

Paper RV-249

Time-to-Degree Issue – Solution using Academic Analytics

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Session Description:

Analyzing academic data and arriving at administrative decisions is a crucial process at any university and made easier using SAS® Business Intelligence creating informative applications. Researchers compared the 1972 cohort with the 1992 cohort of high school graduates and found a statistically significant decline of 13.7 percentage points in graduates and an increase in mean time-to-degree. Excessive time-to-degree is a worsening problem causing loss to both students and universities. Study on Time-to-Degree trends help in identifying the factors that could help in avoiding/decreasing the time-to-degree which then helps in more advancement of the institution.

Objectives:

Our main objective is to analyze the data pertaining to time-to-degree trend and assess the factors that constitute this trend. This paper includes a group of visualizations dealing with Time to Degree Trend and Time to Degree by Field. These reports are developed in SAS® Visual Analytics using the dataset extraction and processing done in the SAS® Enterprise Guide. The other objectives are to provide insights on Time to degree at UConn in order to avoid or decrease the losses incurred due to more time to degree added direct costs to students, reduced ROI and increased debts, lost new admission seats to university due to occupancy of students for a long time and bad success rate affecting the reputation of the university which leads to decrease in future revenue. This data can be observed for different departments using active filters and can be used to see the bird's eye view of trend of time to degree in different fields. Maintaining research standards at a university is of utmost importance at a university and the key metrics of the quality will be monitored using Academic Analytics.

Higher Education institutions need reliable and consistent quantitative and qualitative information on faculty productivity and accountability. Efficient research and analysis using visualization tools in these multiple areas support the planning and decisions which are critical to a university.

Methodology:

Data Preparation:

Data preparation plays a key role in the analysis as it helps data and results to be more effective and informative. Data preparation involves many phases like data collection, data transformation, data cleaning, data validation and they are used as and when needed to make sure data is ready for analysis. The work in this paper has all its data preparation done using SAS Enterprise Guide. The data once ready is then moved in SAS Visual Analytics LASR from where the reports are generated using Visual Analytics designer. All these help in identifying the Time-to-degree trend for different years based on various options available.

CompTerm	CMPReq	Pos1	Pos2	Yrs_to_Add	Yrs_to_Comp	ACAD_YEAR	ROLLUP_KEY	PS_Acad_Plan	_2_or_3	PS_Descr
10	01	0	1		2	2014	POST_FALL_14	AGECON_MS	A	Agricultural Economics MS
15	01	5	1		2	2014	POST_FALL_14	AGECON_MS	A	Agricultural Economics MS
15	01	5	1		2	2014	POST_FALL_14	AGECON_MS	A	Agricultural Economics MS
10	01	0	1		2	2014	POST_FALL_14	AGECON_MS	A	Agricultural Economics MS
25	02	5	1		3	2013	PRE_FALL_14	AGECON_MS	A	Agricultural Economics MS
7	00	7	2		2	2014	PRE_FALL_14	AGECON_MS	A	Agricultural Economics MS
10	01	0	1		2	2012	PRE_FALL_14	AGECON_MS	A	Agricultural Economics MS
17	01	7	2		3	2012	PRE_FALL_14	AGECON_MS	A	Agricultural Economics MS
20	02	0	1		3	2013	PRE_FALL_14	AGECON_MS	A	Agricultural Economics MS
27	02	7	2		4	2012	PRE_FALL_14	AGECON_MS	A	Agricultural Economics MS
20	02	0	1		3	2011	PRE_FALL_14	AGECON_MS	A	Agricultural Economics MS
17	01	7	2		3	2014	PRE_FALL_14	AGECON_MS	A	Agricultural Economics MS
17	01	7	2		3	2013	PRE_FALL_14	AGECON_MS	A	Agricultural Economics MS
10	01	0	1		2	2012	PRE_FALL_14	AGECON_MS	A	Agricultural Economics MS
12	01	2	1		2	2012	PRE_FALL_14	AGECON_MS	A	Agricultural Economics MS
7	00	7	2		2	2013	PRE_FALL_14	AGECON_MS	A	Agricultural Economics MS
17	01	7	2		3	2013	PRE_FALL_14	AGECON_MS	A	Agricultural Economics MS
30	03	0	1		4	2012	PRE_FALL_14	AGECON_MS	A	Agricultural Economics MS
20	02	0	1		3	2011	PRE_FALL_14	AGECON_MS	A	Agricultural Economics MS
172	17	2	1		18	2014	PRE_FALL_14	AGECON_MS	A	Agricultural Economics MS

