



Modeling Seamless College Enrollment and Retention Among KCS Alumni

Technical Report

Clint Sattler
Supervisor of Research and Evaluation
Knox County Schools
Department of Research, Evaluation, and Assessment

January 2021

Overview

Knox County Schools (KCS) high school counselors requested information related to seamless college enrollment and retention as an extension of a previous study from the Knox County Department of Research, Evaluation, and Assessment (Sattler 2020). This study correlated college enrollment and retention rates with students’ terminal grade point average (GPA). This information could help counselors orient students to performance (course grades) that align with students’ post-graduation plans.

This report was created to serve as a record of the assumptions and methodology used to fulfill this request.

Methodology

College enrollment data was extracted from the National Student Clearinghouse (NSC) database. Knox County Students who matriculated to a college or university that does not report to the NSC were not identified as college-going students in this study. Student demographic variables, including graduation cohort, and final GPAs were extracted from the Knox County Schools’ Student Information System (ASPEN). The GPAs used in the regression analyses were unweighted Knox County GPAs (i.e. GPA quality points for advanced courses were excluded) at the request of the KCS counselors.

After a preliminary exploration, findings suggest NSC college-going data from the class of 2017-2018 (SY1718) and SY1819 could be validated with external resources (CEPR, 2020). Data from prior Knox County graduation cohorts deviated significantly from aggregate data reported by CEPR and was therefore excluded from this study.

Methodology: Seamless Enrollment

A student was considered seamlessly enrolled in a college or university if they enrolled in any institution reporting to the NSC within the same calendar year as their high school graduation cohort. This methodology allows early graduates to enroll in a college or university in the spring, summer, or fall terms following their KCS graduation and still be considered a seamless enrollee. A logistic hierarchical linear model (HLM) was constructed using student demographic variables, unweighted GPA, and the KCS high school from which a student graduate. The HLM equation used to estimate the probability of seamless enrollment is available in Equation 1. The random intercept term (β_{0j}) varied by the KCS high school from which a student graduated.

Equation 1: Seamless Enrollment Model

$$\ln\left(\frac{p_{Seamless\ Enrollment}}{1 - p_{Seamless\ Enrollment}}\right) = \beta_{0j} + \sum_{s=1}^9 \beta_s Demo_{sij} + \beta_{610} GPA_{ij}$$

$$\beta_{0j} = \gamma_{00} + \mu_{0j}$$

Seamless enrollment modeling included 7,995 KCS graduates who were awarded a regular or endorsed/advanced diploma.

Methodology: College Retention after Seamless Enrollment

SY1718 and SY1819 graduates enrolled in 360 post-secondary institutions (that reported to the NSC). Because most of the reporting institutions had very few enrollees, the model may overfit the data. Therefore, the final model used data from the nine most frequently enrolled institutions (Table 1). Inspection of the post-secondary enrollment data indicated that nine post-secondary institutions had a reasonable number of enrollees from each of the KCS high schools.

Table 1: Most Common Post-Secondary Institutions

Post-Secondary Institution	N Students
Pellissippi State Community College	2006
University of Tennessee Knoxville	1222
Roane State Community College	248
East Tennessee State University	204
University of Tennessee Chattanooga	188
Carson-Newman University	151
Middle Tennessee State University	115
South College	97
Tennessee Technological University	93

A student was considered to be retained in a college or university if they had seamlessly enrolled and were enrolled in any institution that reported to the NSC in the summer or fall term of the next academic year. A student did not have to re-enroll in the same college or university to be considered “retained.” This methodology allows students who matriculated from a two-year college to a four-year institution to be identified as “retained.” Student retention would be ascribed to the post-secondary institution in which a KCS graduate initially enrolled. The HLM equation used to model the probability of student retention is available in Equation 2. The KCS high school from which a student graduated was modeled as a fixed effect. The random intercept term (β_{0j}) varied by the post-secondary institution in which a student seamlessly enrolled.

Equation 2: Retention after Seamless Enrollment Model

$$\ln\left(\frac{p_{Retention}}{1 - p_{Retention}}\right) = \beta_{0j} + \sum_{s=1}^9 \beta_s Demo_{sij} + \beta_{10} GPA_{ij} + \sum_{t=11}^{25} \beta_s HS_{Grad,tij}$$

$$\beta_{0j} = \gamma_{00} + \mu_{0j}$$

Retention modeling included 4,324 KCS graduates who were awarded a regular or endorsed/advanced diploma and seamlessly enrolled in a post-secondary institution (that reports to the NSC).

