Using Classification Tree as a Data Mining Method to Determine Effect of Online Courses and Bar Success

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What we plan to do…

- Background

- Methods

- Study Results

- Implications and Discussions

IU McKinney School of Law

- Above-median sized midwestern public law school offering three degree programs
- Primary degree – Juris Doctor – prepares students for bar examination and law practice
- Top-50 nationally part-time program a large draw for IU McKinney students
- Online offerings highly attractive primarily for reasons of convenience

About the Online Program

- Law school's online program development, using best efforts to guide program development using an evidence-based approach and taking into account studies of pedagogical best practices.

- What is the impact of Online program on student success, using licensure exam as a primary outcome?

Past Studies of Online Course Outcomes

- Existing literature contains **no serious examination** of impact of online teaching on licensure exam outcomes
- Studies of online learning on success in law school develop anecdotal observations of student performance or survey evidence of student attitudes as proxies for outcome evidence
- Examples:
  - Huffman (2016): online offering increases enrollment and increases participation by diverse students
  - Dutton & Ryznar (2018, 2019): success of online offerings dependent on design and student preference
  - Swift (2018): outlining individual approach characterized as "best practices"

Past Studies of Drivers of Licensure Exam Success

Possible predictors of bar outcomes:
- Undergraduate major
- Grade in particular LS courses
- Undergraduate GPA
- 1L GPA
- Final LS GPA
- **LSAT Score**
- Post-grad./pre-exam work hours

Bar Success Study: Studying Effectiveness of Online Offerings in Bar Exam Outcomes

Image from mckinneylaw.iu.edu

Bar Success Study: Methodology

- New beginner students in the Doctor of Jurisprudence (J.D.) program from 2013-2017 (n=1,520).

- Bar examination dates from July 2017 through 2020

- Study examined first-time bar outcomes (not second- or subsequent-time takers)

- Classification Tree method was used to explore the effect of online courses and Bar success.
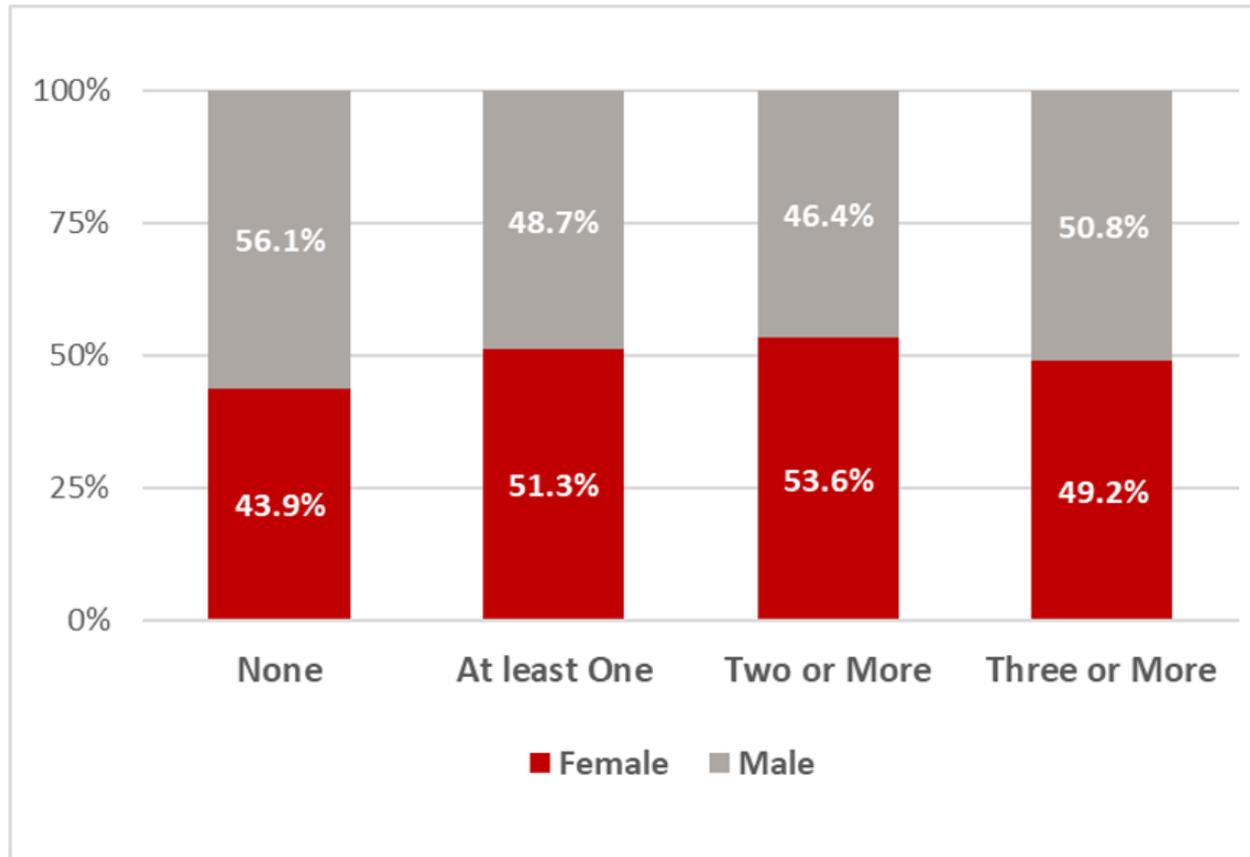
How many online courses do students take?

