical Sciences	272
Policy, Law, Communications	168
Education	157
Health sciences	122
Other	102
Languages	100
Arts	50
Early Childhood Education	2

UG_major_bySchool(To-Be)

Count of Progress_3_Accepted_toCorp

50%
assigned to Math subject

Statewide teacher shortages

- Special Ed
- **Math**
- Computer Science
- Science
- Foreign Language
- English/Language Arts
- ESL-Bilingual Ed
- Career Technical Education
- Arts
- Social Studies
- Pre-K
- Health/PE
- Home Economics
- Librarians
- Counselors
- Nurses
- Gifted and Talented
- Industrial Arts

Source : U.S Department of Education Office of Postsecondary Education '16 - '18
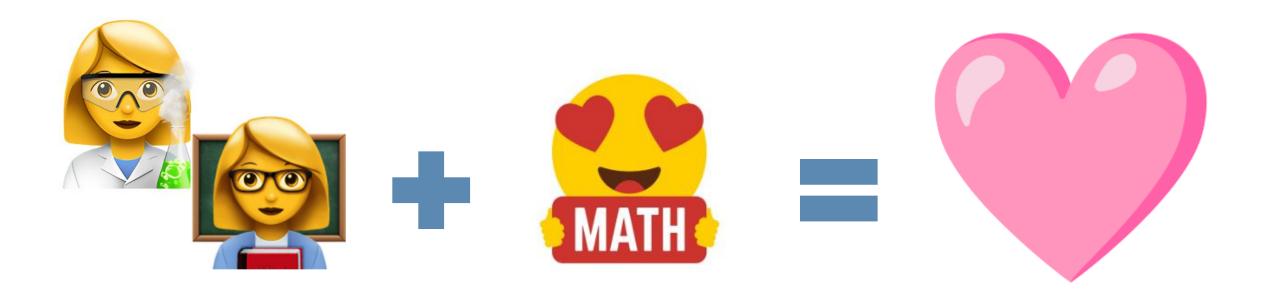
Suggestion 2 – Hiring more Physical Sciences Major as a Math Teacher
99% of PS applicants had STEM as minor. Corps who taught math and had PS major were more likely to complete the program compared to corps with Biz, Math&Tech, and Engineering majors.

Suggestion 3 – New Recruitment Process for Teacher Shortage Regions
Possible to recruit teachers in advance in areas where there is a shortage of teachers

| Application(1) | Application(2) | Invite interview | Interview |

TEACHFORAMERICA   How To Join   Life in the Corps   Life as an Alum

Application

APPLICATION
- Personal Information
- Academic History
- Leadership Experience
- You and TFA

Some of your work could not be saved, please check the field for more information.

General

Special
(Teacher Shortage Regions)

Region Preference

First Region
Region

Second Region
Region

Third Region
Region

Follow internal policy

Special

Benefits : Build a **Partnership** with Federal or Universities in Teacher Shortage Regions

1. Be assigned near home or school
   - **Certification cost support**

2. Relocate the place to teach
   - **Relocation cost support**

Potential Risks that TFA need to consider

```
                    ┌─────────────────────────┐
                    │     Potential Risks     │
                    └─────────────────────────┘
```

1 Process limit

- No data about regions and subjects preferences before the interview.

2 Diversity

- Balance between diversity and very selecting qualified people.

3 Job Market (Salary)

- Salary gap with other jobs

- Lose candidates after the interview because of unmatched preferences.

- Corps' acquired diversity could not be related to students in some regions.

- Less applicants
- Quality of applicants
- Increase tenure

ANY QUESTIONS?