Regression models were created in R version 3.6.1 running on RStudio version 1.3.959 and using the lme4 package (version 1.1-21).

Results: Seamless Enrollment in a 2-Year or 4-Year Post-Secondary Institution

The fixed effect estimates for calculating the probability of a student enrolling in a 2-year or 4-year post-secondary institution are contained in Table 2. The random effect estimates are in Table 3.

Table 2: Fixed Effect Estimates for Seamless Enrollment in a 2-Year or 4-Year Post-Secondary Institution

Fixed Effects	Estimate	Std. Error	z value
γ_{00} : Intercept	-3.98	0.32	-12.52
β_1 Demo ₁ : Special Education (1=Yes)	-0.60	0.09	-6.60
β_2 Demo ₂ : Economically Disadvantaged (1=Yes)	-0.50	0.07	-7.31
β_3 Demo ₃ : Ethnicity = Black/Afr. Amer. (1=Yes)	0.35	0.23	1.50
β_3 Demo ₄ : Ethnicity = Hispanic/Latino (1=Yes)	-0.17	0.24	-0.70
β_3 Demo ₅ : Ethnicity = Nat. Amer. (1=Yes)	0.61	0.47	1.30
β_3 Demo ₆ : Ethnicity = Pac. Isl. (1=Yes)	-0.51	0.50	-1.03
β_3 Demo ₇ : Ethnicity = White (1=Yes)	0.03	0.22	0.15
β_4 Demo ₈ : English Language Learner (1=Yes)	-0.94	0.18	-5.32
β_5 Demo ₉ : Gender (1=Male)	-0.18	0.06	-3.02
β_{10} : GPA	1.67	0.06	29.82

Table 3: Random Effect Estimates for Seamless Enrollment in a 2-Year or 4-Year Post-Secondary Institution

School	μ_{0j} : Intercept (School-Level)
Austin East High School	-0.46
Bearden High School	0.64
Career Magnet Academy	0.06
Carter High School	-0.26
Central High School	-0.06
Farragut High School	0.80
Fulton High School	-0.28
Gibbs High School	-0.78
Halls High School	0.20
Hardin Valley Academy	0.56
Karns High School	-0.19
L & N Stem Academy	0.99
Paul Kelley Academy	-1.09
Powell High School	-0.15
South Doyle High School	-0.26
West High School	0.27

Example school-level plots for the probability of seamlessly enrolling in a 2-year or 4-year post-secondary institution (for regular education students who identify as female, Hispanic, non-economically disadvantaged, and non-English language learner) are available in Figure 1.

