# Has the Relationship Between College Readiness Measures and Developmental Course Placement Changed in Recent Years?

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May 2024

# Conclusions

This study highlights the relationship between high school GPA, ACT Composite score, and the likelihood of developmental course placement in college. Higher high school GPAs and ACT Composite scores were associated with lower probabilities of developmental course placement. This study also highlights how this relationship between college readiness measures and developmental course placement has evolved over time. While the relationship between high school GPA and developmental course placement has had notable increases over time, the relationship between ACT Composite score and developmental course placement has been relatively stable.

# So What?

The changes that were observed and the relationship between high school GPA and developmental course placement may suggest that colleges are adjusting their interpretation of high school grades due to grade inflation. The presence of an interaction relationship between high school grades and ACT Composite scores suggests that colleges are using both measures to assess academic preparedness, recognizing the multifaceted nature of student preparation.

# Now What?

This study recommends a holistic approach to developmental course placement that uses multiple measures rather than relying on only a single criterion such as high school grades or ACT Composite score alone. This approach aligns with best practices and can lead to a more equitable and effective education journey for students.

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# Introduction

For some students, enrollment in college may include needing to take remedial or developmental courses during their first year (Parsad & Lewis, 2003). In the class of 2020, 31.4% of students in four-year colleges took at least one remedial or developmental course (U.S. Department of Education, 2023). Some research has suggested that having enrolled in developmental coursework was found to be negatively associated with degree completion. Adelman (2004) found that 70% of college-going students in the class of 1992 who required remedial reading completed no college credential. Noble and Sawyer (2013) found that students with developmental course needs were generally less successful than students without developmental course needs in terms of high school GPA (HSGPA), persistence over time, and degree completion within a set time period.

Sanabria et al. (2020) found that students who successfully completed remedial coursework were more likely to graduate from college, and those who failed remedial courses were less likely to earn a bachelor's degree and took longer to graduate. Bahr (2008) found that remedial math courses were effective for resolving skill deficiencies. Bettinger and Long (2005) also found that students who completed their remedial courses had similar, if not better, degree outcomes as students who did not take remedial coursework. Taking developmental courses can also have a significant impact on a student's retention to the second year (Bettinger & Long, 2009). These findings indicate the significance of being able to predict who will be enrolled in developmental coursework.

Both HSGPA and ACT test scores have been shown to be effective for the purpose of placing students into first-year remedial college courses (Sawyer, 1989). There is, additionally, some evidence to suggest that using high school transcript data instead of standardized test scores can significantly reduce misplacement into developmental courses (Scott-Clayton et al., 2014).

Prior studies have documented the historical predictive validity of both HSGPA and ACT test scores (Randunzel & Noble, 2012; Sanchez, 2013; Steedle et al., 2019; Radunzel & Mattern, 2020). Sanchez (In Press) found that HSGPA and ACT Composite scores historically predict first-year college GPA (FYGPA). However, after the onset of the pandemic, HSGPA resulted in lower FYGPA predictions than prepandemic HSGPA, indicating potential impacts of high school grade inflation. That study further found that using only prepandemic HSGPA for predictions could lead to overprediction of students' actual performance postpandemic. In contrast, predictions using ACT test scores alone or in combination with HSGPA were more accurate. These five studies have documented the utility of using HSGPA and ACT test scores to predict college outcomes such as FYGPA, cumulative hours earned, taking developmental courses, cumulative college GPA, and graduation. These findings highlight the need for colleges to consider the potential impact of grade inflation and altered grading policies before, during, and after the onset of the pandemic.

In this study, I explore how HSGPA and ACT Composite scores relate to placement into developmental coursework. As colleges evaluate students' readiness for college courses, they are likely to use multiple measures, including these two academic achievement measures or related measures (e.g., ACT section test scores and subject-specific HSGPA). In practice, colleges may have several options for students to meet criteria for credit-bearing courses. In these situations, a student need only meet one of the criteria to qualify. At ACT, we recommend the use of multiple measures for admissions and course placement decisions.

As we look back on the impact of the COVID-19 pandemic, we have mounting evidence that college students were negatively affected in nonacademic ways. For example, college students experienced increased symptoms of mood disorders, perceived stress, and alcohol use, with worries about COVID-19 negatively impacting their well-being (Charles et al., 2021). Additionally, the pandemic led to anxiety, depression, and sleep disturbances among college students (Tasso et al., 2021). Among first-year university students, the pandemic impacted mood and wellness behaviors as well (Copeland et al., 2021).

In this study, I propose that the impacts of and the changes that resulted directly from the COVID-19 pandemic may have affected the decision-making policies of the colleges being examined. For example, schools may have been more lenient about making strict cutoffs due to the widespread nonacademic impacts on students during the COVID-19 pandemic. In addition, the impact of the COVID-19 pandemic on HSGPA and ACT Composite scores may have influenced developmental course placement decisions.