APPENDIX

Appendix 1

Interviews will still occur Mar 6-10

SUBMIT YOUR APPLICATION BY	SEPT. 2 2022	OCT. 21 2022	FEB. 10 2023	APR. 19 2023 EARLY ADMISSION
Learn if you're invited to an interview	Sept. 12	Oct. 31	Feb. 21	Apr. 28
Interview sign up and pre-interview activities due	Sept. 19	Nov. 7	Feb. 27	May 3

Application Round 01	Jun 01 - Sep 02
Application Round 02	Sep 03 - Oct 21
Application Round 03	Oct 22 - Feb 10
Application Round 04 (Early Admission)	Feb 11 - May 30 (There is no application in may)

https://www.teachforamerica.org/applying-to-tfa/application-process

Excluded all Preference, region, subject, and Dimension variables

Variable	Category	Being Used	Type	Feature Engineering	Note
user_ID	App process	No			
App_year	App process	No			
App_start_date	App process	No			
App_submit_date	App process	No			
ComfirmOffer_date	App process	No			
career_level	Candidate	Yes	categorical	Target & One-hot Encoding	
UG_school_name	Candidate	No	string		
UG_school_selectivity	Candidate	Yes	ordinal	One-hot Encoding	with a boolean for missing value
UG_major_byGroup	Candidate	No			
UG_major_bySchool	Candidate	Yes	categorical	Target & One-hot Encoding	
UG_major_minor_STEM	Candidate	Yes	bool	-	
UG_GPA	Candidate	Yes	float	-	with a boolean for missing value
UG_sports	Candidate	Yes	bool	-	with a boolean for missing value
UG_PellGrant	Candidate	Yes	categorical	One-hot Encoding	
LIC_served_self_report	Candidate	Yes	bool	-	with a boolean for missing value
LIC_served_rating	Candidate	Yes	ordinal	One-hot Encoding	with a boolean for missing value
Leadership_role	Candidate	Yes	bool	-	with a boolean for missing value
family_responsibility	Candidate	Yes	bool	-	with a boolean for missing value
COVID19_online_period	Added	Yes	bool	-	[App_year] >= 2021
Days_before_submit	Added	Yes	int	-	[App_submit_date] - [App_start_date]
App_start_round	Added	Yes	ordinal	One-hot Encoding	based on application process
App_submit_round	Added	Yes	ordinal	One-hot Encoding	based on application process
App_same_round_done	Added	Yes	bool	-	[App_start_round] == [App_submit_round]

```
career_level
Co-terming Senior      0.300000
Grad Student           0.423450
Junior                 0.442159
Professional           0.496983
Undergrad              0.517677
Name: Progress_6_Complete_2yrs_modified, dtype: float64
```
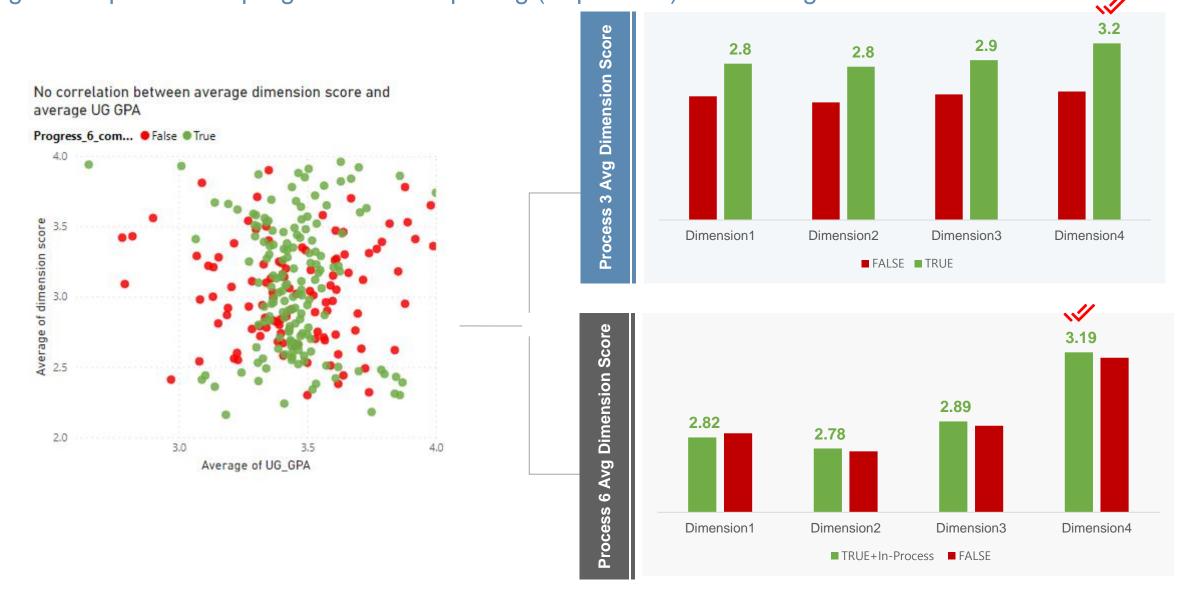
```
UG_major_bySchool
Engineering                    0.383562
Math & Technology              0.409168
Business                       0.444896
Arts                           0.451768
Religion                       0.463636
Policy, Law, Communications    0.485459
Other                          0.492188
Education                      0.492296
Physical Sciences              0.492769
Languages                      0.499127
Health sciences                0.500000
Humanities                     0.505711
Social Science                 0.510076
Physchology / Mental Health    0.541476
NA                             0.582222
Name: Progress_6_Complete_2yrs_modified, dtype: float64
```

