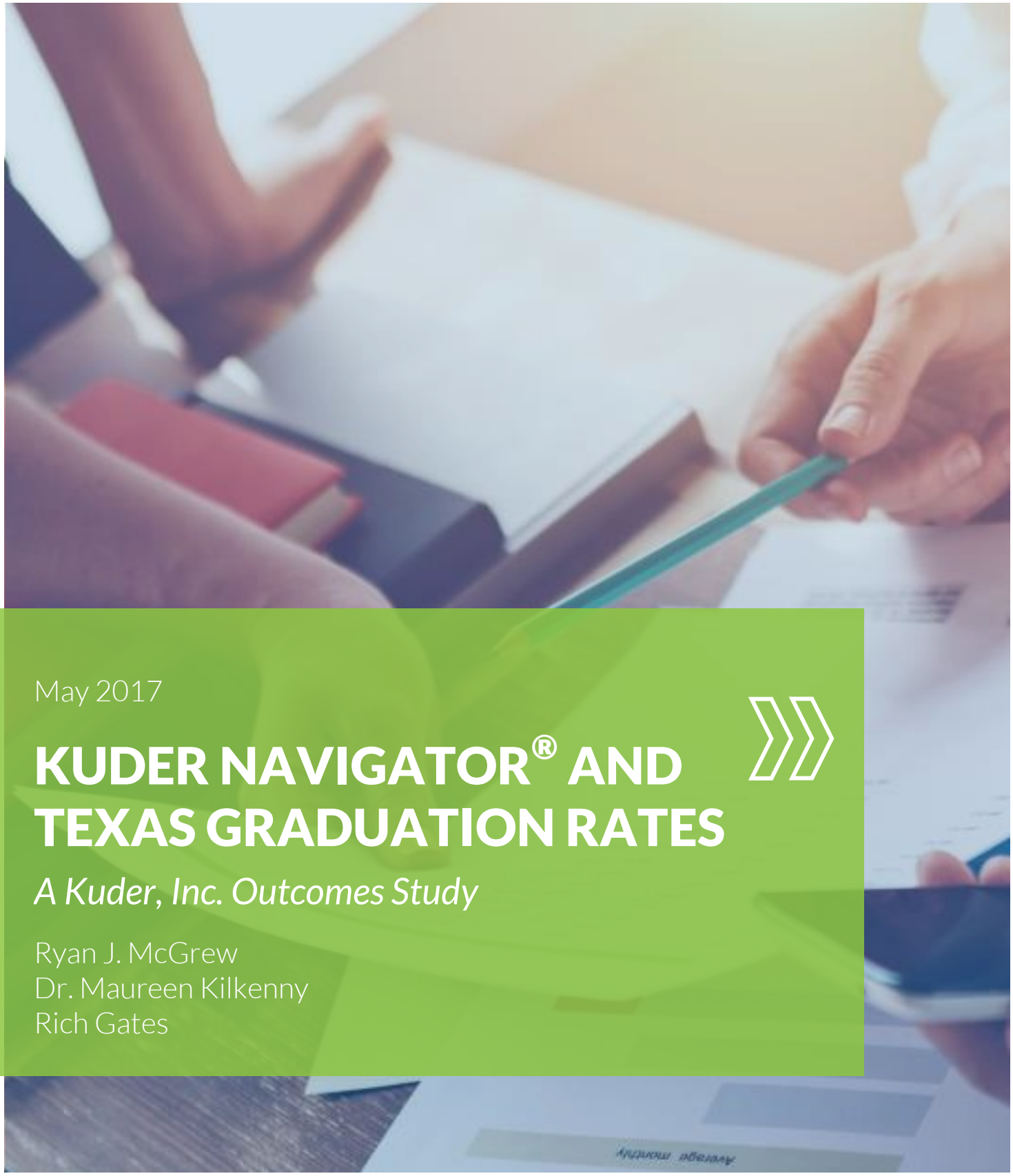

May 2017

KUDER NAVIGATOR® AND TEXAS GRADUATION RATES

A Kuder, Inc. Outcomes Study

Ryan J. McGrew
Dr. Maureen Kilkenny
Rich Gates

kuder®

302 Visions Parkway
Adel, Iowa 50003

T: 800.314.8972
F: 515.993.5422

www.kuder.com
info@kuder.com

CONTENTS

BACKGROUND

When investigating the effectiveness of Kuder Navigator® (Navigator) — an all-in-one online education and career planning system that includes three evidence-based career assessments to helps students in grades six through 12 visualize their futures after discovering personal interests, skills, and work values — researchers find feedback from students overwhelmingly positive.