Sanchez and Moore (2022) found that, even after accounting for student and school characteristics, the average HSGPA has increased from 3.17 in 2010 to 3.36 in 2021. Further, they found that, while there was evidence of grade inflation throughout the entire period examined, the rate of grade inflation dramatically increased after 2016. Between 2016 and 2021, there was a dramatic increase in high school grades relative to grades being assigned in 2010. One of the problematic causes of grade inflation is the increasing variation in grading standards across high schools. In the college admissions context, this means that a 4.0 from one school may not indicate the same level of content mastery as a 4.0 from another school. While HSGPA is still an important predictor of future outcomes, this reduces its utility in evaluating college applicants. In addition, the nonacademic components of HSGPA may be particularly susceptible to the impact of the COVID-19 pandemic. These well-documented concerns about grade inflation across time, the nonacademic components in HSGPA, the differences in coursework taken, and the variability in grading standards result in an unstandardized and potentially problematic way to compare students.

As a result of the academic and nonacademic impacts of the COVID-19 pandemic on HSGPA and ACT scores, it is beneficial to take a retrospective look at the relationship between these achievement measures (HSGPA and ACT Composite score) and college developmental course placement. This study can provide insight into the impact on college course placement practices resulting from the unprecedented interruptions from the COVID-19 pandemic, as well as the changing interpretations of HSGPA due to grade inflation. The present study explores both the individual contributions as well as the combined utility of these achievement measures.

## This study addresses the following research questions:

1. In what ways has the relationship between the likelihood of developmental course placement and HSGPA alone changed prior to and after the onset of the pandemic?

2. In what ways has the relationship between the likelihood of developmental course placement and ACT Composite score alone changed prior to and after the onset of the pandemic?

3. In what ways has the relationship between the likelihood of developmental course placement and the readiness measures HSGPA and ACT Composite score combined changed prior to and after the onset of the pandemic?

# Methods

## Sample

The study sample included students who took the ACT test in a state that provides the ACT test to all 11th-grade students during the school day. With a focus on public high school graduates from 2017 to 2021, the study included students who enrolled in a public four-year college, either part-time or full-time, in the same state during the fall after graduating from high school (Table 1). Five cohorts were defined as students who enrolled in college in fall 2017 through fall 2021. Overall, the sample consisted of 40,194 students from 10 different institutions who had provided their HSGPA at ACT registration.

**Table 1.** Sample Characteristics

| Characteristics | | 2017 | 2018 | 2019 | 2020 | 2021 |
|---|---|---|---|---|---|---|
| Family Income (n(%)) | < $36K | 2,315 (26.5) | 2,109 (24.5) | 1,844 (23.6) | 1,709 (22.0) | 1,304 (17.9) |
| | $36K–$60K | 1,839 (21.0) | 1,703 (19.8) | 1,527 (19.6) | 1,343 (17.3) | 1,049 (14.4) |
| | $60K–$100K | 2,020 (23.1) | 1,910 (22.2) | 1,787 (22.9) | 1,617 (20.8) | 1,407 (19.3) |
| | > $100K | 1,801 (20.6) | 1,932 (22.5) | 1,797 (23.0) | 1,728 (22.3) | 1,688 (23.2) |
| | Missing | 763 (8.7) | 944 (11.0) | 855 (10.9) | 1,367 (17.6) | 1,836 (25.2) |
| Race/Ethnicity (n(%)) | Asian | 203 (2.3) | 212 (2.5) | 216 (2.8) | 199 (2.6) | 213 (2.9) |
| | Black | 1,376 (15.7) | 1,348 (15.7) | 1,130 (14.5) | 1,188 (15.3) | 1,029 (14.1) |
| | Hispanic | 679 (7.8) | 589 (6.9) | 605 (7.7) | 697 (9.0) | 684 (9.4) |
| | White | 5,722 (65.5) | 5,645 (65.7) | 5,081 (65.1) | 4,930 (63.5) | 4,407 (60.5) |
| | Other | 438 (5.0) | 486 (5.7) | 458 (5.9) | 376 (4.8) | 373 (5.1) |
| | Missing | 320 (3.7) | 318 (3.7) | 320 (4.1) | 374 (4.8) | 578 (7.9) |
| Gender (n(%)) | Female | 4,964 (56.8) | 4,869 (56.6) | 4,369 (55.9) | 4,382 (56.4) | 3,980 (54.6) |
| | Male | 3,774 (43.2) | 3,622 (42.1) | 3,318 (42.5) | 3,197 (41.2) | 2,843 (39.0) |
| | Another Gender/ Missing | 0 (0.0) | 107 (1.2) | 123 (1.6) | 185 (2.4) | 461 (6.3) |
| Developmental Course Taken (n(%)) | English | 842 (9.6) | 793 (9.2) | 613 (7.8) | 693 (8.9) | 631 (8.7) |
| | Math | 1,551 (17.8) | 1,880 (21.9) | 1,767 (22.6) | 1,773 (22.8) | 1,768 (24.3) |
| | Reading | 346 (4.0) | 307 (3.6) | 296 (3.8) | 310 (4.0) | 88 (1.2) |
| | Any Course | 1,939 (22.2) | 2,233 (26.0) | 2,058 (26.4) | 2,136 (27.5) | 2,045 (28.1) |
| ACT Composite (mean (SD)) | | 22.3 (4.67) | 22.5 (4.80) | 22.5 (4.86) | 22.3 (5.00) | 21.9 (5.12) |
| HSGPA (mean(SD)) | | 3.4 (0.49) | 3.5 (0.47) | 3.5 (0.46) | 3.6 (0.43) | 3.6 (0.42) |
| N | | 8,738 | 8,598 | 7,810 | 7,764 | 7,284 |