Top Three Major

Others

There is no correlation between avg of dimension 1~4 score and avg of GPA score but Corps who got accepted to the program and completing (In-process) had the higher score on dimension4.

No correlation between average dimension score and average UG GPA

Progress_6_com... ● False ● True

Scatter plot: Average of dimension score (y-axis, 2.0–4.0) vs Average of UG_GPA (x-axis, 3.0–4.0)

Process 3 Avg Dimension Score

	Dimension1	Dimension2	Dimension3	Dimension4
TRUE	2.8	2.8	2.9	3.2

■ FALSE ■ TRUE

Process 6 Avg Dimension Score

	Dimension1	Dimension2	Dimension3	Dimension4
TRUE+In-Process	2.82	2.78	2.89	3.19

■ TRUE+In-Process ■ FALSE

Appendix 5 - KS score for variables (Top 20)
Dataset: Progress_3_Accepted_toCorp == True (Only someone who got accepted)
Dependent Variable: Progress_6_Complete_2yrs_modified (Test for outcome at Year 2)

Variable	KS score	p-value
Days before submit	0.095905	0.000000
UG_GPA	0.064152	0.000000
App_start_round	0.053364	0.000000
App_start_round_4.0	0.053364	0.000000
career_level	0.049640	0.000000
career_level_Undergrad	0.047502	0.000000
App_submit_round	0.046961	0.000000
App_submit_round_4.0	0.046961	0.000000
UG_major_bySchool	0.045217	0.000000
