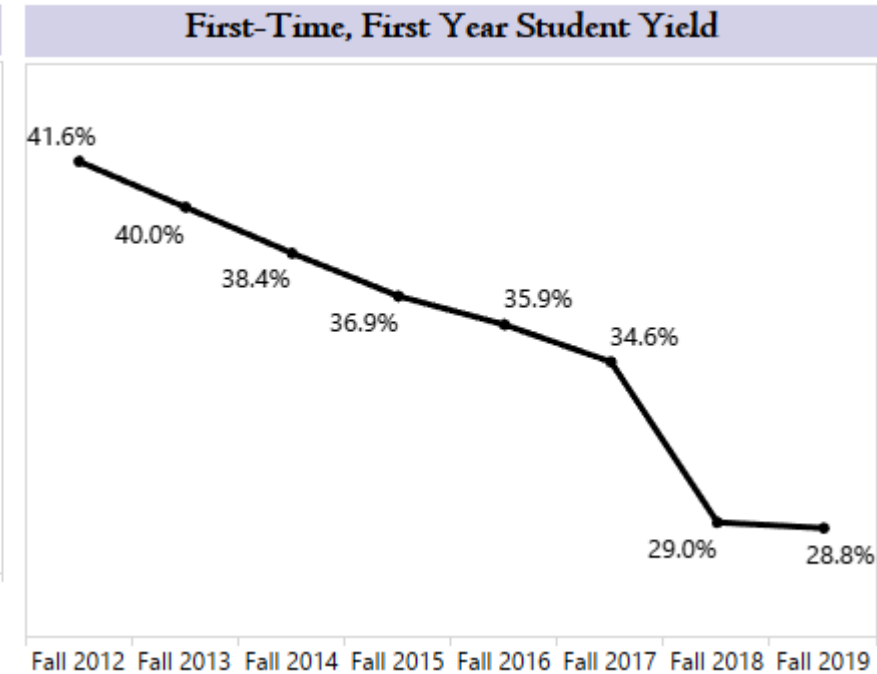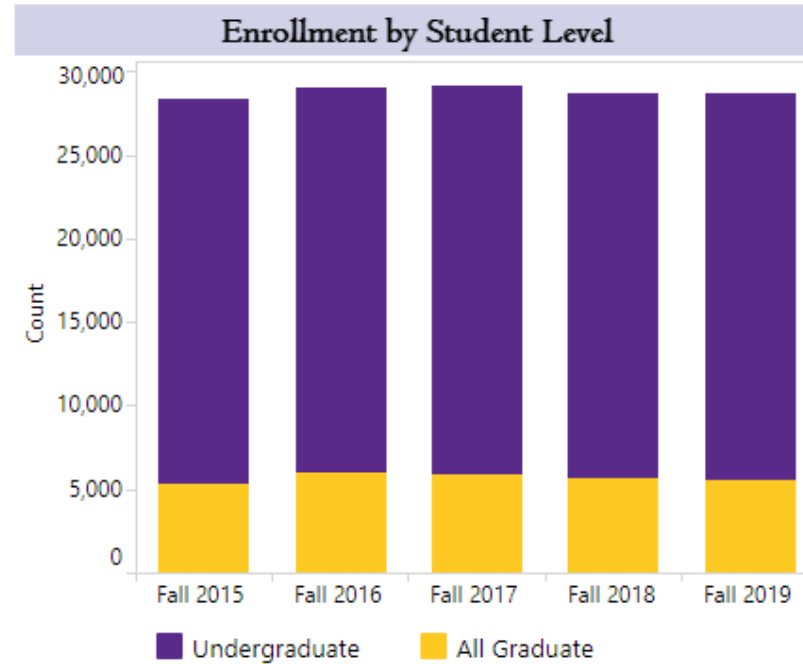# What's your Mosaic? Household-based Consumer Lifestyle and Freshman Yield

By **Hanyan Wang and Ying Zhou**

East Carolina University

AIR FORUM *virtual*

About the Pirate Nation

Research Interest

Goal: to improve yield rate, employ customized marketing strategies, and communicate to perspective students effectively

Inquiry:

- Are geographic variables significant predictors of matriculation?
- To what extent does proximity to a competitor school impact matriculation to ECU?
- Are there any patterns of matriculation based on household characteristics?
- What are the preferred channel of communication with students from different geographic regions or with different household characteristics?

Experian's Mosaic® USA

"A household-based consumer lifestyle segmentation system that classifies all U.S. households and neighborhoods into **71 (01 to 71)** unique types and **19 (A to S)** overarching groups, providing a 360-degree view of consumers' choices, preferences and habits."
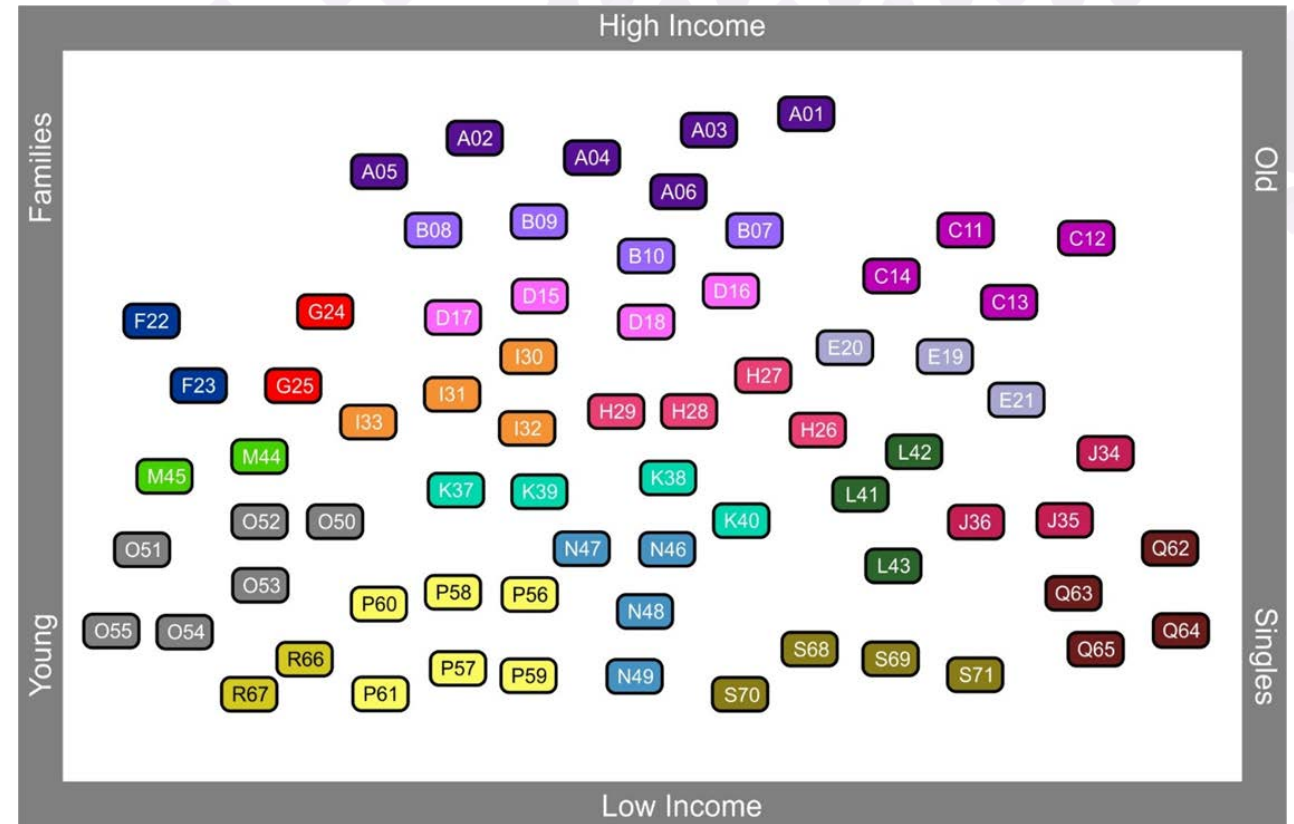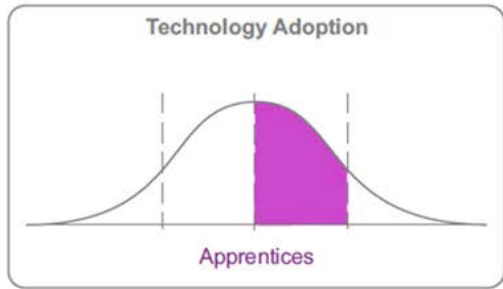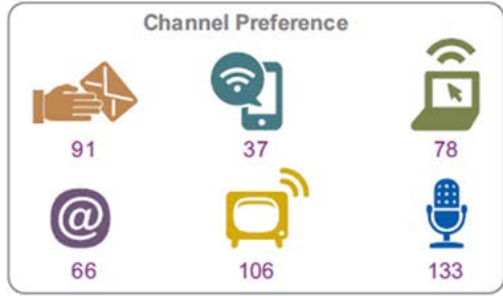