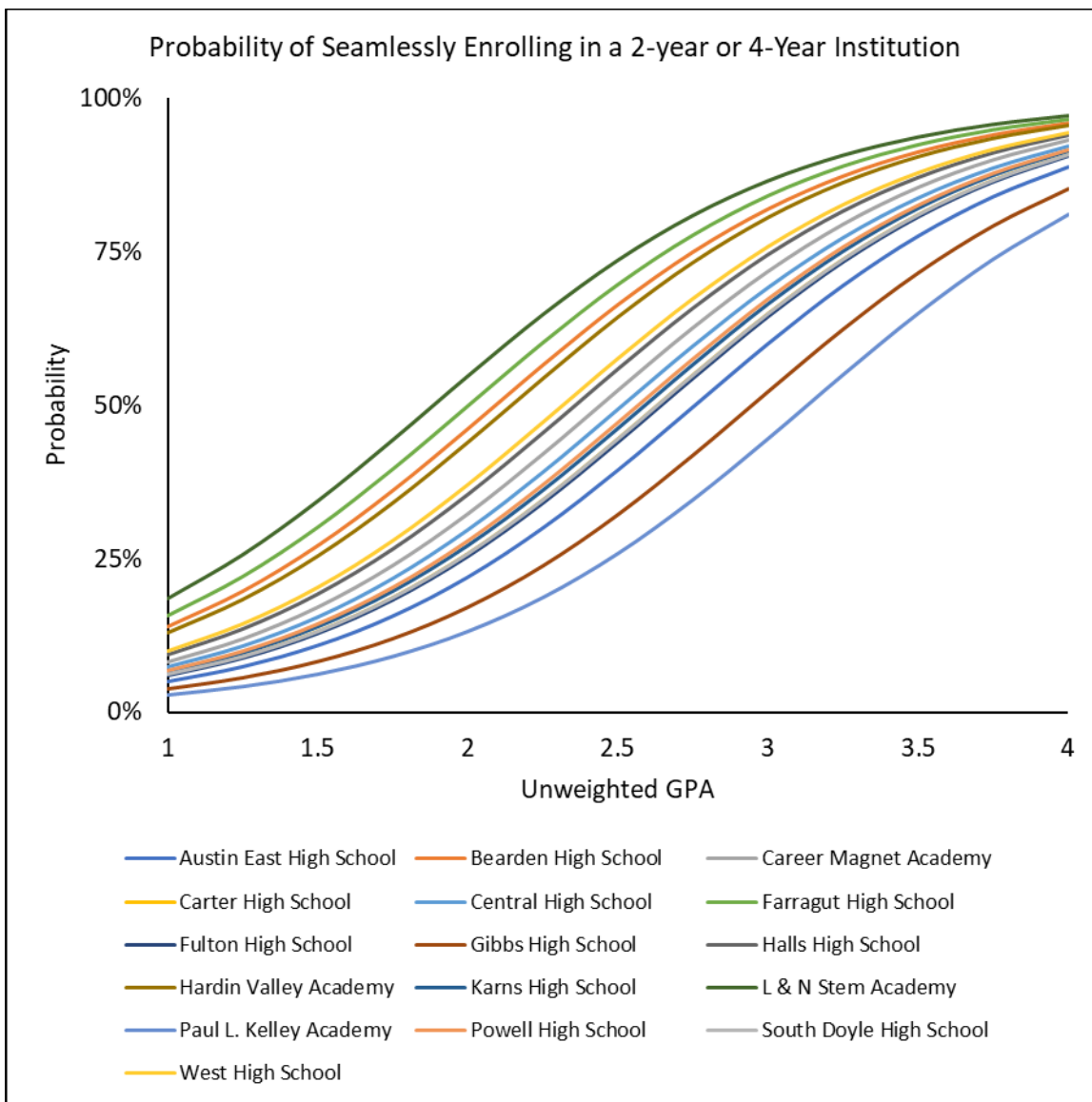


Figure 1: Probability of Seamless Enrollment in a 2-Year or 4-Year Post-Secondary Institution by GPA (Female, Hispanic, Non-Economically Disadvantaged, Non-English Language Learner, Non-Special Education)

Results: Seamless Enrollment in a 4-Year Post-Secondary Institution

The fixed effect estimates for calculating the probability of a student enrolling in a 4-year post-secondary institution are contained in Table 4. The random effect estimates are in Table 5.

Table 4: Fixed Effect Estimates for Seamless Enrollment in a 4-Year Post-Secondary Institution

Fixed Effects	Estimate	Std. Error	z value
γ_{00} : Intercept	-7.35	0.32	-23.03
β_1 Demo ₁ : Special Education (1=Yes)	-1.12	0.14	-7.88
β_2 Demo ₂ : Economically Disadvantaged (1=Yes)	-0.42	0.08	-5.04
β_3 Demo ₃ : Ethnicity = Black/Afr. Amer. (1=Yes)	0.22	0.20	1.08
β_3 Demo ₄ : Ethnicity = Hispanic/Latino (1=Yes)	-0.84	0.22	-3.86
β_3 Demo ₅ : Ethnicity = Nat. Amer. (1=Yes)	-0.48	0.41	-1.16
β_3 Demo ₆ : Ethnicity = Pac. Isl. (1=Yes)	-0.82	0.46	-1.78
β_3 Demo ₇ : Ethnicity = White (1=Yes)	-0.31	0.18	-1.73
β_4 Demo ₈ : English Language Learner (1=Yes)	-1.45	0.26	-5.48
β_5 Demo ₉ : Gender (1=Male)	0.06	0.06	1.01
β_{10} : GPA	2.26	0.07	34.61

Table 5: Random Effect Estimates for Seamless Enrollment in a 4-Year Post-Secondary Institution

School	μ_{0j} : Intercept (School-Level)
Austin East High School	0.40
Bearden High School	0.56
Career Magnet Academy	-0.59
Carter High School	-0.13
Central High School	-0.14
Farragut High School	0.50
Fulton High School	0.32
Gibbs High School	-0.63
Halls High School	-0.31
Hardin Valley Academy	0.19
Karns High School	-0.52
L & N Stem Academy	0.90
Paul Kelley Academy	-0.33
Powell High School	-0.62
South Doyle High School	-0.28
West High School	0.71

Example school-level plots for the probability of seamlessly enrolling in a 4-year post-secondary institution (for regular education students who identify as female, Hispanic, non-economically disadvantaged, and non-English language learner) are available in Figure 2.