App_same_round_done	0.044115	0.000000
UG_school_selectivity_rank	0.037014	0.000001
UG_school_selectivity_rank_5.0	0.037014	0.000001
career_level_Junior	0.033943	0.000007
App_start_round_1.0	0.032526	0.000019
UG_school_selectivity_rank_4.0	0.023352	0.005172
LIC_served_self_report_missing	0.022524	0.007829
App_submit_round_2.0	0.020518	0.020083
UG_major_bySchool_Physchology / Mental Health	0.020477	0.020453
UG_PellGrant_NO	0.019968	0.025611
App_submit_round_3.0	0.019261	0.034658
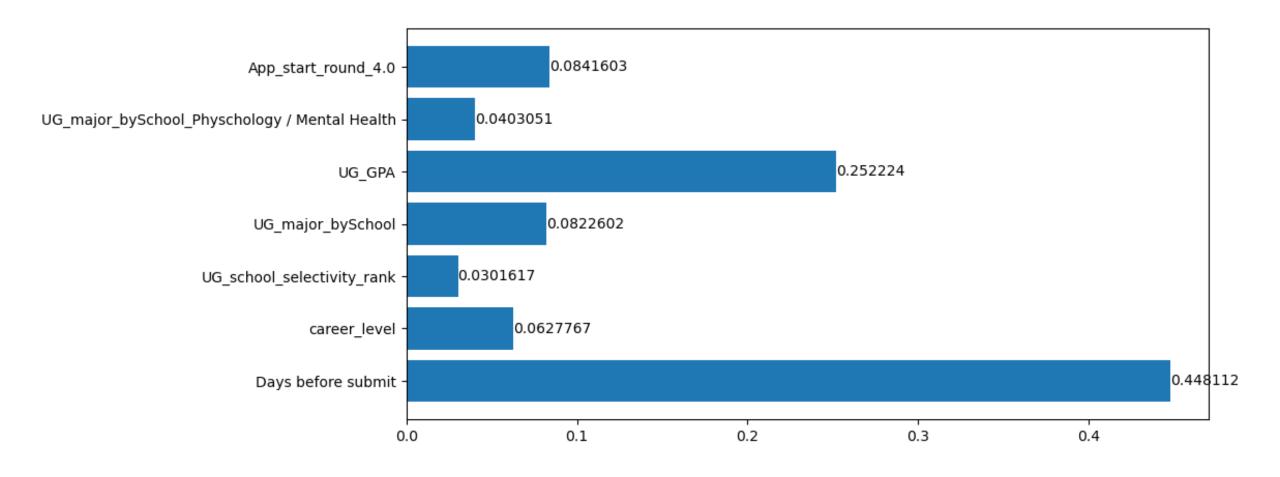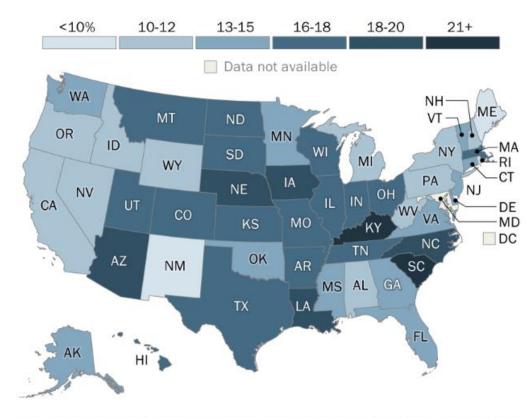
South Carolina, Kentucky have the largest shares of teachers younger than 30

% of public school teachers in each state who are under 30 years old, 2017-18 school year

Legend: <10% | 10-12 | 13-15 | 16-18 | 18-20 | 21+ | Data not available
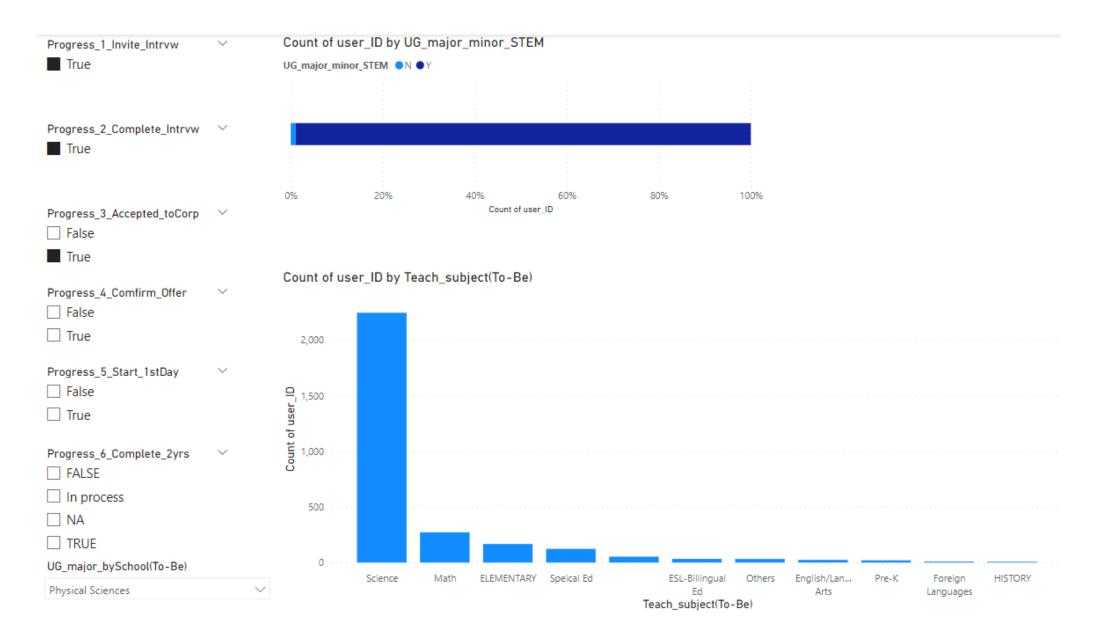
Note: Teachers include both full-time and part-time teachers. Data unavailable for Maryland and the District of Columbia due to low response rates or unmet data collection standards.
Source: U.S. Department of Education, National Center for Education Statistics, National Teacher and Principal Survey (NTPS), "Public School Teacher Data File," 2017-18.