Mosaic USA family tree

The short descriptions of all mosaic segments are attached in the appendix.

Top Mosaic Types of ECU Freshman Admits

D15 Sports Utility Families
Upscale, multi-generational households of middle-aged couples with school-aged children living active family lifestyles in outlying suburbs
Kevin & Wendy
1.59% | 2.60%

Who We Are

Age: 36-45 — 55.7% | 306
Property type: Single family — 96.6% | 130
Household income: $75,000-$99,999 — 38.2% | 287
Household size: 5+ persons — 40.9% | 340
Home ownership: Homeowner — 92.9% | 143
Age of children: 13-18 — 48.7% | 370

Channel Preference: 91, 37, 78, 66, 106, 133
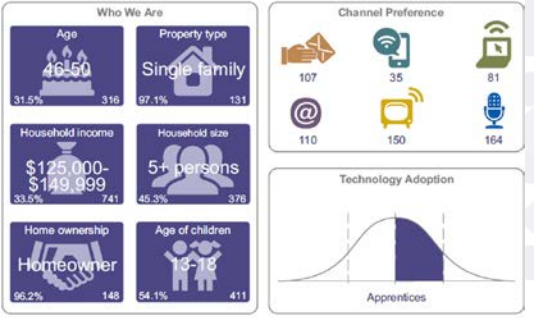
Technology Adoption: Apprentices

Key Features
- Suburb living
- Comfortable spending
- Athletic activities
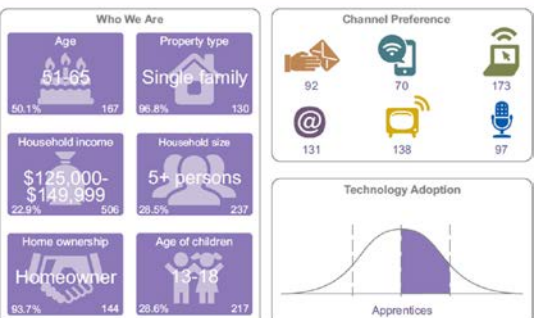- Outdoor leisure
- Saving for college
- Soccer moms and dads

A04 Picture Perfect Families
Established families of child-rearing households living in wealthy suburbs
Thomas & Linda
0.79% | 1.46%

Who We Are
Age: 46-50 — 31.5% | 316
Property type: Single family — 97.1% | 131
Household income: $125,000-$149,999 — 33.5% | 741
Household size: 5+ persons — 45.3% | 376
Home ownership: Homeowner — 96.2% | 148
Age of children: 13-18 — 54.1% | 411

Channel Preference: 107, 35, 81, 110, 150, 164

Technology Adoption: Apprentices

Key Features
- Wealthy households
- Educated
- Digitally plugged-in
- PTA members
- Practical priorities
- Travel enthusiasts

B07 Generational Soup
Affluent couples and multi-generational families living a wide range of lifestyles in suburbia
Paul & Deborah
1.09% | 1.67%

Who We Are
Age: 51-65 — 50.1% | 167
Property type: Single family — 96.8% | 130
Household income: $125,000-$149,999 — 22.9% | 506
Household size: 5+ persons — 28.5% | 237
Home ownership: Homeowner — 93.7% | 144
Age of children: 13-18 — 28.6% | 217