# Online Law Courses Taken	# Students	%
None	593	39.0%
One	389	25.6%
Two	233	15.3%
Three	141	9.3%
Four	102	6.7%
Five	43	2.8%
Six	12	0.8%
Seven	4	0.3%
Eight	3	0.2%
Grand Total	**1,520**	**100.0%**

Who are the online course takers?

Number of online Law courses attempted by gender

	None	At least One	Two or More	Three or More
Male	56.1%	48.7%	46.4%	50.8%
Female	43.9%	51.3%	53.6%	49.2%

■ Female ■ Male

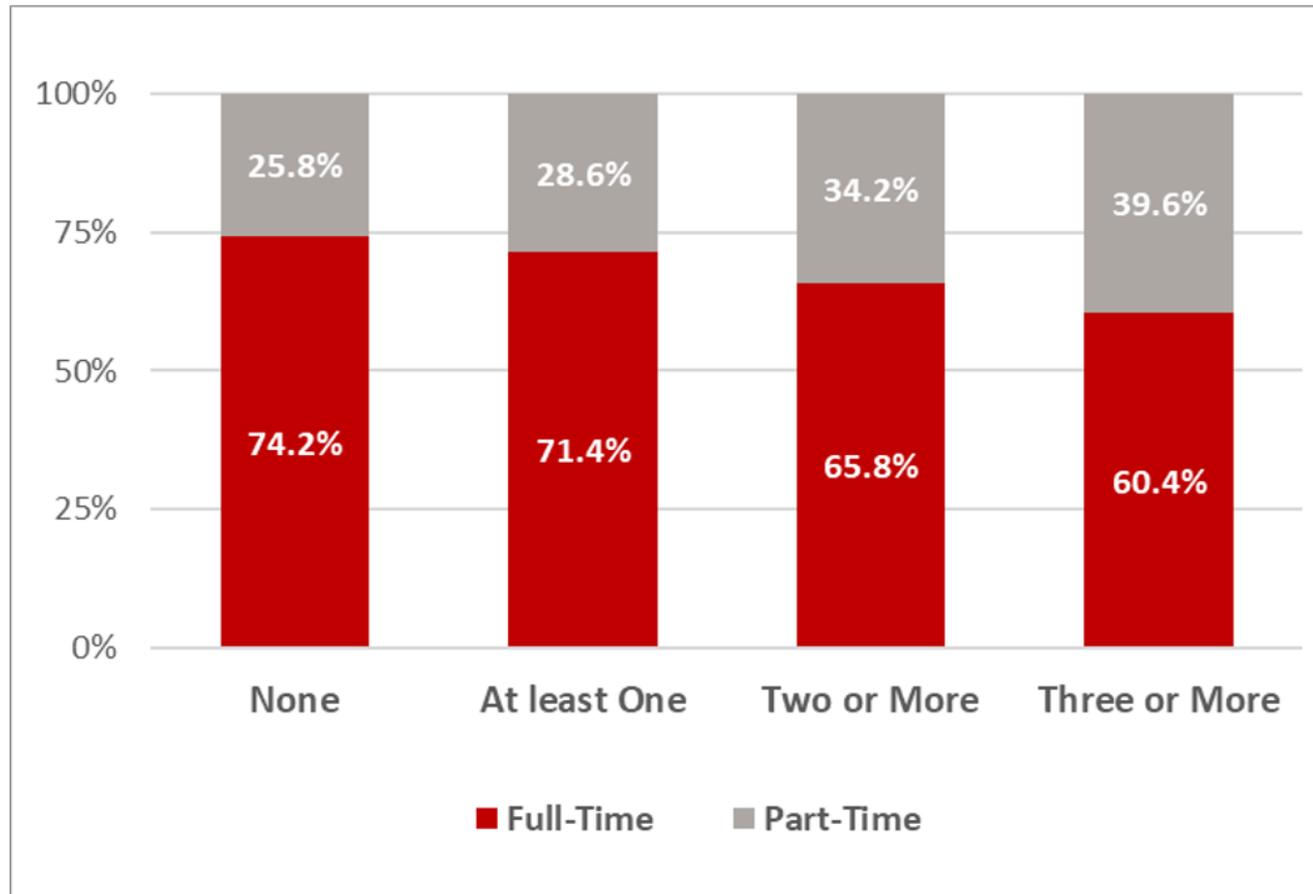Note, 47% identify as female for the IU McKinney 2018 entering class.