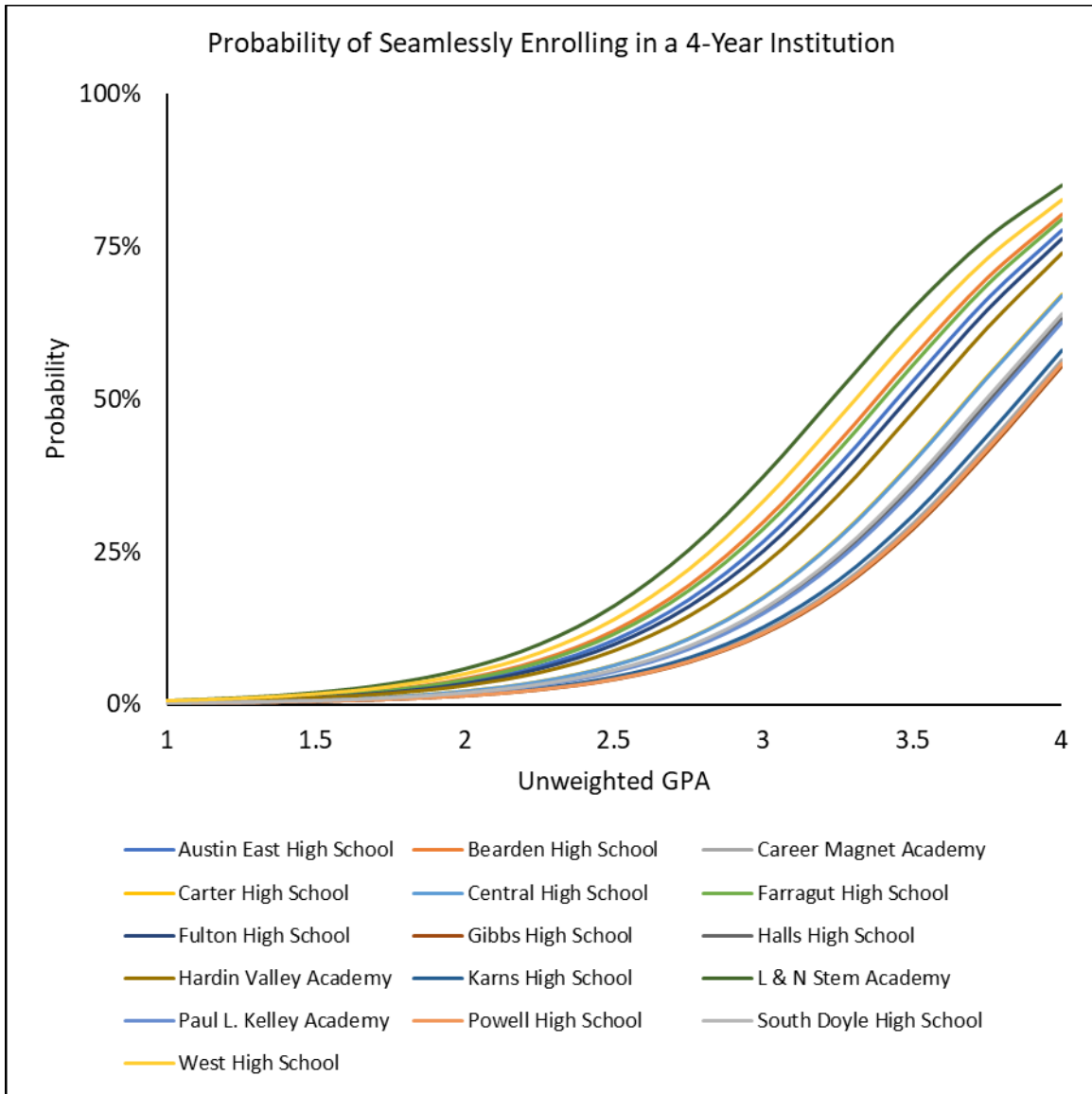


Figure 2: Probability of Seamless Enrollment in a 4-Year Post-Secondary Institution by GPA (Female, Hispanic, Non-Economically Disadvantaged, Non-English Language Learner, Non-Special Education)

Results: College Retention after Seamless Enrollment

The fixed effect estimates for calculating the probability of a student who seamlessly enrolls in a 2-year or 4-year institution and remaining enrolled into a second year are contained in Table 6. The random effect estimates are in Table 7.