Channel Preference: 92, 70, 173, 131, 138, 97

Technology Adoption: Apprentices

Key Features
- Affluent
- Rooted in the suburbs
- Multi-generational households
- Fitness club members
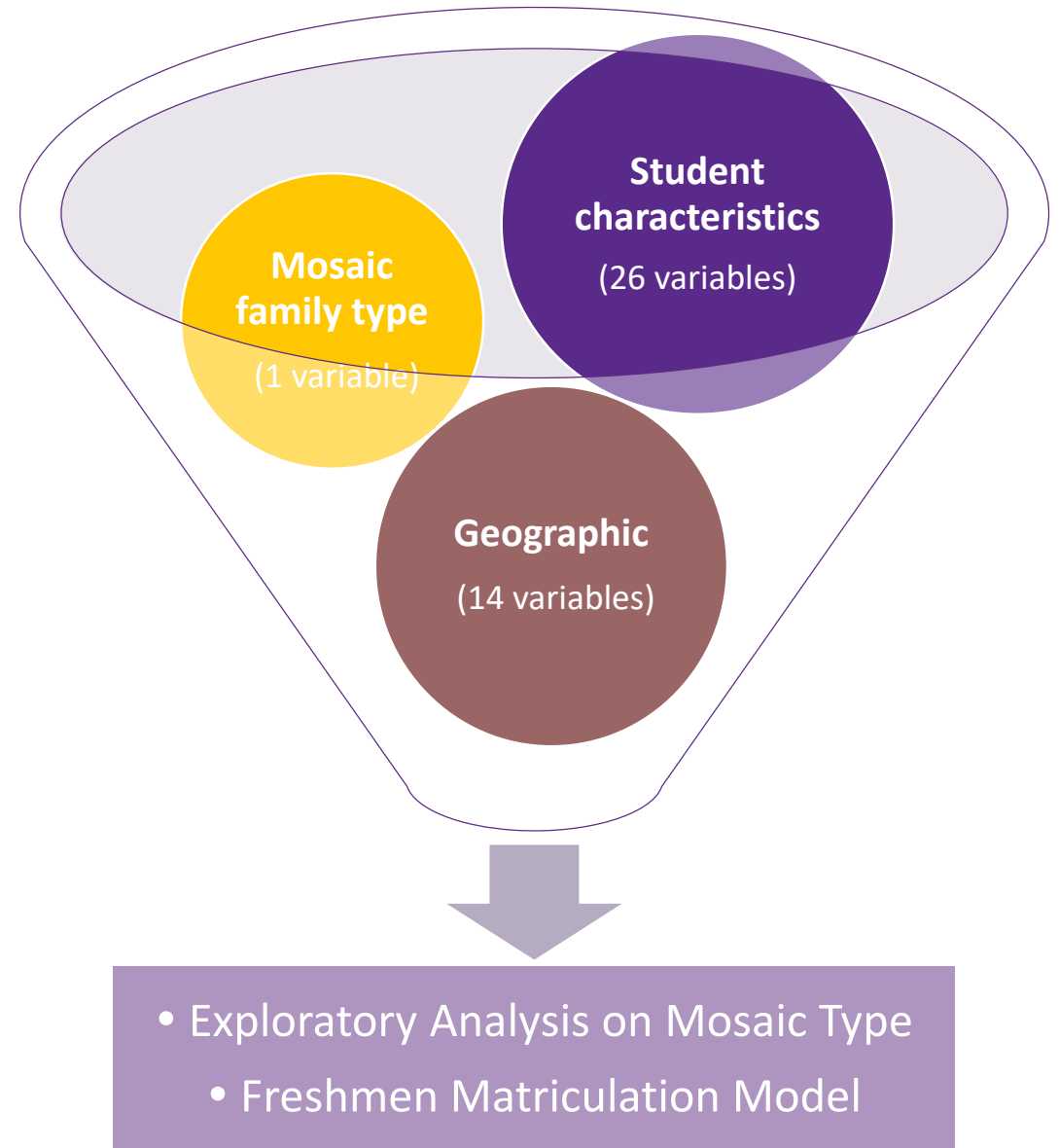- Outdoor hobbies
- Environmental donor

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Covering **Fall 2016** and **2017 in-state First-time, First-year (FTFY) admitted students**, the study analyzed 41 variables in 3 categories:

Student characteristics (26 variables)

Mosaic type (1 variable)

Geographic (14 variables)

Mosaic family type (1 variable)

Student characteristics (26 variables)

Geographic (14 variables)

- Exploratory Analysis on Mosaic Type
- Freshmen Matriculation Model

ECU First-time Freshman*: Top Six Mosaic Types

Mosaic	# of enrollees	Yield	Short Description
D15	563	43%	**Upscale**, multi-generational households of middle-aged couples with school-aged children living active family lifestyles in outlying suburbs
A04	393	36%	Established families of child-rearing households living in **wealthy** suburbs
B07	361	35%	**Affluent** couples and multi-generational families living a wide range of lifestyles in suburbia
B08	357	38%	Middle-aged couples with large families and active lives in **affluent** suburbia
C14	350	41%	Baby boomer adults and their teenage/young adult children sharing suburban homes
N48	340	42%	**Lower middle-income** multi-generational families living in small towns

*Includes first-time freshmen who enrolled at ECU in Fall 2016 and Fall 2017.

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Mosaic Types with Highest Yield Rates

Mosaic	# of enrollees	Yield	Short Description
O52	110	44%	Mainly **Generation Y** singles and single families established in mid-market cities
D15	563	43%	Upscale, **multi-generational** households of middle-aged couples with school-aged children living active family lifestyles in outlying suburbs
O51	222	43%	Mix of **Generation Y and X** singles who live digital-driven, urban lifestyles
E20	181	42%	Upper middle-class **multi-generational** households in exurban areas
F23	103	42%	**Young**, middle-class families in scenic suburbs leading active, family-focused lives

*Includes first-time freshmen who enrolled at ECU in Fall 2016 and Fall 2017.

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Mosaic Group, Student Characteristics and Yield

Overarching Group	No. of Admitted students	Yield Rate	Weighted High School GPA	Concorded SAT	Applied for financial aids	Pell	In rural county of NC	Application day
A (A01 to A06)	3611	33%	3.96	1194	57%	8%	19%	81
B (B07 to B10)	2506	36%	3.99	1179	73%	16%	21%	83
C (C11 to C14)	1769	40%	4.00	1170	67%	16%	33%	85
D (D15 to D18)	2342	42%	4.02	1143	83%	29%	49%	89
E (E19 to E21)	931	40%	4.04	1155	74%	30%	61%	91
F (F22, F23)	834	40%	3.90	1146	77%	37%	36%	91
G (G24, G25)	176	48%	3.82	1147	83%	51%	15%	93
H (H26 to H29)	418	40%	3.95	1143	80%	37%	41%	94
I (I30 to I33)	929	40%	4.07	1146	81%	36%	68%	89
J (J34 to J36)	369	42%	4.02	1140	78%	42%	71%	89
K (K37 to K40)	169	44%	3.78	1128	88%	60%	33%	96
L (L41 to L43)	471	37%	4.02	1141	83%	52%	72%	93
M (M44, M45)	640	37%	4.03	1121	84%	51%	83%	92
N (N46 to N49)	1185	42%	3.95	1104	87%	60%	84%	95
O (O50 to O55)	1149	45%	3.90	1118	86%	62%	52%	99
P (P56 to P61)	175	35%	3.93	1106	87%	75%	60%	103
Q (Q62 to Q65)	231	43%	3.97	1134	85%	48%	66%	89
R (R66, R67)	152	42%	3.89	1092	95%	86%	59%	104
S (S68 to S71)	265	39%	3.96	1103	88%	77%	74%	96