Number of online Law courses attempted by ethnicity
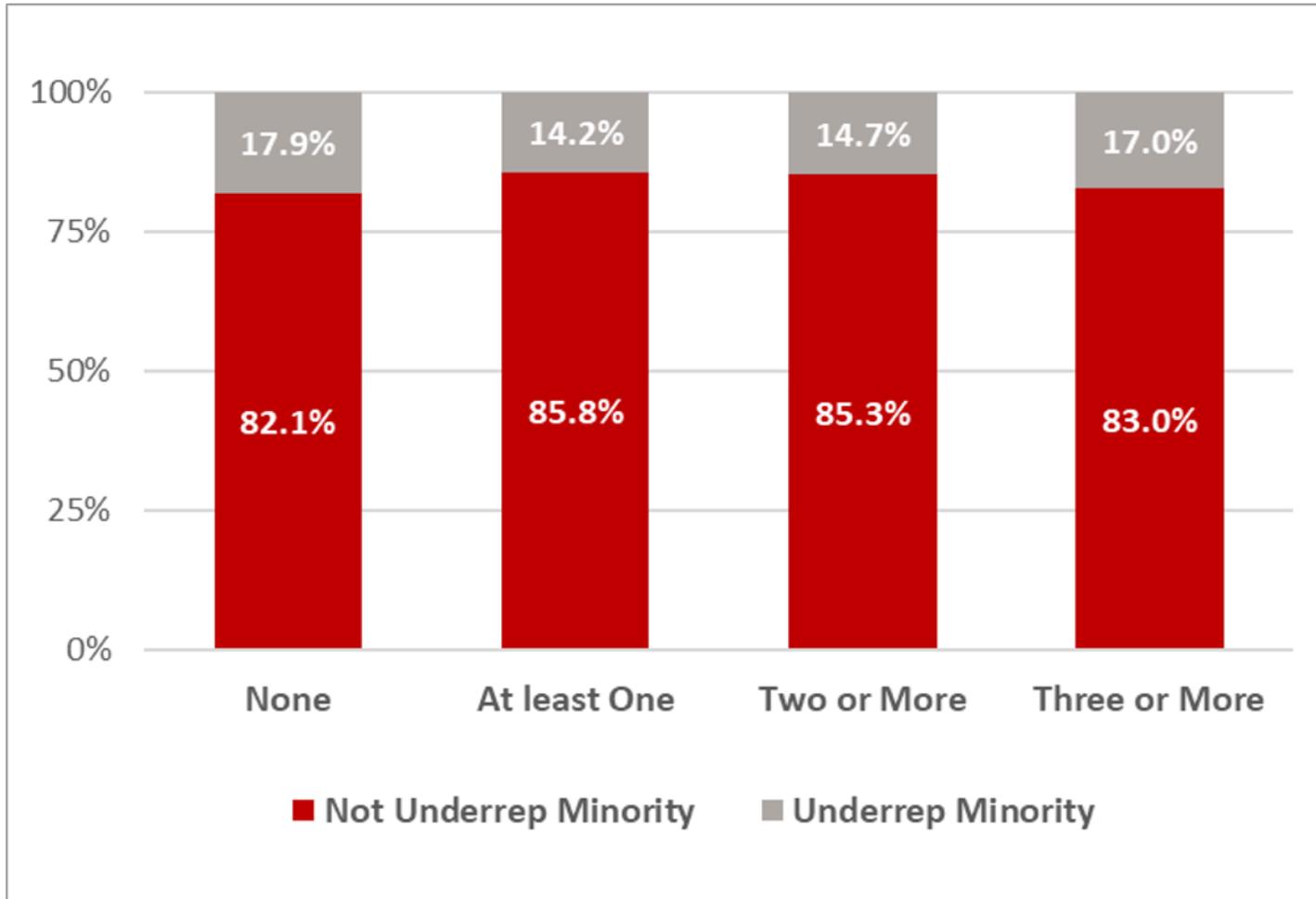
Note: 18% identify as underrepresented minority for IU McKinney 2018 entering class.