Most recently, Kuder surveyed more than 300 former Navigator users from across the U.S. regarding their perceived level of helpfulness that access to the system had on improving academic and professional skills. [1]Participants rated Navigator as ***highly helpful*** in the areas of:

- Self-awareness (discovering interests, skills, and values).
- Awareness of educational and career opportunities.
- Setting educational and career goals and making plans.
- Developing motivation for education and career.
- Generating hope for the future.
- Increased motivation to in class and improve academic performance.

Findings of this not only provided insight but also the opportunity to examine how perceived improvements relate to quantifiable changes in academic accomplishment. And, as an important metric of academic success for a secondary institution is its graduation rate, logic therefore supplied the hypothesis that use of Navigator in high schools is linked to greater academic success in the form of higher graduation rates.

This report showcases the correlation between the use of Navigator and significantly identifiable increase of high school graduation rates and return on investment for the state of Texas

[1] Kuder High School Graduate Follow-Up Study. Dr. Jerry Trusty, 2013; www.kuder.com

DATA AND METHODS

This study relied on Texas Education Agency (TEA) data specific to high school completion, graduation, and dropouts[2]. Four-year longitudinal graduation rates served as the dependent variable for high school completion, rather than alternative rates such as number of students who received/are receiving a general education diploma (GED) or required/are requiring more than four years to earn a diploma, as a primary goal of assessment usage is timely completion.

As defined by the TEA, the rate is calculated in Figure 1.

Figure 1: Longitudinal Graduate Rate Calculation

$$\text{Longitudinal Graduation Rate} = \frac{\text{4-Year Graduates}}{\text{(Graduates + Continuers + GED Recipients + Dropouts)}} \times 100$$

Secondary Schools

- Longitudinal ***rates from 2010 through 2015 were collected from 48 high schools***, all of which currently have access to Navigator. Only schools with data available in ***each observed year*** were included to ensure that the panel variable (school) was strongly balanced.
- Schools are located across the state however the majority are in near proximity to the ***Dallas/Fort Worth, Houston, San Antonio, or Brownsville*** greater metropolitan areas.
- ***Length of Navigator use varied among schools***, with periods ranging from less than one to nearly 10 years. This metric is significant for two reasons:
    - If a school or district had access to the system for a relatively longer period, it would suggest a more experienced and effective approach to implementation, while those in their first, second, or even third year of use could not yet be fully efficient in the delivery or interpretation of tools and results.
    - A student with access to Navigator throughout high school would be expected to have a better sense of academic direction, improved goal-setting capabilities, and increased motivation based on previously noted outcomes.

The resulting hypothesis is that a positive relationship exists between the duration of a stakeholder's system use and that institution's graduation rate.

[2] TEA Completion, Graduation, and Dropouts Data Search

Additional Variables

To accurately estimate the degree to which Navigator use affects graduation rates, it is necessary to observe additional variables associated with academic success. Doing so reduces the probability of omitted variable bias, where effects of Navigator are misrepresented due to a lack of adequate independent variables in the model.

Pertinent data was collected from the TEA's Academic Excellence Indicator System[3] and the Texas Academic Performance Report[4]. The variables chosen (based on prior research regarding academic outcomes) were class size and a measure indicating the percentage of students considered "economically disadvantaged" as determined by qualification for "free or reduced-price lunch or eligibility for other public assistance."

Finally, to accurately identify the effects of the Kuder variable[5], it is necessary to control for differences between the institutions that may be systematic in nature, and thus correlated with Navigator use. To do so, a series of regressions were conducted to estimate changes in graduation rates using both fixed-effects (FE) and random-effects (RE) models.

An FE model is used to control for potential unobservable characteristics of each school in the event that these characteristics are related to changes in the relevant variables (Navigator use). Alternately, the RE model is appropriate if the unobservable differences between schools are not correlated with the variables in question.

[3] 2010 – 2012.

[4] 2013 – 2015.

[5] "Kuder variable" is defined as the number of years a school has used Navigator; "Kuder coefficient refers to the marginal effect each year of Navigator use has on a graduation rate.

OUTCOMES

Figures 2a and 2b summarize the results of analysis of the data through linear regression using only the Kuder variable as a descriptor (see Appendix A for estimation details).