Enrollment Likelihood Model

Mosaics or Other Predictors Not Available: 769

2016 In-state Admits: 9,154

Enrolled at ECU: 7,196

First-time First-year Admits: 19,222
Total Students in the Model: 18,453

2017 In-state Admits: 10,068
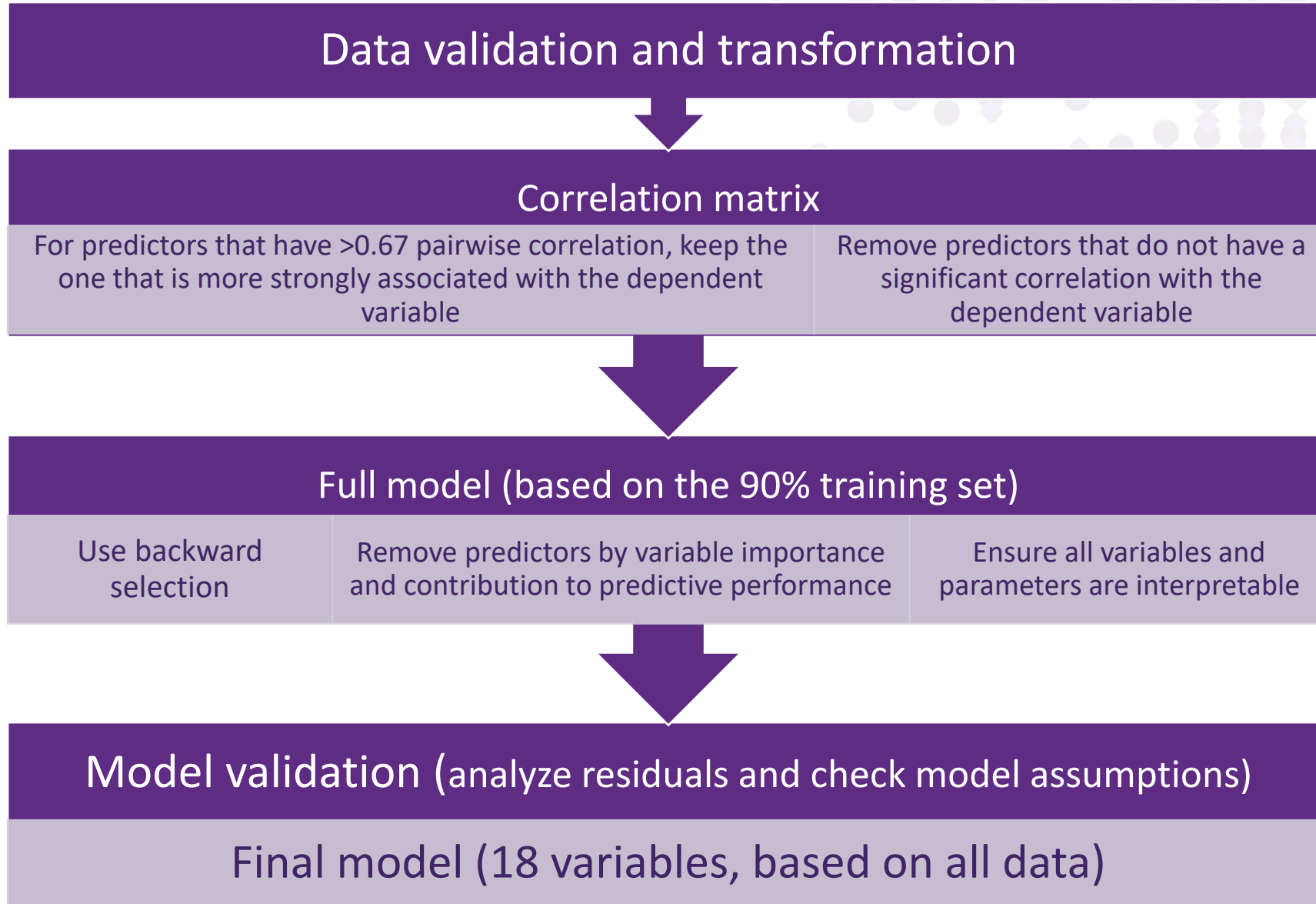
Did not enroll at ECU: 11,257
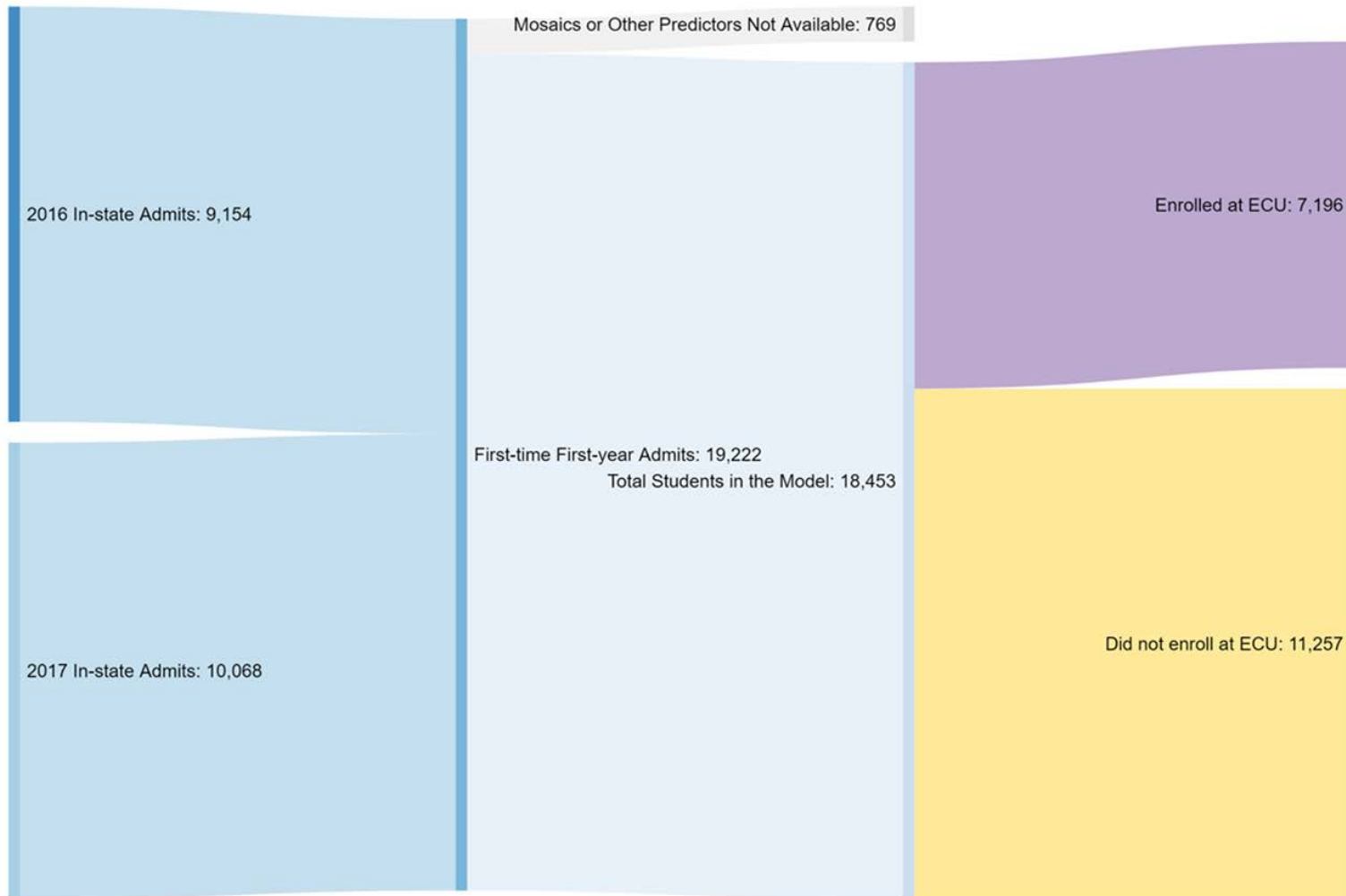
We built a logistic regression model to predict the enrollment likelihood of accepted students.