Over the five cohorts examined, from 2017 to 2021, the percentage of students from families whose income was less than $36,000, $36,000 to $60,000, and $60,000 to $100,000 tended to decrease while the percentage of students who came from families with incomes over $100,000 tended to increase. There was a notable increase in students not providing their family income beginning in the 2020 cohort. In the same time period, the percentage of Hispanic students increased from 7.9% in 2017 to 9.4% in 2021. The percentage of Asian students increased slightly from 2.3% in 2017 to 2.9% in 2021. At the same time, the percentage of Black students decreased from 15.7% in 2017 to 14.1% in 2021. Overall, the percentage of students who did not report their race/ethnicity increased from 3.7% in 2017 to 7.9% in 2021. In addition, the percentage of students taking developmental English decreased from 9.6% in 2017 to 8.7% in 2021 as did the percentage of students taking developmental reading: 4.0% to 1.2%. The percentage of students taking developmental math increased substantially from 17.8% in 2017 to 24.3% in 2021. Lastly, while the average ACT Composite score decreased from 22.3 in 2017 to 21.9 in 2021, HSGPA increased from 3.4 in 2017 to 3.6 in 2021. Across cohorts, there may have been an effect of the pandemic and the number of students not reporting their family income, race/ethnicity, and gender beginning in 2020.

## Measures

**ACT Composite.** The ACT Composite scores used in the study could either be from a state and district school-day ACT test or a national ACT test administration. In cases where students took the ACT test multiple times, the study used the latest ACT test score obtained through July of their high school graduation year.

**Cumulative High School GPA.** Students' cumulative high school GPA (HSGPA) was calculated by averaging self-reported grades in up to 23 courses in English, mathematics, social studies, and natural science. Research by Sanchez and Buddin (2016) revealed a strong correlation between students' self-reported HSGPA and their transcript GPA. Additionally, other studies support the use of self-reported data for research purposes (Camara et al., 2003; Kuncel et al., 2005; Shaw & Mattern, 2009).

**Developmental Course-Taking.** Developmental course placement indicators for English, math, and reading were obtained from the first full year student transcripts at the institutions where students enrolled immediately after high school. If students had a record of taking a developmental course in either the fall or spring semester in either English, math, or reading, they were categorized as having taken at least one developmental course. As part of the decision-making process for placing students into a developmental course, colleges in this state followed the state higher education department's guidelines.

## Data Analysis

In this analysis, students were nested within colleges. Hierarchical logistic regression modeling was used to examine the relationship between the predictors (HSGPA and ACT Composite score) and college developmental course placement (see Appendix for regression model results, including the standardized regression coefficients). The hierarchical models included random intercepts and random slope terms. In each of the models that included either HSGPA alone or ACT Composite score alone, an interaction term was also included with each cohort. In the model that included both HSGPA and ACT Composite score, interaction terms were included between the two achievement measures as well as between each achievement measure and cohort.

In order to evaluate model fit, Akaike Information Criterion (AIC), the Bayesian Information Criterion (BIC), and area under the curve (AUC) were examined. AIC and BIC are used to compare different models to select which explains the data best with the fewest parameters. Comparing AIC and BIC values between models, lower values are considered indicators of better model fit. AUC provides an overall measure of a model's ability to discriminate between classification levels: in this case, being classified as placed in developmental courses or not. AUC can be interpreted as the probability that the model will rank a chosen positive instance higher than a randomly chosen negative one. For example, an AUC of 0.8 indicates that there's an 80% chance that the model will be able to correctly classify an individual as being placed into a developmental course.