Figure 1: SAS Dataset – School of Agriculture

*only few sample variables are included in the snapshot

Variables to be considered for ETL and analysis

- Campus
- Student Demographics
- Students per faculty (CDS)
- Student credit hours (SCHs) per full-time faculty
- Direct instructional and personnel costs per FTE student
- GRE scores / GMAT scores

- Percentage of faculty with a citation / books / articles
- SCHs taught by T/TT faculty
- Six year graduation rates
- Median scores on Student Evaluation of Teaching
- T/TT faculty as a percentage of total full-time faculty
- Ratio of TAs and RAs to total graduate students
- Total research expenditures per full-time faculty

Secondary variables- Departmental/Faculty Productivity to study indirect relation between predictors and dependent variable

- Grants per Faculty Member
- Citations per Publication
- Total Number of Grants
- Grant Dollars per Faculty Member
- Number of Faculty
- Total Grant Dollars
- Percentage of Faculty With a Grant

Basic static analysis between variables to estimate the relationship between them is an important first step in any statistical analysis. Analysis of Variance, linear regression, contingency table or logistic regression can be performed depending on the data type of the variables.

Hypothesis testing is a cornerstone of statistical inference and is necessary for analyzing data related to many problems. A statistical hypothesis is a statement about an unknown value in the population under study. One of the variables 'Campus' is considered for the null hypothesis. Here we can check the hypothesis whether the Time-to-Degree is really different for different campuses or not. This is a two-sided hypothesis:

H₀ (Null Hypothesis): group means are identical ($\mu_1 = \mu_2$)

H_a (Alternate Hypothesis): group means are different ($\mu_1 \neq \mu_2$)

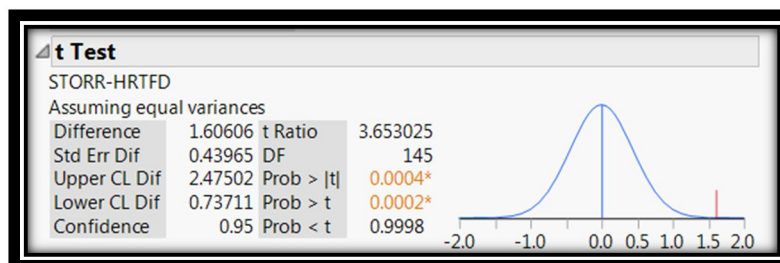


Figure 1.1: Campus vs Time-to-Degree: Two sample t-test results

Based on the Two-sample t-test results (using SAS JMP), we have enough evidence to conclude that the means are different because the $P\text{-value}=0.0004<0.05$. We can conclude there is a significant difference between the Times-to degree for different campuses.

In the same way we observe decreasing trend in professional test scores with increase in Time-to-degree. We can conclude the statistical significance of the statement using corresponding tests and regressions. Since the dependent variable 'Time-to-degree' is a continuous variable against predictors, we can use linear regression technique to do the driver analysis to identify crucial areas affecting the Time-to-Degree.

We can follow the below approach to work on the model:

Prepare Academic analytic and In-house data -> Identification of problematic Departments and Schools -> Exploration/descriptive statistics and variable selection using corresponding tests and regressions -> Perform Linear Regression to identify key drivers -> Visual Analytics dashboard with parametric interaction.