Mosaic type was identified for 96% (18,453 of 19,222) of Fall 2016 and 2017 in-state First-time, First-year (FTFY) accepted students. Of these students, 39% (7,196) enrolled at ECU.

769 students were excluded from the regression model.

Variable Selection Process

Data validation and transformation

Correlation matrix

For predictors that have >0.67 pairwise correlation, keep the one that is more strongly associated with the dependent variable	Remove predictors that do not have a significant correlation with the dependent variable

Full model (based on the 90% training set)

Use backward selection	Remove predictors by variable importance and contribution to predictive performance	Ensure all variables and parameters are interpretable

Model validation (analyze residuals and check model assumptions)

Final model (18 variables, based on all data)

Strongest Predictors by Variable Importance

Variable Importance

HS_weighted_GPA
Drive_miles_to_ECU
Drive_mins_to_nearest_universities
Concorded_SAT
Application_day_centered
Application_day_centered_squared
Financial_aid_application_indicator
Male
Pell
Research_Triangle_economic_region
Mosaic_type_D15
Honor_admit
Charlotte_economic_region
Mosaic_type_C14
Intended_program_Engineering
Mosaic_type_Bottom
Mosaic_type_N48
Mosaic_type_I30

MeanDecreaseGini

The Mean Decrease Gini, derived from the random forest, was used to illustrate the variable importance.

Weighted high school GPA, drive miles to ECU, drive minutes to nearest UNC competitor, concorded SAT, application day, and financial aid application were the most important predictors. The remaining variables were statistically significant, but their inclusion or exclusion had little impact on the model.

Distance is a key predictor of in-state freshmen enrollment

After controlling for all other variables in the model

Every additional 10 miles of driving to ECU

Every additional 10 minutes of driving to nearest UNC competitor

- 4%

+ 6%

Likely to be a Pirate

ECU is less attractive to academically high achievers

After controlling for all other variables in the model

Each additional point in weighted high school GPA	Every additional 50 points in concorded SAT scores
- 49%	**- 16%**

Likely to be a Pirate

Financial aid matters to ECU admits

After controlling for all other variables in the model, students who

Applied for financial aid

+ 218%

Received Pell

+ 14%

Likely to be a Pirate

Enrollment likelihood varies by Mosaic type

After controlling for all other variables in the model

C14, Boomers and Boomerangs
Baby boomer adults and their teenage/young adult children sharing suburban homes

+ 23%

N48, Rural Southern Bliss
Lower middle-income multi-generational families living in small towns

- 37%

D15, Sport Utility Families
Upscale, multi-generational households of middle-aged couples with school-aged children living active family lifestyles in outlying suburbs

+ 17%

Lowest Frequency Mosaic Types
The 24 Mosaic types that have fewest admitted freshmen

- 25%

I30, Stockcars and State Parks
Middle-class couples and families living in more remote rural communities

