Predictors and Indicators of College Readiness and Success

Presented by the national Regional Educational Laboratory (REL) College and Career Readiness (CCR) Workgroup
The Regional Educational Laboratory (REL) Program

- 10 Regions
- Bridging research, policy, and practice
Goals of the Webinar

• Learn about indicators identifiable throughout a student’s high school and early college years that predict enrollment, persistence, and success in college courses.

• Understand methodologies used to identify and validate predictors of college and career readiness across the studies presented.
Agenda

• Screening students for **college readiness**

• Using **high school data** to understand college readiness in the Pacific

• Exploring the foundations of the **future Science, Technology, Engineering, and Mathematics (STEM) workforce**: K-12 indicators of postsecondary STEM success

• Indicators of **early college success**

• Audience Questions and Answer
A guide to developing and evaluating a college readiness screener

A college readiness screener can help colleges and school districts better identify students who are not ready for college credit courses. This guide describes the steps for developing a college readiness screener. For colleges that already have a screener, this guide discusses several issues to consider in evaluating its accuracy.

Why use a screener?

Half of all undergraduates take one or more developmental education courses (sometimes called remedial coursework), at an average annual cost of $7 billion nationally (Scott-Cannon, Cozza, & Belfield, 2016). The high cost of students taking developmental education courses suggests that many students graduate from high school unprepared to meet college expectations. Many colleges, particularly two-year institutions, use placement test scores to determine whether a student requires a developmental education course (Hughes & Scott-Cannon, 2016). However, placement tests have been criticized, especially when they serve as the primary or only placement criterion. For example, Hoxen, Japan, & Kang, 2016; Scott-Cannon et al., 2016. To improve placement accuracy, colleges that currently rely solely on placement test scores must work to create a broader screening tool that incorporates other student information.

This guide describes four steps for colleges to consider when developing a screener for estimating college readiness. A key focus point is a discussion of ways to improve how well a screener identifies individuals who need developmental education, along with less consideration for a new or developer of such a tool. Specifically, the guide includes these steps:

1. Creating a definition of college readiness.
2. Selecting a measure of readiness.

A guide to developing and evaluating a college readiness screener

John Hughes, Deputy Director, REL Southeast

Screening students for college readiness

REL Webinar Series: College & Career Readiness
Seven Steps for Developing a College Readiness Screener

1. Creating a definition of readiness
2. Selecting a measure
3. Identifying potential predictors
4. Prioritizing types of error
5. Collecting and organizing the data
6. Developing predictive models
7. Evaluating and selecting a final model
Seven Steps for Developing a College Readiness Screener (Steps 1 and 2)

1. Creating a definition of readiness
2. Selecting a measure
3. Identifying potential predictors
4. Prioritizing types of error
5. Collecting and organizing the data
6. Developing predictive models
7. Evaluating and selecting a final model
A College Readiness Definition

A student is college and career ready when he or she has attained the knowledge, skills, and disposition needed to succeed in credit-bearing (non-remedial) postsecondary coursework or a workforce training program in order to earn the credentials necessary to qualify for a meaningful career aligned to his or her goals and offering a competitive salary

(National Forum on Education Statistics)
Operational College Readiness

• Readiness is often defined as a target grade in a gateway course
• But the grade targeted changes the likelihood of success and will impact error rates
Seven Steps for Developing a College Readiness Screener (Step 3)

1. Creating a definition of readiness
2. Selecting a measure
3. Identifying potential predictors
4. Prioritizing types of error
5. Collecting and organizing the data
6. Developing predictive models
7. Evaluating and selecting a final model
Most Colleges Use Placement Tests

**Advantages**
- Readily available
- Require little additional support
- Easily interpretable

**Disadvantages**
- Students may not understand their importance
- Format may artificially lower scores
- Excludes other academic factors
- May not be designed for the target population
- Risk is higher when a single indicator is used
Research Suggests Other Options

- High school grades, cumulative or in specific classes
- High school assessments
- Grades in key courses such as Algebra I
- Credit accumulation

(Hughes & Scott-Clayton, 2011; Scott-Clayton Crosta, & Belfield, 2014)
Seven Steps for Developing a College Readiness Screener (Step 4)

1. Creating a definition of readiness
2. Selecting a measure
3. Identifying potential predictors
4. Prioritizing types of error
5. Collecting and organizing the data
6. Developing predictive models
7. Evaluating and selecting a final model
Managing Error