Table 6: Fixed Effect Estimates for Retention After Seamless Enrollment

Fixed Effects	Estimate	Std. Error	z value
γ_{00} : Intercept	-5.62	0.57	-9.92
β_1 Demo ₁ : Special Education (1=Yes)	-0.20	0.15	-1.31
β_2 Demo ₂ : Economically Disadvantaged (1=Yes)	-0.34	0.11	-3.13
β_3 Demo ₃ : Ethnicity = Black/Afr. Amer. (1=Yes)	0.21	0.32	0.64
β_3 Demo ₄ : Ethnicity = Hispanic/Latino (1=Yes)	0.44	0.34	1.28
β_3 Demo ₅ : Ethnicity = Nat. Amer. (1=Yes)	-1.37	0.53	-2.58
β_3 Demo ₆ : Ethnicity = Pac. Isl. (1=Yes)	-0.57	0.65	-0.88
β_3 Demo ₇ : Ethnicity = White (1=Yes)	0.03	0.29	0.09
β_4 Demo ₈ : English Language Learner (1=Yes)	0.63	0.31	2.02
β_5 Demo ₉ : Gender (1=Male)	-0.16	0.09	-1.82
β_{10} : GPA	1.97	0.10	20.04
β_{11} : Grad HS = Bearden High School	1.51	0.32	4.64
β_{12} : Grad HS = Career Magnet Academy	0.28	0.40	0.70
β_{13} : Grad HS = Carter High School	0.54	0.35	1.52
β_{14} : Grad HS = Central High School	0.83	0.34	2.43
β_{15} : Grad HS = Farragut High School	1.57	0.33	4.74
β_{16} : Grad HS = Fulton High School	0.56	0.36	1.56
β_{17} : Grad HS = Gibbs High School	0.54	0.36	1.50
β_{18} : Grad HS = Halls High School	1.13	0.34	3.34
β_{19} : Grad HS = Hardin Valley Academy	1.12	0.32	3.48
β_{20} : Grad HS = Karns High School	0.47	0.33	1.40
β_{21} : Grad HS = L & N Stem Academy	2.04	0.39	5.21
β_{22} : Grad HS = Paul Kelley Academy	0.39	0.53	0.74
β_{23} : Grad HS = Powell High School	0.49	0.33	1.47
β_{24} : Grad HS = South Doyle High School	0.63	0.35	1.79
β_{25} : Grad HS = West High School	1.10	0.33	3.30

Table 7: Random Effect Estimates for Retention After Seamless Enrollment

Post-Secondary Institution	μ_{0j} : Intercept (Institution-Level)
Carson-Newman University	0.30
East Tennessee State University	0.21
Middle Tennessee State University	0.46
Pellissippi State Community College	-0.43
Roane State Community College	-0.71
South College	-0.81
Tennessee Technological University	0.47
University of Tennessee Knoxville	0.27
University of Tennessee Chattanooga	0.16

Example college-level plots for the probability of post-secondary retention (for regular education students who identify as female, Hispanic, non-economically disadvantaged, and non-English language learner and graduated from Central High School) are available in Figure 3.