+ 19%

Likely to be a Pirate

Application day has a quadratic relationship with yield
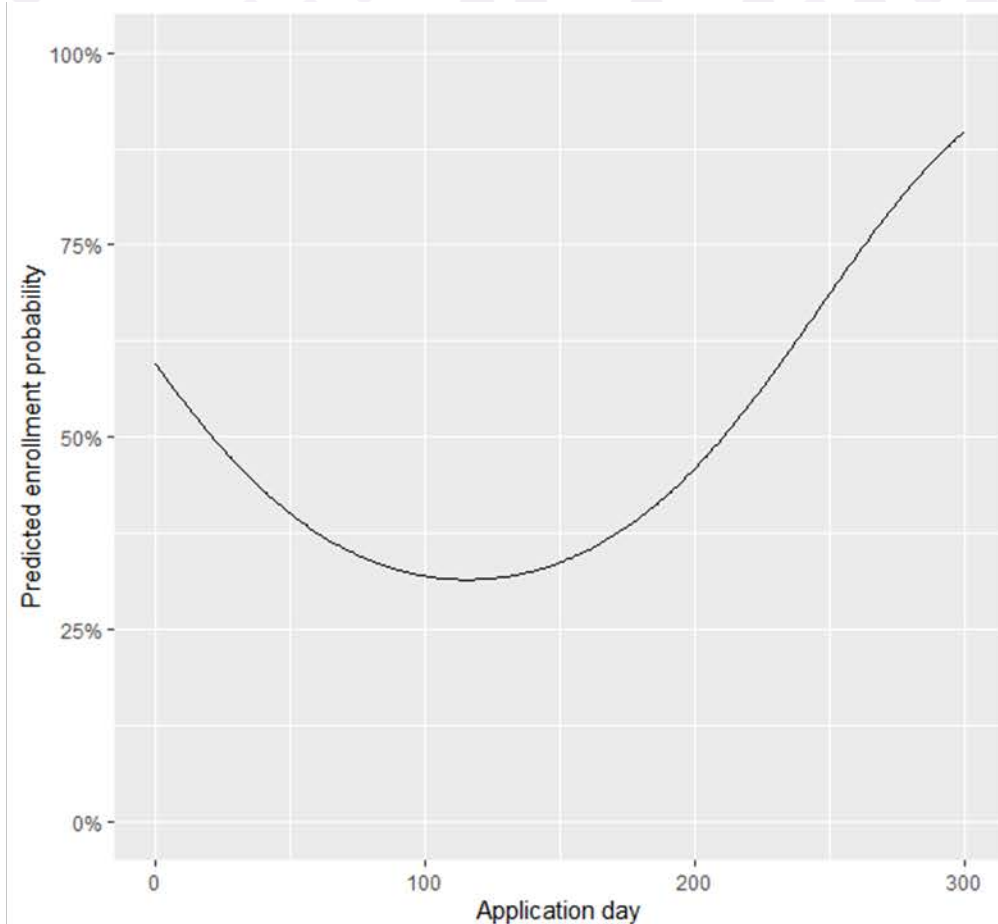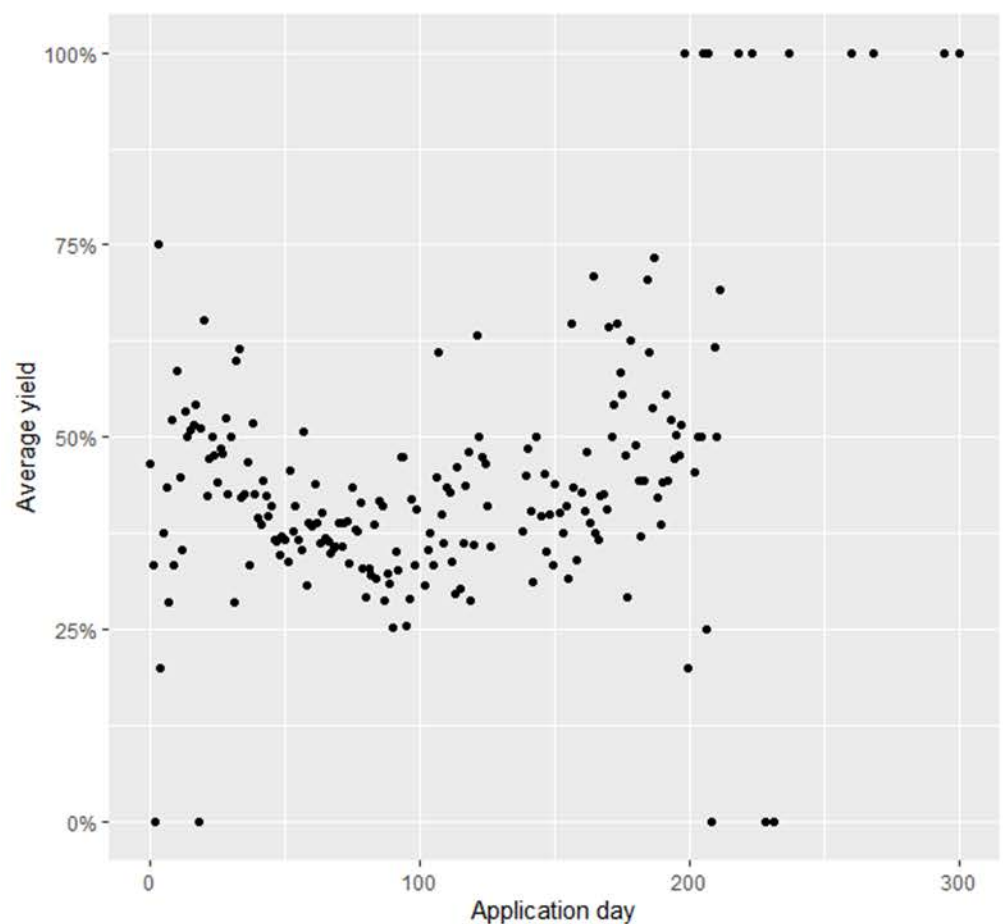
To reflect this pattern, we included two application day variables in the model. The first variable is the centered application day and the second variable is the squared term of the first variable.

Other significant factors

After controlling for all other variables in the model

Male students   **+ 17%**

Students who were admitted to the Honors college   **+ 26%**

Students who chose Engineering as their intended program   **- 30%**

Likely to be a Pirate

Model Performance

The model is good at capturing potential non-enrollees. For the bottom 5% of students with the lowest predicted enrollment scores, the actual yield was **8%**.

For the top 5% of students with the highest predicted enrollment scores, the actual yield was **72%**.

For the top 20% of students with the highest predicted enrollment scores, the actual yield was **65%**.

Actual Yield Rate by Predicted Enrollment Scores
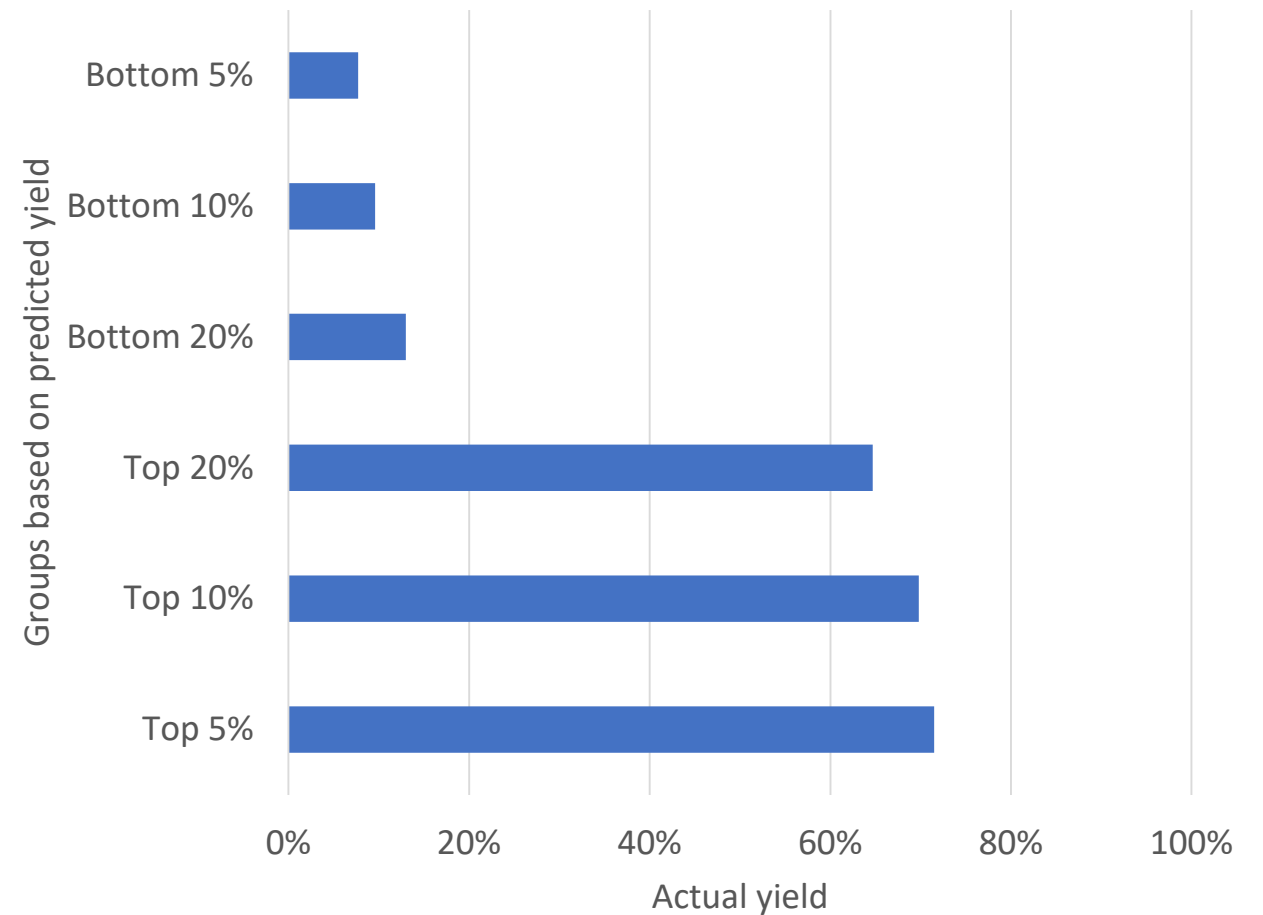
Limitation of the Study