# ➡ Results

## Descriptive Statistics

In the study sample, the first, second, and third quartiles for HSGPA were 3.25, 3.63, and 3.89, respectively. The average HSGPA was 3.51. The first, second, and third quartiles for ACT Composite score were 19, 22, and 26, respectively. The average ACT Composite score was 23.31. In the study sample, 25.9% of students were placed in at least one developmental course, and 74.1% were only placed into standard credit-bearing courses. Furthermore, the percentage of students who had taken an English, math, or reading developmental education course were 8.9%, 21.7%, and 3.4%, respectively.
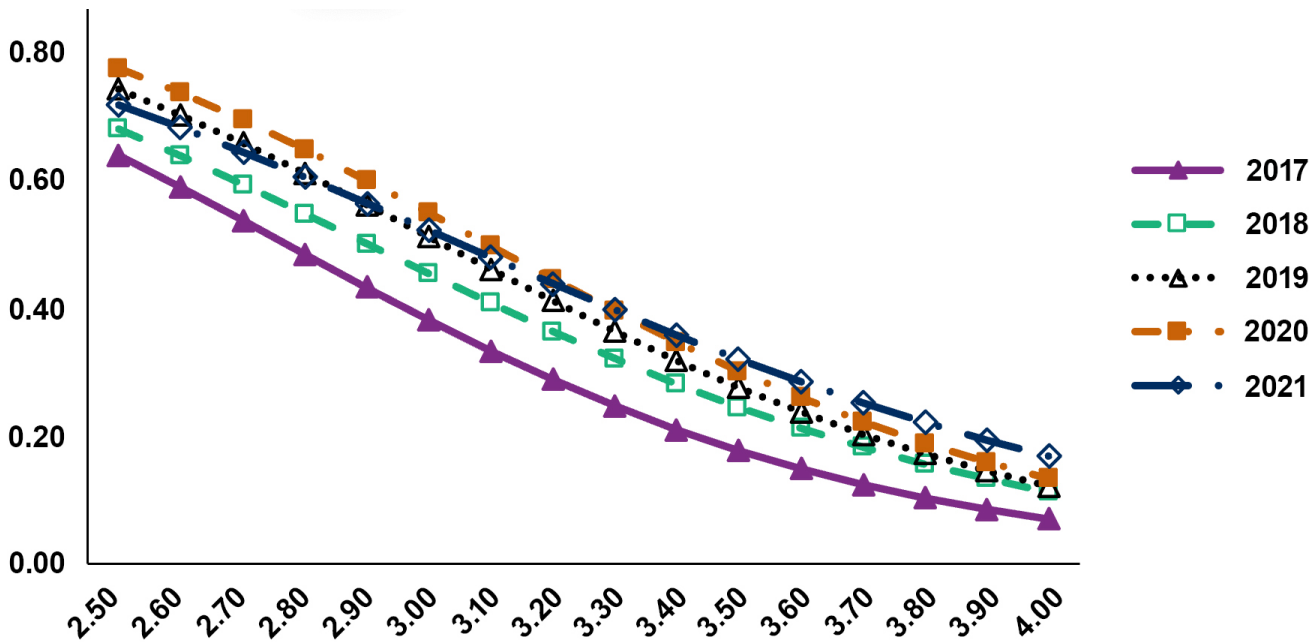
## Research Question 1

In what ways has the relationship between the likelihood of developmental course placement and HSGPA alone changed prior to and after the onset of the pandemic?

**HSGPA.** As HSGPA increased, the probability of developmental course placement decreased ([Figure 1](#)). In the entering 2017–2020 cohorts, the probability of developmental course placement increased each year. This trend continued for the incoming 2021 cohort for students who had an HSGPA of 3.3 or higher. For students in the 2021 cohort who had an HSGPA below 3.3, we see that the probability of developmental course placement was lower than that for the 2020 cohort and similar to that for the entering 2019 cohort. For students with a 3.0 HSGPA in the 2017, 2018, 2019, 2020, and 2021 entering cohorts, the probability of developmental course placement was 0.38, 0.45, 0.51, 0.55, and 0.52, respectively. The HSGPA model had AIC, BIC, and AUC values of 33,721.04, 33,724.67, and 0.78, respectively.

We can see in [Figure 1](#) that, preceding the onset of the COVID-19 pandemic, the incoming 2017 cohort, across much of the HSGPA scale (this prepandemic cohort), tended to have the lowest probability of developmental course placement. The entering 2019 through 2021 cohorts tended to have notably higher probabilities of developmental course placement.

**Figure 1.** Probability of Developmental Course Placement by HSGPA



*Note.* Values of HSGPA from 2.5 to 4.0 are plotted. An HSGPA of 2.5 roughly corresponded with the 5th percentile of HSGPA scores.

## Research Question 2

In what ways has the relationship between the likelihood of developmental course placement and ACT Composite score alone changed prior to and after the onset of the pandemic?

**ACT Composite.** Over the ACT Composite scale, small differences were observed in the probability of developmental course placement between the incoming cohorts of 2017, 2018, 2019, 2020, and 2021 (Figure 2). For example, in the years of 2017, 2018, 2019, 2020, and 2021 students who scored an ACT Composite score of 18 had a 0.48, 0.55, 0.54, 0.52, and 0.48 probability of developmental course taking, respectively. For students with a score of 21, the probabilities of developmental course-taking for the same years were 0.15, 0.23, 0.25, 0.24, and 0.22, respectively. Between ACT Composite scores of 18 and approximately 25, the entering 2017 cohort functioned differently than other cohorts with the probabilities of developmental course placement being lower than subsequent years. There was very little difference in the probability of developmental course placement for the cohorts immediately before the onset of the pandemic (the 2018 and 2019 cohorts) and the 2020 and 2021 cohorts after the onset of the pandemic.