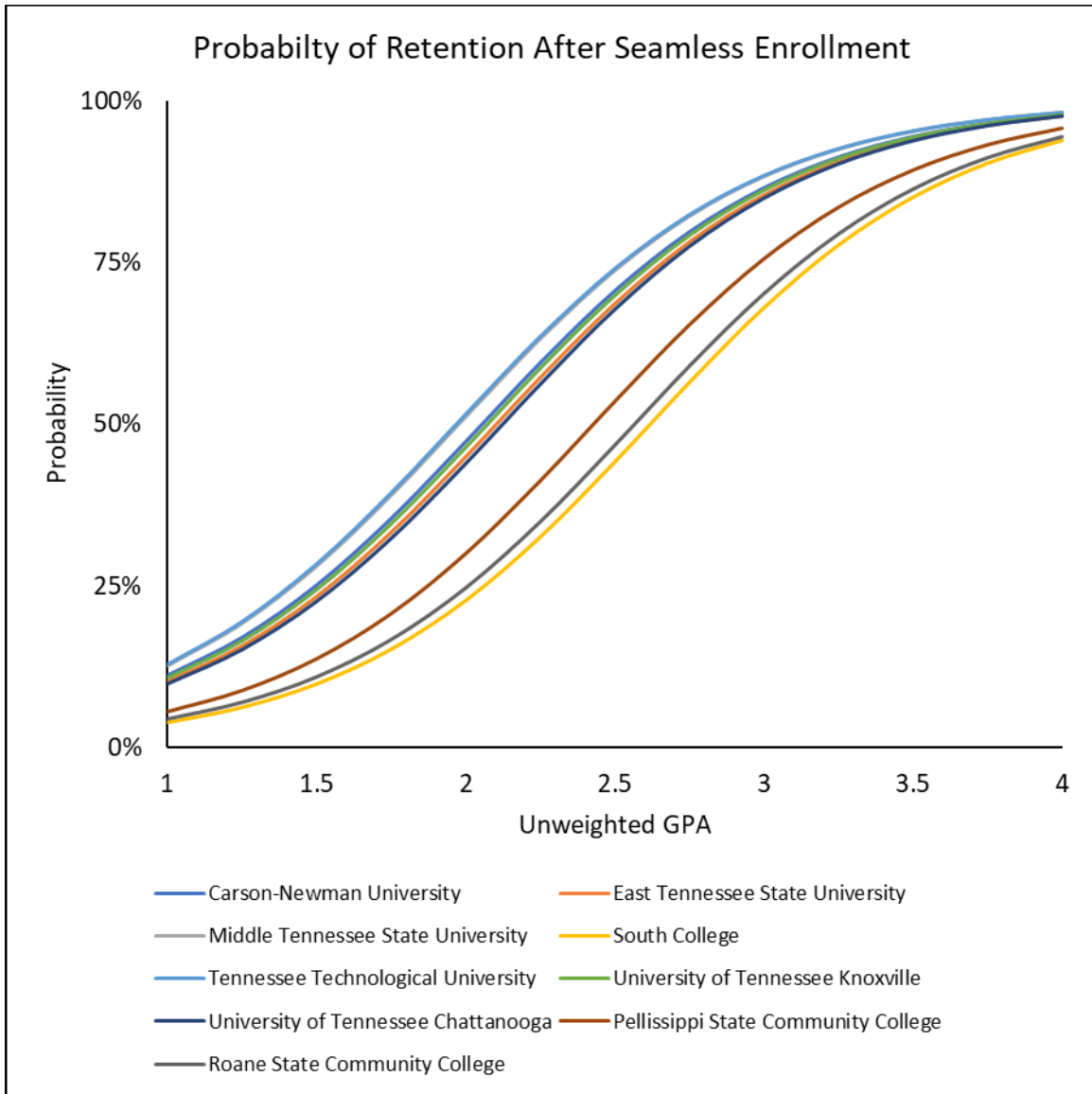


Figure 3: Probability of Retention After Seamless Enrollment by GPA (Female, Hispanic, Non-Economically Disadvantaged, Non-English Language Learner, Non-Special Education, Central High School Graduate)

Conclusions & Considerations

This project was conducted at the request of Knox County counselors to facilitate student-level conversations regarding post-secondary opportunities. Counselors were supplied with an electronic tool to produce estimated probabilities of seamless enrollment and retention for the students they serve.

A significant amount of school-to-school variation exists in the relationship between unweighted GPA and the probability of seamless enrollment in a post-secondary institution. A previous REA study suggests that the school-to-school variation may not be completely attributed to variations in grading practices (Sattler 2020). Counseling staff may be better positioned to support students with a deeper understanding of contextual factors that influence post-secondary enrollment (economic concerns, community values, student interest, etc.). Additionally, the post-secondary retention models show distinct clustering of probability distributions. Typically, students who seamlessly enroll in 4-year post-secondary institutions have a much higher probability of being retained into a second year. The exception appears to be South College, which clusters with the 2-year institutions included in this study. Although there may be few district-level policy implications related to these findings, the information contained in this report may help inform future research questions.

References

Center for Education Policy Research. (2020). Knox County Schools Best for All Attainment Report. Harvard University.

Sattler, C. (2020). School-to-School Variation in ACT and GPA. Knox County Schools Department of Research, Evaluation, and Assessment.