While we endeavored to maximize the model accuracy and find more meaningful predictors, the predictive performance of the final model was not as strong as we would have liked. The model had a predictive accuracy of 68%. The array of pseudo R-squared values generated for the model ranged from 0.11 to 0.19. Given these performance measures, the model results should be interpreted with caution.

Summary of Findings

- Weighted high school GPA, drive miles to ECU, drive minutes to nearest UNC competitor, SAT/ACT score, application day, and financial aid application indicator were ranked as the strongest predictors of yield.

- As expected, **distance** is a significant factor in matriculation decisions. With all other variables controlled, students are more likely to enroll when their home is closer to ECU. A longer drive distance from a student's home to the nearest other UNC system school increases the chance that the student will enroll at ECU.

- Students with the highest high school GPAs and test scores were less likely to enroll, unless they were admitted to the Honor's College.

- Students who applied for financial aid or received Pell grants were more likely to enroll, which fits the mission of ECU (i.e., access and affordability).

Summary of Findings (Cont'd)

- Five Mosaic segments were statistically significant, but their inclusion or exclusion had minimal impact on model performance.

- Three Mosaic types had a positive influence and 2 had a negative influence on matriculation decision.

- There was a quadratic relationship between application day and yield. In other words, students who applied early or late were more likely to enroll, while "peak period" applicants were less likely to enroll.

Recommendations for Future Work

- Examine other variables that indicate student family or community patterns. Some options are: ESRI Tapestry (similar to Mosaic, but free with our ESRI license), American Community Survey data, or student high school information.

- Explore the use of Mosaic USA data to predict application likelihood of inquiries or purchased names.

- Append the National Student Clearinghouse information to the accepted but non-enrolled student dataset to examine the destination school preference of each Mosaic type.

Potential Use of Mosaic Types

- Student Recruitment and Market Segments

    - Amend Mosaic data to the profile of prospective students by using family address.

    - Help institutions identify high- and low-performing market segments.

    - Customize marketing and communication plans for students from different household characteristics.

    - Reach out to perspective students or their parents through their preferred channels of communication.

- Student Diversity

    - When use Mosaic types for recruitment, an institution should evaluate their impact on student diversity.

Presenter Contact Information
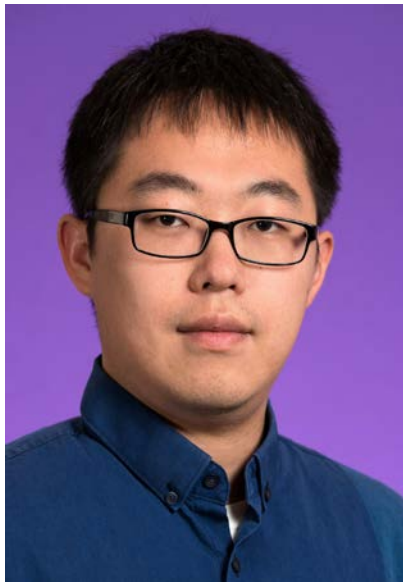
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Appendix: Variables Included in the Dataset

Student characteristics

Gender, high school original GPA, **high school weighted GPA**, ACT/SAT total and sub scores, **concorded SAT** (from ACT and old/new SAT), concorded SAT math, father highest degree, mother highest degree, **year 1 Pell status**, first generation indicator, **financial aid application indicator, application date**, decision date, application to decision days, **intended program**, **honor admit indicator**

Geographic variables

Home direction to ECU, drive minutes to ECU, **drive miles to ECU**, nearest UNC competitor, **nearest UNC competitor drive minutes**, nearest UNC competitor drive miles, travel time to nearest community college, 1976 - 1996 alumni per 1000 population (parent age alumni), 1976 - 2016 alumni per 1000 population, **NC economic region**, East/west of I-95, NC geographic region, County tier, Rural/urban category

Mosaic family type

Variables included in the final model are **bolded**.

Derived variables (e.g. squared term of application days) are not included.

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Appendix: Mosaic USA groups and types

Segment/Group	Name	Short Description
A	**Power Elite**	**The wealthiest households in the US, living in the most exclusive neighborhoods, and enjoying all that life has to offer**
A01	American Royalty	Wealthy, influential couples and families living in prestigious suburbs
A02	Platinum Prosperity	Wealthy and established empty-nesting couples residing in suburban and in-town homes
A03	Kids and Cabernet	Prosperous, middle-aged married couples with children living child-focused lives in affluent suburbs
A04	Picture Perfect Families	Established families of child-rearing households living in wealthy suburbs
A05	Couples with Clout	Middle-aged, childless couples living in affluent metro areas
A06	Jet Set Urbanites	Mix of affluent singles and couples living in urban neighborhoods
B	**Flourishing Families**	**Affluent, middle-aged families and couples earning prosperous incomes and living very comfortable, active lifestyles**
B07	Generational Soup	Affluent couples and multi-generational families living a wide range of lifestyles in suburbia
B08	Babies and Bliss	Middle-aged couples with large families and active lives in affluent suburbia
B09	Family Fun-tastic	Upscale, middle-aged families with older children pursuing busy kid-centered lives in satellite cities
B10	Cosmopolitan Achievers	Affluent middle-aged and established couples and families enjoying dynamic lifestyles in metro areas
C	**Booming with Confidence**	**Prosperous, established couples in their peak earning years living in suburban homes**
C11	Aging of Aquarius	Upscale boomer-aged couples living in city and close-in suburbs
C12	Golf Carts and Gourmets	Upscale retirees and empty-nesters in comfortable communities
C13	Silver Sophisticates	Mature, upscale couples and singles in suburban homes
C14	Boomers and Boomerangs	Baby boomer adults and their teenage/young adult children sharing suburban homes
D	**Suburban Style**	**Middle-aged, ethnically-mixed suburban families and couples earning upscale incomes**
D15	Sports Utility Families	Upscale, multi-generational households of middle-aged couples with school-aged children living active family lifestyles in outlying suburbs
D16	Settled in Suburbia	Upper middle-class diverse family units and empty nesters living in established suburbs
D17	Cul de Sac Diversity	Ethnically-diverse, middle-aged families settled in new suburban neighborhoods
D18	Suburban Attainment	Upper middle-class couples and families living mainly in the expanding suburbs
E	**Thriving Boomers**	**Upper-middle-class baby boomer-age couples living comfortable lifestyles settled in town and exurban homes**
E19	Full Pockets, Empty Nests	Empty-nesting, upper middle-class households with discretionary income living sophisticated lifestyles
E20	No Place Like Home	Upper middle-class multi-generational households in exurban areas
E21	Unspoiled Splendor	Comfortably established baby boomer couples in town and country communities