The ACT Composite score alone model had AIC, BIC, and AUC values of 30,618.75, 30,622.08, and 0.87, respectively. In comparing the AIC and BIC values for the HSGPA model, the ACT Composite score model exhibited better model fit in predicting developmental course placement. When comparing the AUC values, we can also see that the ACT Composite score model was better able to predict developmental course placement in comparison to the HSGPA model.

**Figure 2.** Probability of Developmental Course Placement by ACT Composite Score
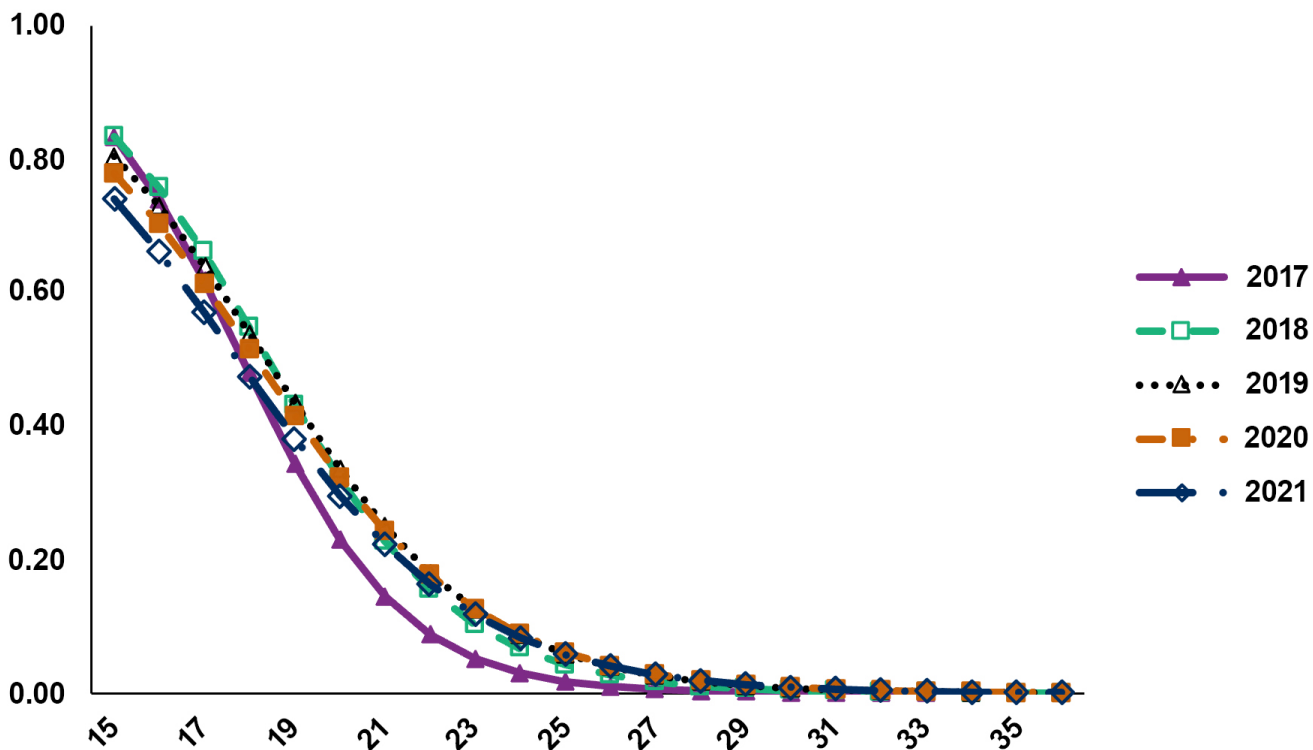


## Research Question 3

In what ways has the relationship between the likelihood of developmental course placement and the readiness measures HSGPA and ACT Composite score combined changed prior to and after the onset of the pandemic?

**ACT Composite and HSGPA Together.** Figure 3 illustrates that an increase in HSGPA was associated with a decrease in the probability of developmental course placement, even when controlling for ACT Composite score. For example, for an ACT Composite score of 21 and HSGPA values of 2.5, 3.0, 3.5, or 3.75, the average probability of developmental course placement across cohorts was 0.49, 0.33, 0.20, and 0.15, respectively. This illustrates that colleges interpreted increases in HSGPA as an increase in college course readiness above and beyond readiness as indicated by ACT Composite score. Across HSGPA and ACT Composite score ranges, the probability of developmental course placement tended to be lowest for the entering 2017 cohort over much of the ACT Composite scale. Figure 3 illustrates that holding HSGPA constant, increases in ACT Composite score were interpreted by colleges as an increase in college course readiness. For example, for an HSGPA of 3.0, the average probability of developmental course placement across cohorts for ACT Composite scores of 15, 21, and 30 was 0.82, 0.33, and 0.02, respectively.