Figure 2a

FE Model 1

	Coefficients	Standard Error	P-Value
Years of Navigator Use	0.4723	0.145	0.001

RE Model 1

	Coefficients	Standard Error	P-Value
Years of Navigator Use	0.4976	0.144	0.001

Figure 2b

Hausman Results

	FE Coefficient	RE Coefficient	Difference	Standard Error
Years of Navigator Use	0.4723	0.4976	-0.0253	0.0191

chi2(1) = 1.74; Prob>chi2 = 0.1871

Figures 3a and 3b subsequently summarize the results of analysis for a second set of regressions using additional descriptor variables (see Appendix B for estimation details).

Figure 3a

FE Model 2

	Coefficients	Standard Error	P-Value
Years of Navigator Use	0.5485	0.157	0.001
% of Economically Disadvantaged Students	-0.0662	0.027	0.016
Class Size	-0.001	0.004	0.757

Prob > F = 0.0010

RE Model 2

	Coefficients	Standard Error	P-Value
Years of Navigator Use	0.5534	0.148	0.000
% of Economically Disadvantaged Students	-0.0761	0.023	0.001
Class Size	-0.0001	0.003	0.967

Prob > chi2 = 0.0000

Figure 3b

Hausman Results

	FE Coefficient	RE Coefficient	Difference	Standard Error
Years of Navigator Use	0.5485	0.5534	-0.0049	0.0511
% of Economically Disadvantaged Students	-0.0662	-0.0762	0.0099	0.0146
Class Size	-0.0012	-0.0001	-0.0011	0.0029

Chi2(1) = 0.75; Prob > chi2 = 0.8613

The broad regression statistics are shown in Figure 4.

Figure 4

Regression Statistics	
rho (FE Model 1)	0.7768
rho (RE Model 1)	0.7658
rho (FE Model 2)	0.7627
rho (RE Model 2)	0.7607

It is worth noting that the intra-class coefficients for the models range from 0.7607 to 0.7768, estimating approximately three quarters of the total variance in observed longitudinal graduation rates is explained by characteristic differences that are unique to each school.

This result is unsurprising in that there are surely a wide variety of factors that help to explain changes in Texas graduation rates. Institutions likely engage in other means of academic development and resource allocation in efforts to improve performance. Nevertheless, the objective of this analysis is to determine the statistical relationship (or lack thereof) between the extended use of Kuder® Navigator and high school graduation rates, rather than to explain changes in the graduation rates themselves.

The most important result concerns the research hypothesis, which states institutions that have utilized Navigator for longer periods of time will see improved graduation rates. The estimations in Figures 2a and 3a imply with a 95 percent degree of certainty that the extended use of Navigator in Texas high schools is statistically significant in explaining changes in academic completion.

To illustrate the potential range of improvement, Figures 5a and 5b project graduation rate increases using the smallest and largest "Kuder" coefficient estimates obtained in the previous models. Figure 5a applies the coefficient estimated in FE Model 1.

Figure 5a

FE Model 1 Estimates

Years of Navigator System Use	Estimated Total Grad Rate Increase
1	0.4723%
2	0.9446%
3	1.417%
4	1.889%

Figure 5b applies the coefficient estimated in RE Model 2 to approximate graduation rate increases associated with different lengths of Navigator use.

Figure 5b

RE Model 2 Estimates

Years of Navigator System Use	Estimated Total Grad Rate Increase
1	0.5534%
2	1.10%
3	1.66%
4	2.21%

IMPLICATIONS

A vast amount of research exists exploring the economic implications of increased high school graduation rates. In terms of earnings, the Alliance for Excellent Education (AEE) estimates that the average Texas high school graduate earns $8,781 more on a yearly basis than individuals without a diploma.[6] The TEA reports that 313,810 students enrolled for their senior year in the 2014-2015 school year.

Four-Year Use Projections

The AEE references a study by Dr. Peter Muennig indicating "if a student graduates from high school rather than dropping out, the likely Medicaid costs for that person will be reduced by 50 percent."

Using the most conservative per-graduate estimate provided by Muennig, ***Texas could see a savings range of $4,606,056 to $5,388,495*** realized after four years resulting from the decreased likelihood of graduate enrollment in Medicaid.

Projected outcomes after consistent use of Navigator over a four-year period include an increased high school graduation rate, a decreased Medicaid enrollment rate, and substantial revenue gains for the state of Texas.