F	Promising Families	Young couples with children in starter homes living child-centered lifestyles
F22	Fast Track Couples	Active, young, upper middle-class suburban couples and families living upwardly-mobile lifestyles
F23	Families Matter Most	Young, middle-class families in scenic suburbs leading active, family-focused lives
G	**Young, City Solos**	**Younger and middle-aged singles living active and energetic lifestyles in metropolitan areas**
G24	Status Seeking Singles	Younger, upwardly-mobile singles living in mid-scale metro areas balancing work and leisure lifestyles
G25	Urban Edge	Younger, up-and-coming singles living big city lifestyles located within top CBSA markets
H	**Middle-class Melting Pot**	**Mid-scale, middle-aged and established couples living in suburban and fringe homes**
H26	Progressive Potpourri	Mature, couples with comfortable and active lives in middle-class suburbs
H27	Birkenstocks and Beemers	Upper middle-class, established couples living leisure lifestyles in small towns and cities
H28	Everyday Moderates	Mid-scale, multi-cultural couples and families living in mid-tier metro suburban settings
H29	Destination Recreation	Middle-aged, midscale couples in rural towns and fringe suburbs working to enjoy their active lifestyles
I	**Family Union**	**Mid-scale, middle-aged families living in homes supported by solid blue-collar occupations**
I30	Stockcars and State Parks	Middle-class couples and families living in more remote rural communities
I31	Blue Collar Comfort	Middle-class families in smaller cities and towns with solid blue-collar jobs
I32	Steadfast Conventionalists	Conventional Generation X families located in selected coastal city homes
I33	Balance and Harmony	Middle-class families living lively lifestyles in city-centric neighborhoods
J	**Autumn Years**	**Established and mature couples living gratified lifestyles in older homes**
J34	Aging in Place	Middle-class seniors living solid, suburban lifestyles
J35	Rural Escape	Older, middle-class couples and singles living comfortable lives in rural towns
J36	Settled and Sensible	Older, middle-class and empty-nesting couples and singles in city neighborhoods
K	**Significant Singles**	**Middle-aged singles and some couples earning mid-scale incomes supporting active city styles of living**
K37	Wired for Success	Young, mid-scale singles and couples living socially-active city lives
K38	Gotham Blend	Mix of middle-aged and middle-class singles and couples mainly living urban New York City-area lifestyles
K39	Metro Fusion	Middle-aged singles living urban active lifestyles
K40	Bohemian Groove	Older unattached individuals enjoying settled urban lives
L	**Blue Sky Boomers**	**Lower- and middle-class baby boomer-aged households living in small towns**
L41	Booming and Consuming	Older empty-nesting couples and singles enjoying relaxed lives in small towns
L42	Rooted Flower Power	Mid-scale baby boomer singles and couples rooted in established suburban communities and approaching retirement
L43	Homemade Happiness	Lower middle-class baby boomer households living in remote town and country homes
M	**Families in Motion**	**Younger, working-class families earning moderate incomes in smaller residential communities**
M44	Red, White and Bluegrass	Lower middle-income rural families with diverse adult and children household dynamics
M45	Diapers and Debit Cards	Young, working-class families and single parent households living in small established, city residences

N	Pastoral Pride	Mix of lower middle-class unattached individuals and couples who have settled in country and small town areas
N46	True Grit Americans	Older, middle-class households in town and country communities located in the nation's midsection
N47	Countrified Pragmatics	Lower middle-income couples and singles living rural, casual lives
N48	Rural Southern Bliss	Lower middle-income multi-generational families living in small towns
N49	Touch of Tradition	Working-class, middle-aged couples and singles living in rural homes
O	**Singles and Starters**	**Young singles starting out, and some starter families, in diverse urban communities**
O50	Full Steam Ahead	Younger and middle-aged singles gravitating to second-tier cities
O51	Digital Dependents	Mix of Generation Y and X singles who live digital-driven, urban lifestyles
O52	Urban Ambition	Mainly Generation Y singles and single families established in mid-market cities
O53	Colleges and Cafes	Young singles and recent college graduates living in college communities
O54	Striving Single Scene	Young, singles living in Midwest and Southern city centers
O55	Family Troopers	Families and single-parent households living near military bases
P	**Cultural Connections**	**Diverse, mid- and low-income families in urban apartments and residences**
P56	Mid-scale Medley	Middle-aged, mid-scale income singles and divorced individuals in secondary cities
P57	Modest Metro Means	Mid-scale singles established in inner-city communities
P58	Heritage Heights	Singles and families with mid and low incomes living settled lives in urban apartments
P59	Expanding Horizons	Middle-aged, mid-scale income families living mainly within US border cities
P60	Striving Forward	Mid-scale families and single parents in gateway communities
P61	Humble Beginnings	Multi-cultural singles and single-parent households with mid-scale incomes in city apartments
Q	**Golden Year Guardians**	**Retirees living in settled residences and communities**
Q62	Reaping Rewards	Relaxed, retired couples and widowed individuals in suburban homes living quiet lives
Q63	Footloose and Family Free	Elderly couples and widowed individuals living active and comfortable lifestyles
Q64	Town Elders	Stable, minimalist seniors living in older residences and leading sedentary lifestyles
Q65	Senior Discounts	Downscale, settled retirees in metro apartment communities
R	**Aspirational Fusion**	**Low-income singles and single parents living in urban locations striving to make a better life**
R66	Dare to Dream	Young singles, couples and single parents with lower incomes starting out in city apartments
R67	Hope for Tomorrow	Young, lower-income single parents in second-city apartments
S	**Economic Challenges**	**Economically challenged mix of singles, divorced and widowed individuals in smaller cities and urban areas looking to make ends meet**
S68	Small Town Shallow Pockets	Older, low income singles and empty-nesters living in modest ex-urban small towns
S69	Urban Survivors	Older, lower income singles and single parents established in modest urban neighborhoods
S70	Tight Money	Middle-aged, lower income unattached individuals in transitional small town and ex-urban apartments
S71	Tough Times	Older, lower income and ethnically-diverse singles typically concentrated in inner-city apartments