PEW RESEARCH CENTER

How many people got accepted to the corp?
(TFA decison: From progress 2 to progress 3)
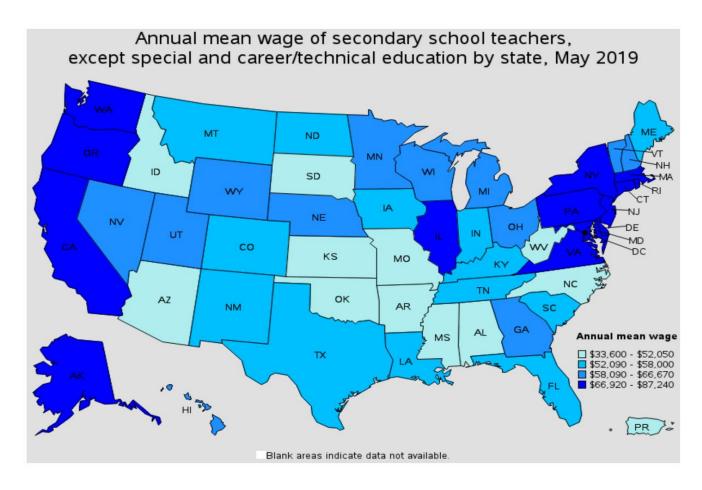
Percentage of ..

17.89%   78.54%

UG school selectivity	Ug Gpa						
	2.50 - 2.75	2.75 - 3.00	3.00 - 3.25	3.25 - 3.50	3.50 - 3.75	3.75 - 3.90	3.90 - 4.00
Least Selective	17.89%	35.29%	37.20%	43.11%	39.26%	43.17%	45.69%
Less Selective	30.22%	41.94%	44.21%	45.98%	50.06%	54.23%	57.20%
Selective	30.53%	37.30%	44.74%	48.85%	52.81%	57.66%	66.26%
More Selective	34.21%	43.15%	48.97%	54.38%	58.43%	64.18%	72.03%
Most Selective	35.91%	50.67%	54.86%	62.42%	67.54%	75.18%	78.54%

Percentage_Count broken down by Ug Gpa and Progress 3 Accepted toCorp vs. UG school selectivity. Color shows Percentage_Count. The marks are labeled by Percentage_Count. The data is filtered on Progress 2 Complete Intrvw, which keeps True.