If the four-year-use estimates shown in Figures 5a and 5b are applied to the state graduation rate:

- The expected gain in terms of new graduates would range from ***5,928 to 6,935***.
- Total gains in income would therefore range from ***$52,052,634 to $60,897,999***.
- An additional ***5,800 graduates in the state of Texas would increase federal tax revenue by $10,000,000.*** Furthermore, an increase of this degree would galvanize spending on homes and automobiles by ***$97,000,000*** and ***$6,900,000***, respectively.
- Shifting focus toward direct returns it is estimated that every 1% increase in the state graduation rate produces a marginal increase of $1,200,000 in state and local tax dollars, meaning ***Texas could estimate a revenue increase between $2,266,800 and $2,652,000.***

[6] The figure used here is taken from a study conducted by the Alliance for Excellent Education in cooperation with Economic Modeling Specialists Inc., which provides state-by-state estimates of increases in annual earnings for high school graduates compared to the earnings of high school dropouts (2011). Obtaining a precise earnings differential in this sense is highly complex, and the degree to which improved educational attainment exclusively increases income on an annual basis is unclear in that numerous other factors (e.g., experience and location) undoubtedly affect relative earnings.

Figure 6 below shows the standard calculation for net present value to demonstrate a return on investment, where *i* denotes a given discount rate, *N* denotes the total number of years in the observed timespan, *t* denotes a given year, and R_t denotes a benefit realized in year *t*.

Figure 6

$$NPV(i,N) = \sum_{t=0}^{N} \frac{R_t}{(1+i)^t}$$

To project the value of a potential investment for the state of Texas, a five period calculation is used where annual site licensing fees are posed as costs in years 0-3. In year four, a benefit is realized in the form of state and local tax revenue, savings attributable to reduced Medicaid enrollment, and increased earnings resulting from those that would've otherwise failed to graduate in year three without the utilization of Navigator.

The annual cost in years 0-3 is determined by multiplying the site licensing fee of $700 by the total number of junior high and high schools in the state, (1,591 and 1,445, respectively) for a total of ***$2,125,000*** each year.

The benefit realized in year four based on the previously cited literature ranges from ***$58,925,490 to $68,938,494***, using estimates from FE Model 1 and RE Model 2.

At a discount rate of 3.13% (based on current market interest rates), the net present value of a four year investment in Navigator by the state of Texas would range from $43,970,245 to $52,821,897.

CONCLUSION

Qualitative response-based examinations have frequently shown use of Navigator to be viewed positively by the students and educators that have experienced the system. Among the most frequently mentioned areas of improvement are self-awareness, identifying educational opportunities, increased motivation, and improved classroom performance.

The analysis conducted in this report is consistent with this feedback, and indicates that increased academic performance in the form of higher graduation rates can be statistically linked to extended integration of the Navigator system among Texas high schools.

The previously noted estimations suggest that investment in Navigator at a state-wide level could potentially provide returns in the form of various economic measures including earnings, spending, and tax revenue increases.

REFERENCES

(2010-2015). *Academic Excellence Indicator System/Texas Academic Performance Report*. Performance Reporting Division. State of Texas. Austin, TX: Texas Education Agency.

(2010-2015). *Four-Year Graduation and Dropout Data*. Reports and Data. School Performance. State of Texas. Austin, TX: Texas Education Agency.

(2011). *Education and the Economy: Boosting the Nation's Economy by Improving High School Graduation Rates*. Washington, DC: Alliance for Excellent Education.

(2016). *the Graduation Effect: Economic Impact Data*. Washington, DC: Alliance for Excellent Education. Retrieved from all4ed.org.

Muennig, P. (2013). *Decreasing Medicaid and Health-Care Costs by Increasing Educational Attainment*. Washington, DC: Alliance for Excellent Education.

Ryon, H. et al. (2016*). Enrollment in Texas Public Schools 2014-15*. Division of Research and Analysis. Department of Assessment and Accountability. State of Texas. Austin, TX: Texas Education Agency.

Trusty, J. (2012). *Kuder High School Graduate Follow-Up Study: Survey of Kuder Navigator Users who Graduated from 2010 to 2012*. Adel, IA: Kuder, Inc.

ABOUT THE AUTHORS

Ryan McGrew, Economics Analyst | Kuder

Ryan McGrew supports Kuder's mission by identifying economic outcomes associated with usage of the KCPS. His main priorities are detecting and defining research opportunities with potential to illustrate the widespread benefits of investing in Kuder systems and assessments. Ryan often works in collaboration with Kuder's marketing, product development, and client engagement teams, as well as members of Kuder's esteemed Research Faculty, providing insight from an economic standpoint.