Number of online Law courses attempted by day time/night time indicator

- PT/FT designation based on cohort term

- 40% of those taking three or more online courses were part-time students.

- Note: 20% part-time for IU McKinney 2018 entering class.

Classification Tree Analysis

Advantages

- *Easy to interpret and visualize*

- *Not sensitive to outliers or missing values*

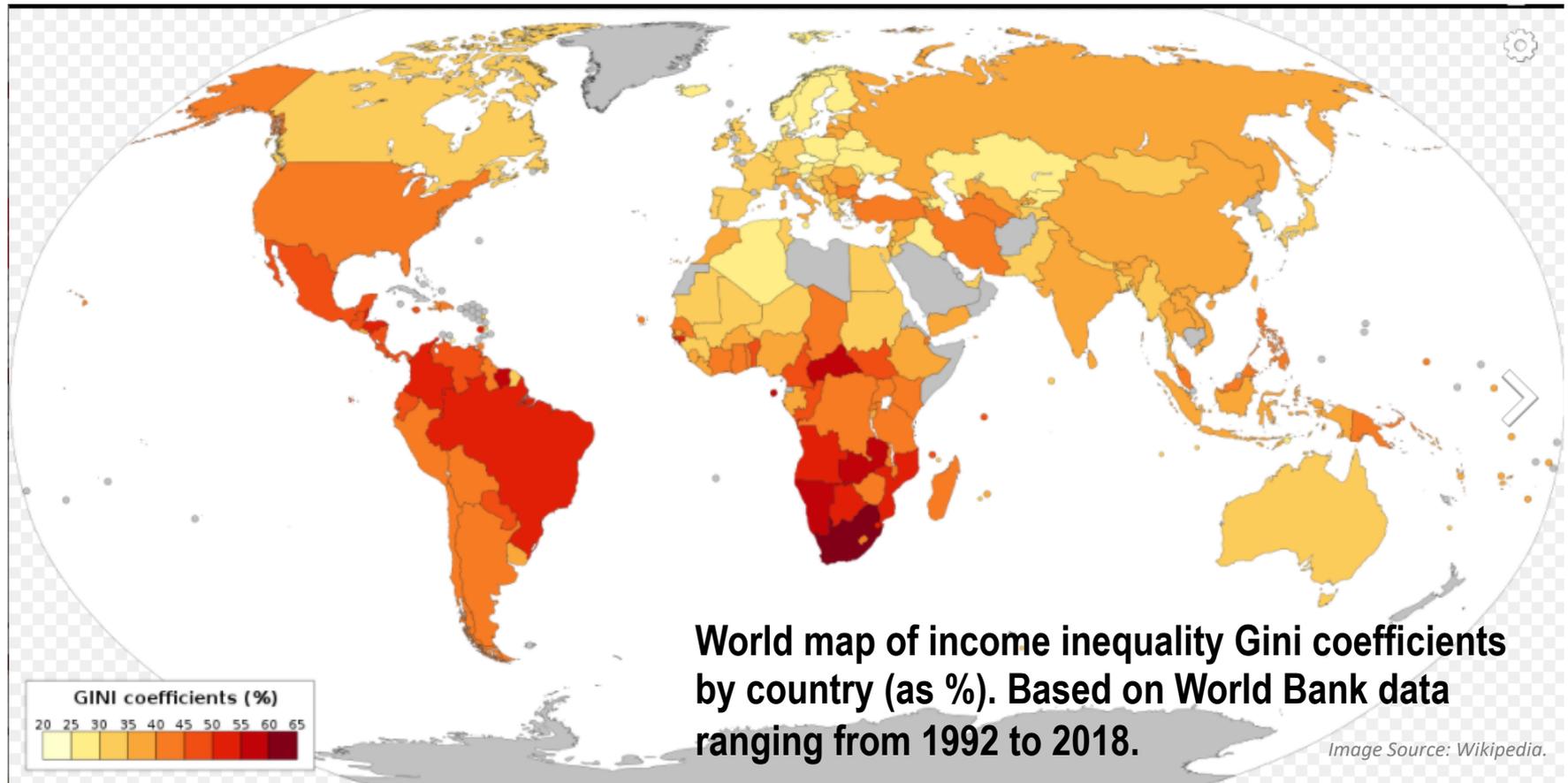- *A powerful tool for detecting step functions, interactions and non-linear relationships*