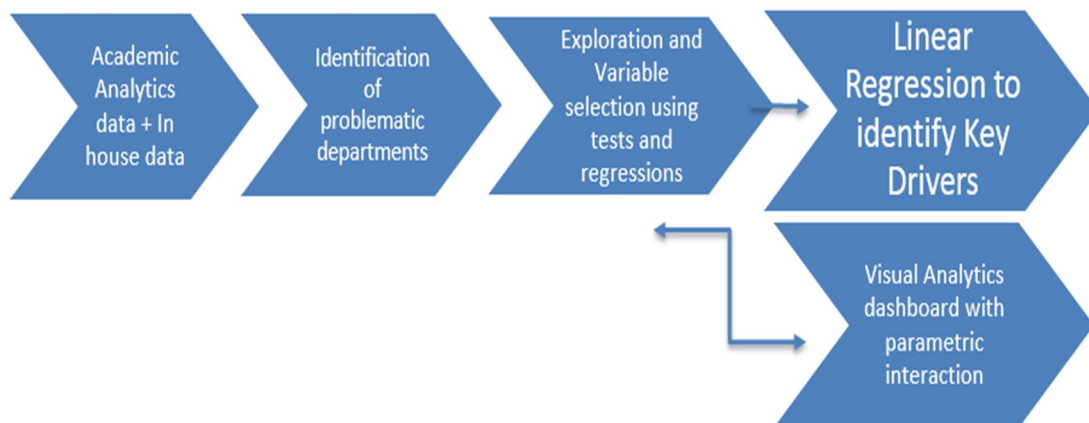


Figure 1.2: Model development and Visual Analytics dashboard creation

Detailed Intended Outcomes For Attendees:

The primary purpose of this study is to evaluate the factors affecting time taken by students at UConn to complete their degree and this study has been performed based on various factors like department, school, and field for different years.

Analysis	Outcomes	Measurement Approach
Time to Degree Trend	Assess the trends in time to degree for different schools and their respective departments	Measure the time taken for the degree(in years) completion for different fields i.e. Masters and Doctoral [Figure 3,4,5]
GRE/GMAT Exploratory Analysis	Understand the impact on professional test scores with increase in time-to-degree	Compare the average GRE score for different years for a department [Figure 6,7]
Bi-Variate Analysis	Track which campuses are having more time-to-degree	Compare the campus data with the Average years taken to complete degree at that campus [Figure 8,9]

Conclusion:

In conclusion, Academic analytics can offer numerous opportunities to evaluate student learning and student success. Cultural differences from one institution to another can have a significant influence on success of an analytics effort. Understanding those issues and being prepared to address them are important steps in planning such an effort. Linear Regression is a powerful algorithm which can be used to derive significant drivers. These drivers/variables can monitored using visual analytics dynamic dashboards and change accordingly in order to decrease time to degree. The employment of academic analytics used in combination with other forms of evidence can assist educational institutions in determining the best plans that will have a positive impact on student success.

Implications for Future Research:

Dashboard creation using prediction/regression formulas and parameters will be the long term plan. Variable sliders will be designed to see the effect on Time-to-degree. Variable sliders are for department level decision variables (like Research funding, Student to Faculty ratio) to assist higher level management.



Figure 2: An example of input sliders for decision variables in dynamic dashboard

Appendix:

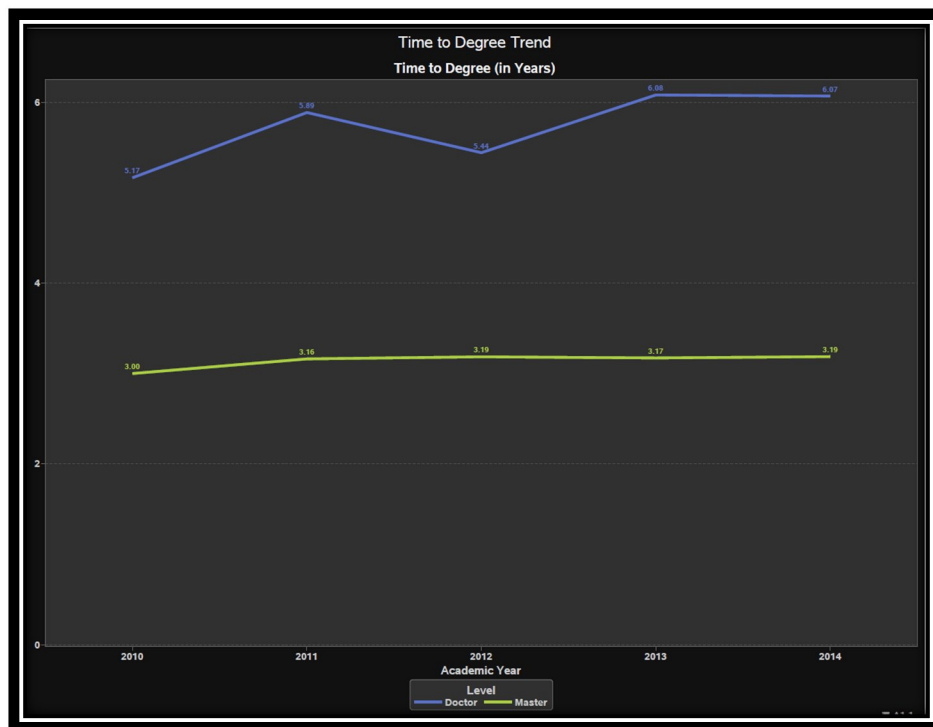


Figure 3: Analysis of Increased Time-to-degree at UConn (School of Agriculture) using SAS VA



Figure 4: Analysis of Increased Time-to-degree at UConn (School of Fine Arts) using SAS VA

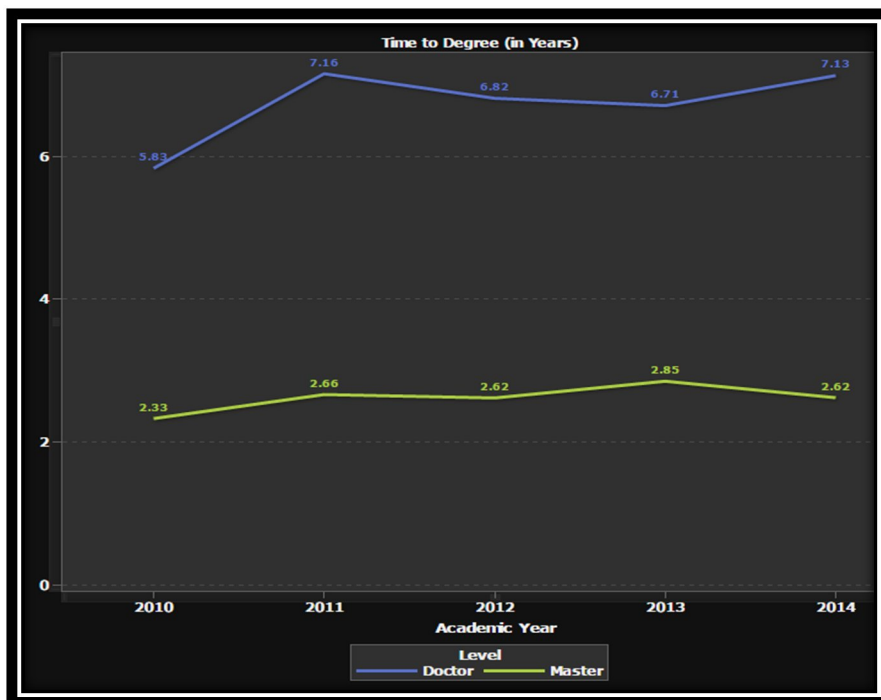


Figure 5: Analysis of Increased Time-to-degree at UConn (School of Liberal Arts and Sciences) using SAS VA