Before joining Kuder in 2016, Ryan attended the University of Iowa, where he was actively involved with writing, research, and social student groups prior to graduating with distinction. He holds a bachelor's degree in economics.

Dr. Maureen Kilkenny, Contracted Economist | Kuder

Dr. Maureen Kilkenny is an expert at the quantitative analysis of regional economies, economic policy, and markets. She has published dozens of refereed articles on topics as diverse as commercial banking and water rights, and has won awards for best journal article of the year, outstanding researcher (national scope), and for teaching and advising. In 2013 Google Scholar ranked Maureen among the top ten in the world in her four fields of regional science, rural development, (banking and finance, and computable general equilibrium).

Currently a senior fellow at the National Center for Food and Agricultural Policy (NCFAP, a virtual think-tank in Washington, D.C.), Maureen was formerly a professor of economics at the University of Nevada, Reno; Iowa State University; the University of Colorado, Boulder; and Pennsylvania State University.

She holds a Ph.D. in agricultural and applied economics from the University of Minnesota and an honorary doctorate from Jönköping University in Sweden.

Rich Gates, Vice President of Research | Kuder

Rich Gates oversees research activities that elevate vocational acumen, occupational preparation, and career health across a lifetime. He works to foster quality research and scholarship, provide access to supportive information, enhance the ability to respond to research priorities, pursue research opportunities, encourage and direct inquiry into new and emerging aspects of careers and vocations, and promote science-based outcomes.

Since joining Kuder in 2003, Rich has worked closely with the research faculty and the development team as well as administration, operations, and accounting in his roles as research systems analyst and director of reporting and analytics. Previously, Rich served as a pastor, a systems programmer and analyst in the agriculture industry, a university instructor of statistics, and a business administrator for a nonprofit organization.

He holds a bachelor's degree and a master's degree in mathematics from Truman State University and a master's degree in divinity from the Lutheran School of Theology at Chicago.

APPENDICES

A | Estimation Details for Fixed Effects Model 1 and Random Effects Model 1

Figure 2a illustrates a positive and significant relationship between Navigator use and Texas graduation rates in both models. The p-values associated with the "Kuder" coefficient are both near zero, well below the standard significance level of α = .05. The FE and RE "Kuder" coefficients are 0.47 and 0.497, respectively. This implies that the FE (RE) model estimates a 0.47 %(0.497 %) increase in graduation rates for each year a school uses Navigator.

Figure 2b shows the results of a Hausman test comparing the coefficients of each model, where prob>chi2 = 0.1871. This figure is greater than α = .05, which intuitively means the RE model is as efficient as the FE model.

B | Estimation Details for Fixed Effects Model 2 and Random Effects Model 2

Figure 3a illustrates that the relationship between Navigator use and graduation rates remains positive and significant when controlling for class size and economic status. In both models, the p-value for the Kuder variable remains at a level near zero.

The Kuder coefficients[7] in Figure 3a are 0.5485 and 0.5534 in the FE and RE models, respectively. The differences between Kuder coefficients in Figures 2a and 3a are attributable to the inclusion of variables inversely related to graduation rates. Including these variables helps to prevent understating the positive effect of Navigator use.

The coefficients for the variable measuring economically disadvantaged students are negative and statistically significant, with p-values of 0.016 and 0.001 in the FE and RE models, respectively. The coefficients in this case estimate a decrease of 0.067-0.076 percent in graduation rates for every 1 percent of economically disadvantaged students. The coefficients for the class size variable show a negative relationship with graduation rates, though the relationship is both insignificant and virtually 0.

Figure 3a also lists the results of F tests for each model, with each showing values less than 0.05 (0.0010 and 0.0000). This implies that it is safe to assume all included coefficients in each model are statistically different from zero. Figure 3b shows the results of a Hausman test comparing the coefficients of each model, where prob>chi2 = 0.8613. This figure is greater than α = .05, which again implies that the RE model is as efficient as the FE model.

[7] *Kuder coefficient is defined as the marginal effect that each year of Navigator use has on a graduation rate.*

About Kuder

Over 165 million people have used Kuder's research-based career assessment, education planning, and guidance resources to help visualize which industry or career, field of study, or school to pursue next in life.

Kuder helps ensure that people of all ages can unlock the power of their own potential, and create a bright future. For more information, visit kuder.com or call 800.314.8972.

Our Vision

To help people discover and achieve what they want to be.

Our Mission

To be the global authority in career guidance and education by providing evidence-based and proven tools to navigate life's journey. Our resources help to raise aspirations to last a lifetime.