Disadvantages

- *Tree can get too big*

- *Risk overfitting the data*

- *A small change in the dataset can make the tree structure unstable which can cause variance. Random Forest could be better choice.*

Recursive Partitioning for Classification
What is Gini Index?

World map of income inequality Gini coefficients by country (as %). Based on World Bank data ranging from 1992 to 2018.

Image Source: Wikipedia.

- Gini Index: developed by the Italian statistician and sociologist Corrado Gini. Homogeneity measure.
- Gini Index = 0 means indicates perfect homogeneity.

Recursive Partitioning for Classification

- Start with a single cluster

- Split into clusters that have the smallest within cluster distances in some metric.

- "Within cluster distance" measure of how homogeneous the cluster is with respect to the classes of the objects in it
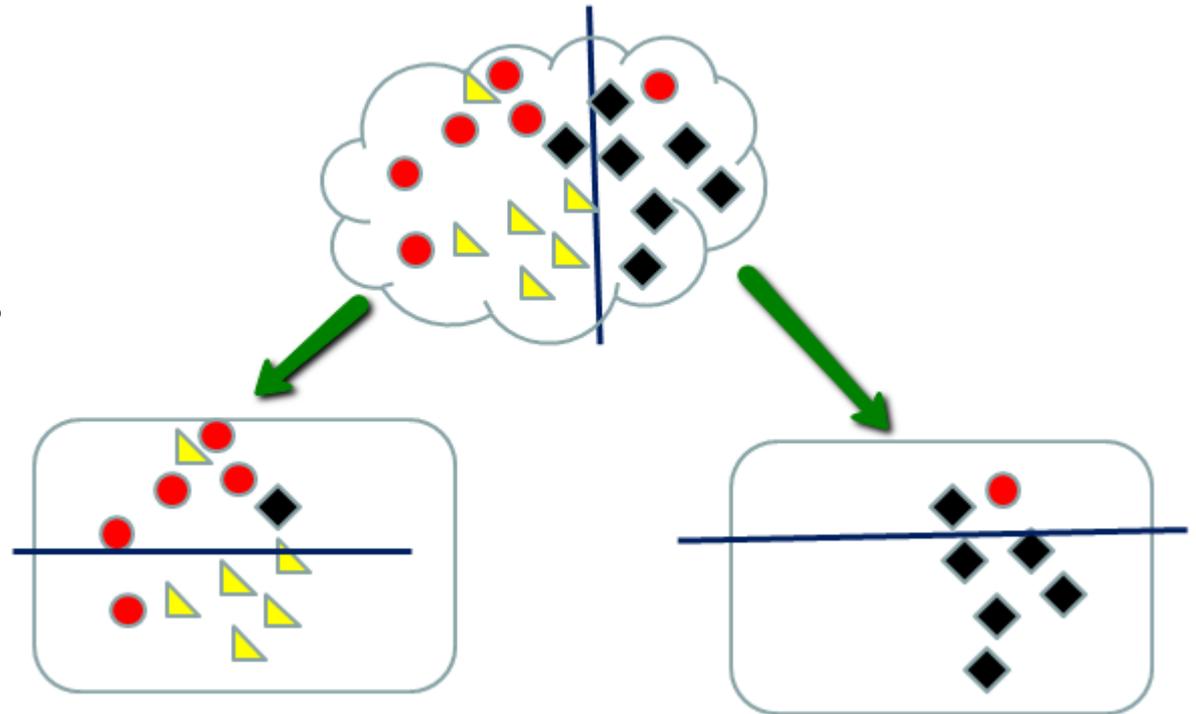
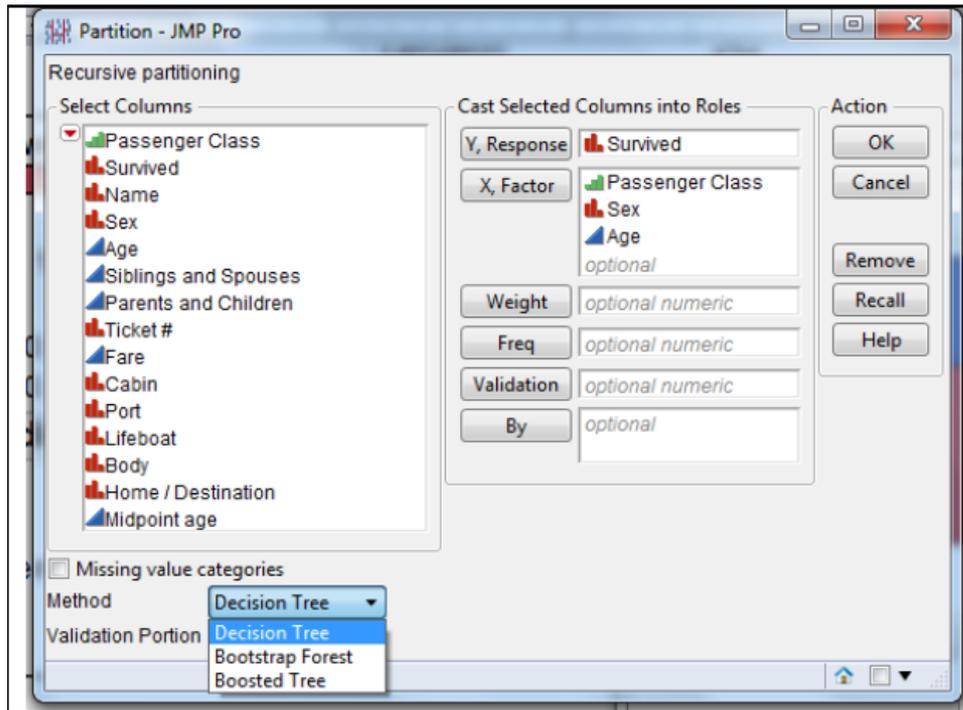*Image Source: The Pennsylvania State University. Accessible from: https://online.stat.psu.edu/stat555/node/100/*
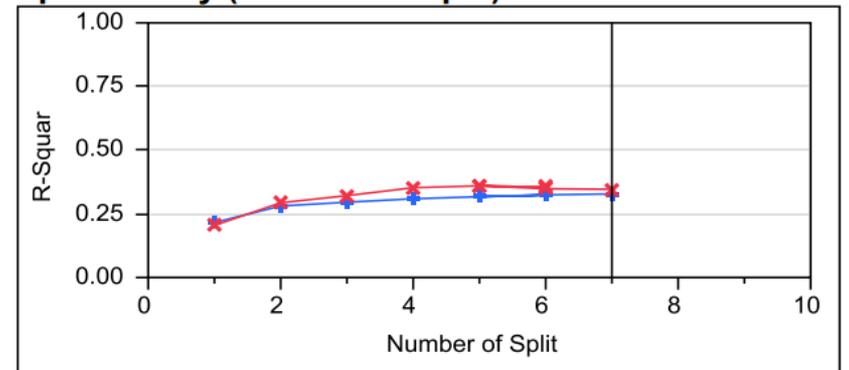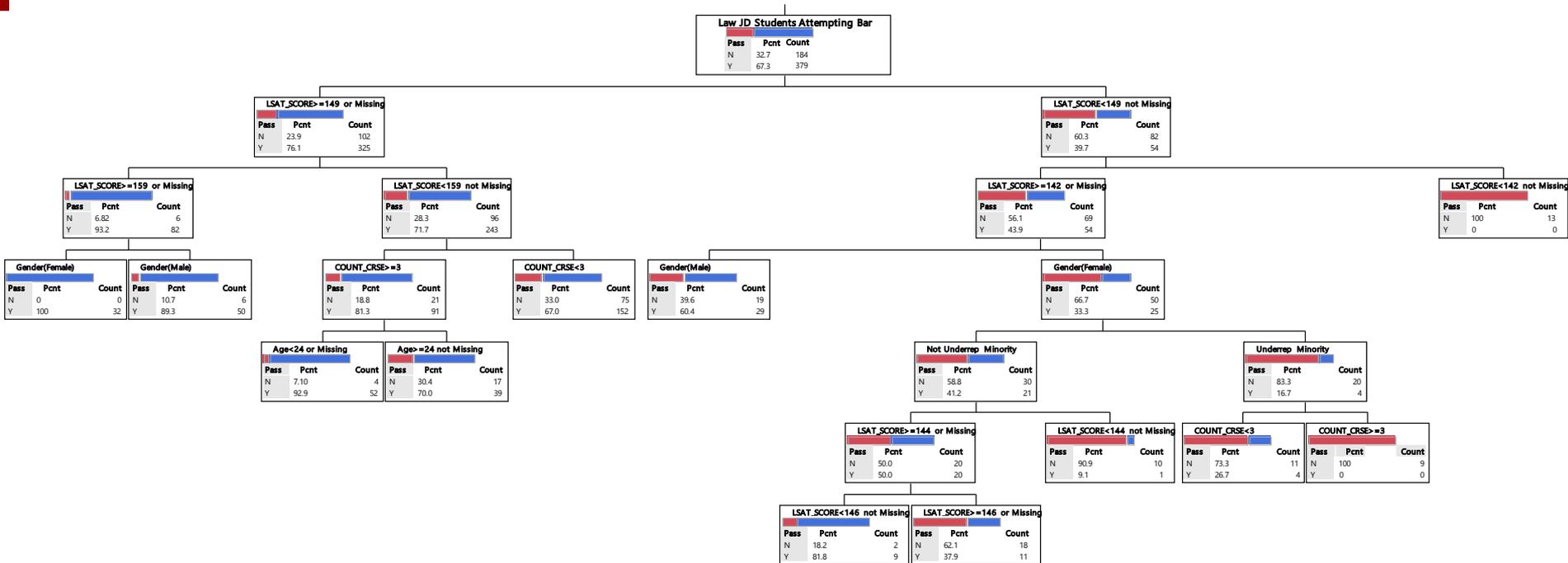
JMP Product