It is also notable in Figure 3 that as HSGPA increased, the stability of the probability of developmental course placement across cohorts also increased, conditioned on ACT Composite score. This is most dramatically seen with a lower HSGPA of 2.5. For students with an HSGPA of 2.5 and ACT Composite score of 20, the probability of developmental course placement in the entering 2017, 2018, 2019, 2020, and 2021 cohorts was 0.48, 0.54, 0.62, 0.61, and 0.53, respectively. This suggests that over the cohorts examined, the relationship between HSGPA and ACT Composite score was shifting for students with a low HSGPA. This was seen less for students with a higher HSGPA, however. For example, students with a 3.5 HSGPA and a 23 ACT

Composite score had a probability of developmental course placement of 0.04, 0.09, 0.11, 0.12, and 0.11 across cohorts. It is also worth noting that as HSGPA increased, the rate of decrease in predicted probability of developmental course placement associated with an increase in ACT Composite score also increased. This can be seen in Figure 3 by the steeper slopes associated with the logistic curves at higher HSGPA levels.

Across cohorts, the combinations of HSGPA and ACT Composite score needed to attain a less than 0.50 probability of developmental course placement was relatively stable and became more similar at higher HSGPAs. Across cohorts, students with a 2.5 HSGPA needed to have attained an ACT Composite score of at least a 20, 21, 22, 22, and 21 in each of the respective cohorts to have a less than 0.50 probability of developmental course placement. Students with a 3.0 HSGPA needed to have attained an ACT Composite score of at least 19, 20, 20, 20, and 19 to have a less than 0.50 probability of developmental course placement. For students with a 3.5 HSGPA, they would have needed to attain an ACT Composite score of 18 in the incoming 2017 and 2021 cohorts and a score of 19 in the incoming 2018, 2019, and 2020 cohorts to have a less than 0.50 probability of developmental course placement. With an HSGPA of 3.75, students would have needed to attain an ACT Composite score of 18 across cohorts to have a less than 0.50 probability of developmental course placement.

This demonstrates that, while there was some variability of one to two scale score points across cohorts in attaining a 0.50 probability of developmental course placement, it appears that colleges are using both achievement measures in a compensatory manner to make inferences about students' academic readiness.

The entering 2017 cohort appears to be an outlier in having unusually low probabilities of developmental course placement. For HSGPAs of 2.5 and 3.0, we can see that, in the entering 2018 cohort for students with an ACT Composite score above 16, probabilities of developmental course placement were lower than those in the 2019 cohort as well as the subsequent 2020 cohort. The 2019 and 2020 cohorts for these two HSGPAs tended to have the highest probabilities of developmental course placement. At these HSGPAs, the incoming 2021 cohort had probabilities of developmental course placement that were lower than the entering 2019 and 2020 cohorts. At an HSGPA of 2.5, the 2021 cohort had lower probabilities of developmental course placement than the 2018 cohort when associated with an ACT Composite score of less than 20; however, the opposite was true for higher ACT Composite scores. At an HSGPA of 3.0, the 2021 cohort had lower probabilities of

developmental course placement then the 2018, 2019, and 2020 cohorts for an ACT Composite score of less than 20. The differences in probabilities of developmental course placement were very small across the 2018–2021 cohorts for students with an HSGPA of 3.5 or 3.75 and ACT Composite scores at or above 20.

The combined HSGPA and ACT Composite score model had an AIC, BIC, and AUC of 25,210.49, 25,216.24, and 0.89, respectively. The AIC and BIC values for the combined model were considerably lower than those for the ACT Composite score alone model, indicating better model fit than either the ACT test score alone or the HSGPA alone models. This model also had a higher AUC value then either the ACT Composite score alone or HSGPA alone model, indicating that this model could better predict developmental course placement.