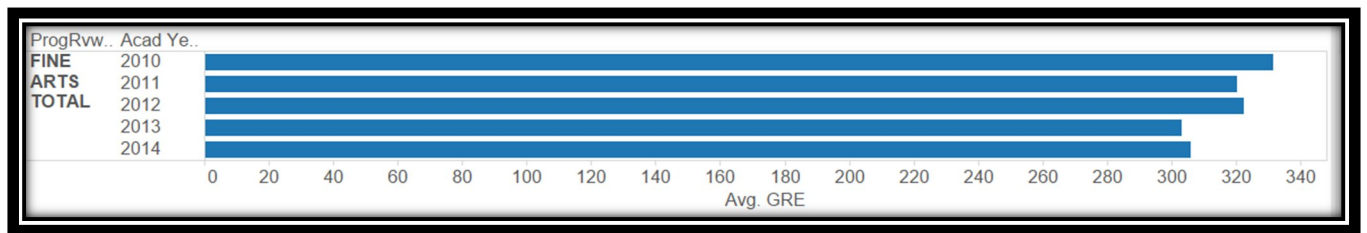


Figure 6: Exploratory data analysis for a department – GRE/GMAT

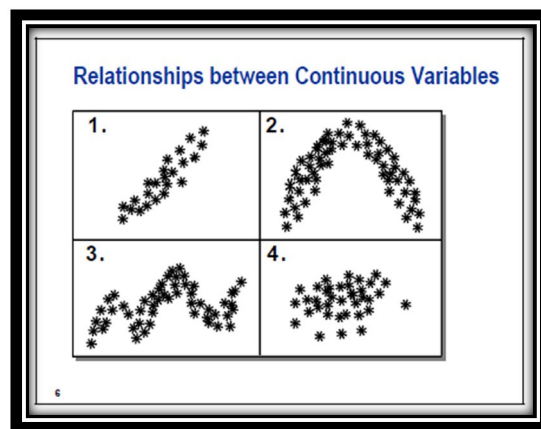


Figure 7: Relation between two continuous variables GRE and time-to-degree



Figure 8: Bi-variate analysis of categorical and continuous variable [Campus vs Time-to-degree]

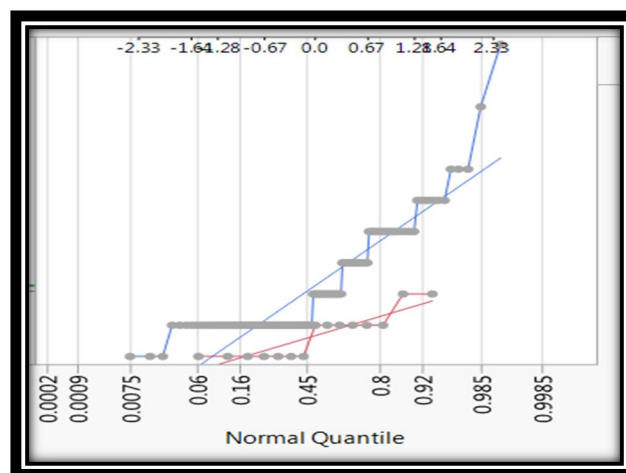


Figure 9: Another example Bi-variate analysis of categorical and continuous variable [Campus vs Time-to-degree]

References:

1. Michael F. Mridaugh. Understanding Faculty Productivity – Standards and Benchmarks for Colleges and Universities. The Jossey-Bass higher and adult education series, 2001.
2. Campbell and Oblinger 2007, 14–15
3. Higher Learning Commission “Employing Academic Analytics to Identify Strategies for Student Success”
4. JMP® Software: ANOVA and Regression
5. Bound, Lovenheim, & Turner, 2012

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