Image Source: Lavery, R. (2018).

Classification Tree Analysis
Bar Pass on First Attempt

Model R-Square=0.202

Legend

Blue: Passed the Bar within first try

Red: Did not pass the Bar within first try

Results

- Did not find any evidence that taking one or two online courses negatively impacted Bar outcomes.

- LSAT scores - the strongest predictor of Bar pass

- Taking many online Law courses appeared to affect students with various academic levels differently.

    – High LSAT scores (between 149 and 159), taking three online Law courses or more tended to be associated with high Bar pass outcomes, especially for those who were younger (less than 24 years of age).

    – Lower LSAT scores (between 142 and 149) and are female and underrepresented minority, taking three or more online Law courses seemed to be adversely related to Bar success, as none of the nine students in this group passed the Bar at first try. Caution: low sample size.

Results

- Model R-square: Ability of the model to predict Y (Bar Success).

- Our model R-square is low (0.202). Suggests that model can be improved. Adding other variables?

  - E.g. non-curricular work/family responsibilities;
  - E.g. types of classes offered online (skills/theory/seminar or core/elective);
  - E.g. timing of online classes in degree program (1L/2L/3L for example)

Implications

- Intuition suggests access and flexibility may help explain why students chose to take online law courses, but study results suggests these qualities do not uniformly support bar outcomes.

- Students already at risk for bar outcomes may suffer from online classes while students not at risk for bar outcomes may thrive from increased flexibility.

- Understanding the respective needs of these groups of students will be crucial in order to tailor online offerings to optimize overall outcomes.

Questions?

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