Appendix 11

Annual mean wage of secondary school teachers, except special and career/technical education by state, May 2019

Annual mean wage
- $33,600 - $52,050
- $52,090 - $58,000
- $58,090 - $66,670
- $66,920 - $87,240

Blank areas indicate data not available.

https://www.bls.gov/oes/current/oes251081.htm#(1)

Top Paying Professions	Average Starting Salary with a Bachelor's Degree
Engineering	$69,188
Computer Science	$67,539
Math and Sciences	$62,177
Business	$57,657
Social Sciences	$57,310
Humanities	$56,651
Agriculture	$55,750
Communications	$52,056

Data source of average starting salary : *The above figures are according to a study done by NACE (National Association of Colleges and Employers)*

Logistic Regression Results for checking Dimensions impact in Progress-6 variable
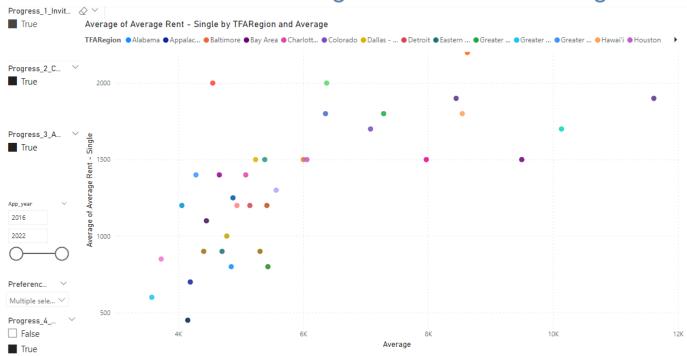
Logit Regression Results

Dep. Variable:	Progress_6_Complete_2yrs	**No. Observations:**	5360
Model:	Logit	**Df Residuals:**	5355
Method:	MLE	**Df Model:**	4
Date:	Sat, 18 Feb 2023	**Pseudo R-squ.:**	0.1532
Time:	18:47:42	**Log-Likelihood:**	-3138.0
converged:	True	**LL-Null:**	-3705.5
Covariance Type:	nonrobust	**LLR p-value:**	1.964e-244

	coef	std err	z	P>|z|	[0.025	0.975]
const	-7.3398	0.267	-27.481	0.000	-7.863	-6.816
SelectionDimension_1	0.4424	0.089	4.966	0.000	0.268	0.617
SelectionDimension_2	0.6935	0.084	8.232	0.000	0.528	0.859
SelectionDimension_3	0.6192	0.093	6.652	0.000	0.437	0.802
SelectionDimension_4	0.8488	0.062	13.744	0.000	0.728	0.970

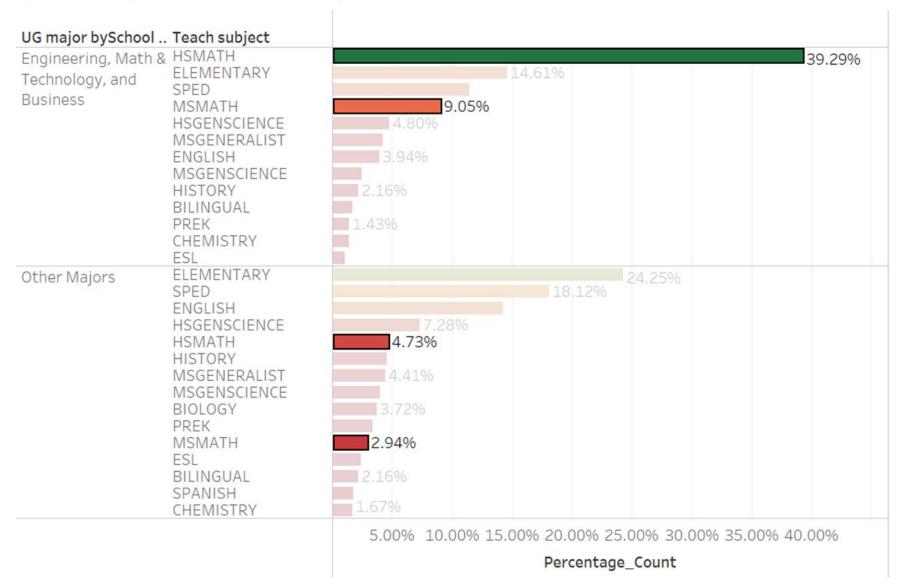# Correlation between housing cost and cost of living

a sharp change when the house price reaches $ 1,500

Three major are math heavy

Applicants from math-related degree are also less likely to complete the interview