**Figure 3.** Probability of Developmental Course Placement by HSGPA and ACT Composite Score
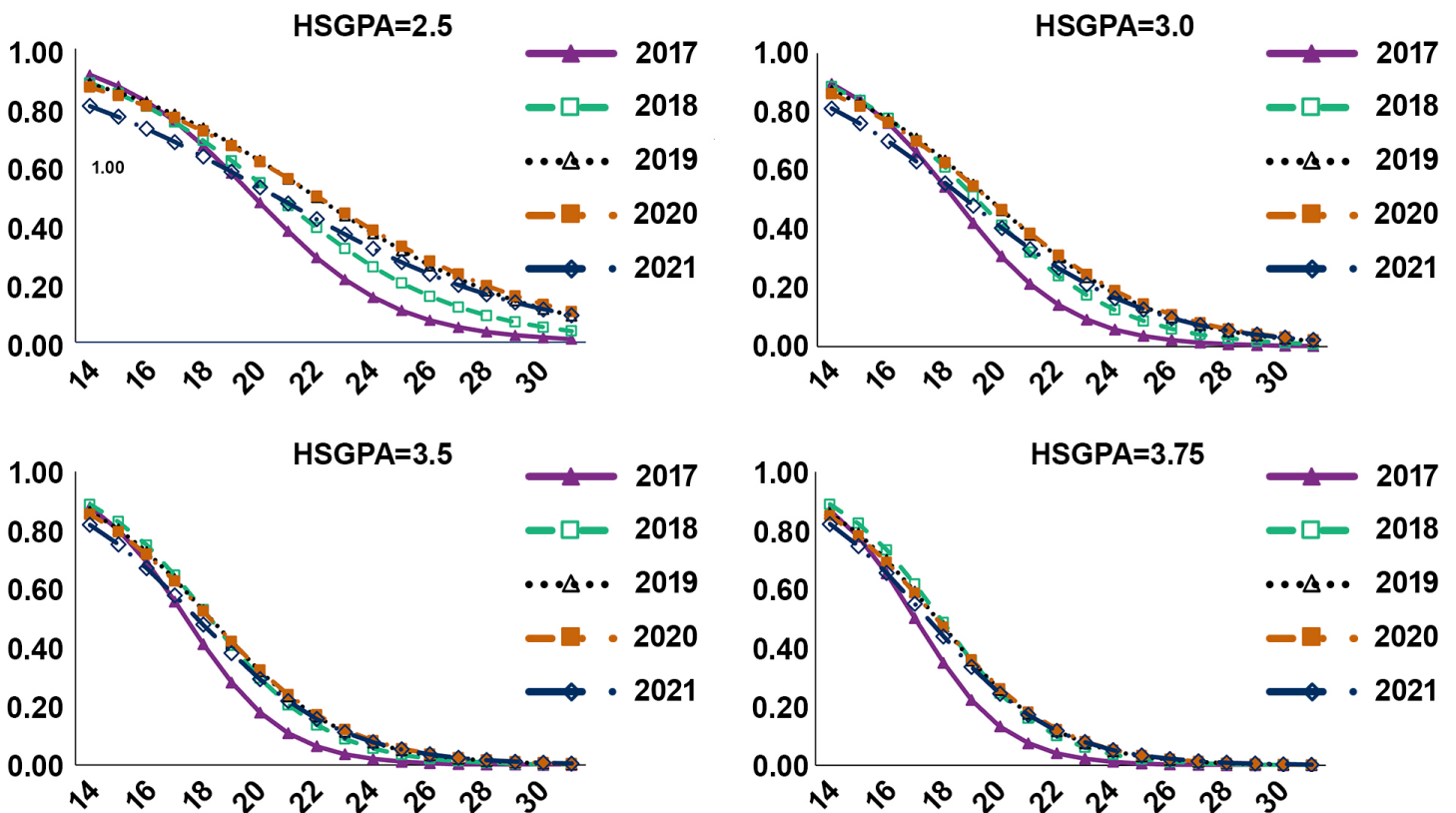
# ➡️ Discussion

This study explored how course placement decisions at one state's colleges are related to high school GPA (HSGPA) and ACT Composite score and how those relationships have changed over time. In addition, I was able determine how students' general readiness relates to developmental course placement. HSGPA and ACT test scores can be used as two of several criteria for developmental course placement. In the colleges used in this study, developmental course placement criteria included standardized and normed exams such as the ACT and SAT, high school academic performance, assessment of students' motivation to succeed, or other measures that were sufficiently supported by predictive validity analyses such as ACCUPLACER. In practice, colleges are likely using subject-relevant achievement data to make placement decisions.

The study highlights the differences in the probability of developmental course placement for students of varying HSGPAs. As expected, as HSGPA increases, the probability of developmental course placement decreases. These probabilities also change substantially across cohorts. This was not the case for ACT Composite score, however. As with HSGPA, an increase in ACT Composite score was associated with a decrease in the probability of developmental course placement. Across cohorts, there tended to be very little difference in the probability of developmental course placement for students with the same ACT Composite score. Given that both achievement measures are included in many developmental course placement policies, it is not surprising to find they have a strong relationship with developmental course placement. If ACT cut scores were used for developmental course placement, this could account for the strength of the relationship between ACT Composite score and developmental course placement.

It is notable that substantial differences in the probabilities of developmental course placement for students with the same HSGPA were seen across cohorts prior to and after the onset of the COVID-19 pandemic in 2020. This suggests that colleges may have been adjusting their interpretation of HSGPA due to grade inflation. Figure 1 clearly demonstrates a pattern of change in the relationship between HSGPA and developmental course placement across time. This figure is also consistent with the effects of grade inflation for the entering cohorts of 2017 to 2020. We saw that as years progressed, the probability of developmental course placement increased.

This study reveals an important relationship between HSGPA and ACT Composite scores and the probability of developmental course placement. As illustrated in Figure 3, HSGPA and ACT Composite score provide incremental information to be used by colleges to assess academic preparedness. This more holistic way to look at students' college readiness acknowledges the multifaceted nature of student abilities and potential for success in college. This may also suggest that colleges are interpreting ACT scores as more stable over time for students with higher HSGPAs, relative to students with low HSGPAs. In the context of a grade inflation lens, it may be that colleges are more concerned about grade inflation at lower levels of HSGPA than at higher levels of HSGPA.

This study also highlights the importance of colleges adopting a more holistic approach to developmental course placement. The use of multiple measures for developmental course placement not only aligns with best practices but can also help to facilitate a more equitable and effective education journey for students. In practice, it may be easier to use only a single measure for developmental course placement; however, using multiple measures allows for a compensatory methodology to better understand student performance and preparation for college. Sanchez (In Press) found that the use of both HSGPA and ACT Composite score for predicting FYGPA was more effective than using either alone. This approach using multiple measures can be extended to making course placement decisions.

# ➡️ Limitations

The study was limited to students who took the ACT test and enrolled in a public four-year institution in the same state immediately after high school. This necessarily excludes certain students who attended private institutions or community colleges or those who delayed college enrollment. Additionally, as this study used data from one state, its generalizability to the broader population of U.S. high school graduates and college enrollees may be limited. Further, colleges were given guidelines by the higher education department in the state as to how to establish their developmental course placement decisions. Institution-specific decisions were not available for this analysis.

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# Appendix

**Table A1.** Standardized Coefficients for Modeling Developmental Course Placement With HSGPA Score Alone

| Effect | Incoming Cohort | Estimate | StdErr | tValue | P-value |
|--------|-----------------|----------|--------|--------|---------|
| Intercept | — | −0.99 | 0.15 | −6.82 | <.01 |
| Cohort | 2017 | −0.57 | 0.05 | −11.92 | <.01 |
| | 2018 | −0.16 | 0.04 | −3.58 | <.01 |
| | 2020 | 0.12 | 0.05 | 2.80 | 0.06 |
| | 2021 | 0.21 | 0.05 | 4.73 | <.01 |
| HSGPA | — | −0.93 | 0.07 | −12.97 | <.01 |
| HSGPA*cohort | 2017 | −0.04 | 0.04 | −0.89 | 0.38 |
| | 2018 | 0.07 | 0.04 | 1.54 | 0.12 |
| | 2020 | −0.02 | 0.05 | −0.50 | 0.61 |
| | 2021 | 0.16 | 0.05 | 3.32 | 0.01 |

**Table A2.** Standardized Coefficients for Modeling Developmental Course Placement With ACT Composite Score Alone

| Effect | Incoming Cohort | Estimate | StdErr | tValue | P-value |
|--------|-----------------|----------|--------|--------|---------|
| Intercept | — | −1.65 | 0.13 | −12.35 | <.01 |
| Cohort | 2017 | −0.87 | 0.07 | −12.44 | <.01 |
| | 2018 | −0.19 | 0.06 | −3.24 | <.01 |
| | 2020 | −0.01 | 0.06 | −0.18 | 0.86 |
| | 2021 | −0.11 | 0.06 | −1.74 | 0.08 |
| ACT Composite | — | −2.05 | 0.05 | −39.38 | <.01 |
| ACT Composite*cohort | 2017 | −0.71 | 0.08 | −8.54 | <.01 |
| | 2018 | −0.26 | 0.07 | −3.53 | <.01 |
| | 2020 | 0.10 | 0.07 | 1.40 | 0.16 |
| | 2021 | 0.17 | 0.07 | 2.48 | 0.01 |

**Table A3.** Standardized Coefficients for Modeling Developmental Course Placement with ACT Composite Score and HSGPA Together

| Effect | Incoming Cohort | Estimate | StdErr | tValue | P-value |
|---|---|---|---|---|---|
| Intercept | — | −1.78 | 0.12 | −15.16 | <.01 |
| Cohort | 2017 | −1.11 | 0.08 | −13.80 | <.01 |
|  | 2018 | −0.23 | 0.07 | −3.46 | <.01 |
|  | 2020 | 0.06 | 0.07 | 0.85 | 0.40 |
|  | 2021 | −0.04 | 0.07 | −0.53 | 0.60 |
| ACT Composite | — | −2.13 | 0.17 | −12.38 | <.01 |
| HSGPA | — | −0.77 | 0.07 | −10.74 | <.01 |
| ACT Composite*HSGPA | — | −0.41 | 0.03 | −15.17 | <.01 |
| HSGPA*cohort | 2017 | −0.08 | 0.05 | −1.68 | 0.09 |
|  | 2018 | 0.09 | 0.05 | 1.94 | 0.05 |
|  | 2020 | 0.02 | 0.05 | 0.32 | 0.74 |
|  | 2021 | 0.12 | 0.05 | 2.16 | 0.03 |
| ACT Composite*cohort | 2017 | −0.73 | 0.09 | −7.83 | <.01 |
|  | 2018 | −0.27 | 0.08 | −3.24 | <.01 |
|  | 2020 | 0.08 | 0.08 | 0.92 | 0.36 |
|  | 2021 | 0.17 | 0.08 | 2.07 | 0.04 |

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