• Errors are inevitable
• But not all errors are equal
• The goal is minimizing specific kinds of errors
Two Types of Placement Error

Over-Placement
• Students who are not college ready but placed into credit bearing courses
• Called over-placement because they are put in too “high” of a course
• Also a “false negative”

Under-Placement
• Students who are college ready but placed into remediation
• Called under-placement because they are put in too “low” of a course
• Also a “false positive”

(Schatschneider, Petscher, & Williams, 2008)
Policy Question – Weighing the relative costs

**Over-placement**
- Student takes a course they might not be ready for and potentially fails
- Interacts with the target grade
  - If the target is a D or higher, this risk is lower

**Under-placement**
- Student goes into remediation when not needed and wastes time and money and gets discouraged
- Interacts with the target grade
  - If the target is a B or higher, but the student could have earned a C, may unfairly penalize
### Example: Two-by-Two Classification Table

<table>
<thead>
<tr>
<th>Screen</th>
<th>Actual Outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td><strong>Not college ready</strong></td>
</tr>
<tr>
<td>Placed into remediation</td>
<td>A (true positive)</td>
</tr>
<tr>
<td>Not placed into remediation</td>
<td>C (false negative)</td>
</tr>
</tbody>
</table>

(Schatschneider, Petscher, & Williams, 2008).
Interaction of target grade and placement accuracy

- There is a trade-off between over- and under-placement
- Moving a cut-score left or right will increase one and decrease the other
- Same with selecting a different target grade
Seven Steps for Developing a College Readiness Screener (Step 5)

1. Creating a definition of readiness
2. Selecting a measure
3. Identifying potential predictors
4. Prioritizing types of error
5. Collecting and organizing the data
6. Developing predictive models
7. Evaluating and selecting a final model
Collecting and Organizing Data

• Grades for each selected course
• Student predictors
  • What data are available?
  • When are data available?
• Organized around one record per student per outcome
Seven Steps for Developing a College Readiness Screener (Step 6)

1. Creating a definition of readiness
2. Selecting a measure
3. Identifying potential predictors
4. Prioritizing types of error
5. Collecting and organizing the data
6. Developing predictive models
7. Evaluating and selecting a final model
Two Types of Models

• Logistic Regression
• Classification and Regression Tree (CART)
CART Example

- HS GPA < 3.8
  - Yes: Placement Test < 35
    - Yes: Not College Ready
    - No: College Ready
  - No: College Ready
Seven Steps for Developing a College Readiness Screener (Step 7)

1. Creating a definition of readiness
2. Selecting a measure
3. Identifying potential predictors
4. Prioritizing types of error
5. Collecting and organizing the data
6. Developing predictive models
7. Evaluating and selecting a final model
Measuring Diagnostic Accuracy

<table>
<thead>
<tr>
<th>Screen</th>
<th>Actual Outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td>Placed into remediation</td>
<td>Not college ready</td>
</tr>
<tr>
<td>Not placed into remediation</td>
<td>College ready</td>
</tr>
<tr>
<td>A (true positive)</td>
<td>B (false positive)</td>
</tr>
<tr>
<td>C (false negative)</td>
<td>D (true negative)</td>
</tr>
</tbody>
</table>

(Schatschneider, Petscher, & Williams, 2008).
Interaction of target grade and placement accuracy

• There is a trade-off between over- and under-placement
• Raising or lowering a cut-score will increase one and decrease the other
• Same with selecting a different target grade
Interaction of target grade and placement accuracy
Using high school data to understand college readiness in the Pacific

- Daisy Carreon, Researcher, REL Pacific
Helping more students prepare for and succeed in college and careers in the Northern Mariana Islands and American Samoa

Daisy Carreon
REL Pacific serves a geographically and culturally diverse region
Alliances for College and Career Readiness and Success
A comprehensive approach to college and career readiness

• Technical assistance support: workshops and small-group coaching sessions

• Co-designed research studies, which use both high school and college data
Some achievements of the technical assistance support

• Developed a local definition of CCR for the Northern Mariana Islands
• Learned about the value of CCR indicators in school improvement
• Increased awareness of CCR data available within different organizations
• Learned about approaches being used nationally to address CCR
• Learned about some principles and tools of improvement science
• Identified alignment between K-12 and college, and K-12 and careers as a critical improvement strategy
Three research studies conducted in collaboration with alliances

1. Academic Outcomes of Students in Developmental Versus Credit-bearing English or Math Courses at Northern Marianas College

2. College and Career Readiness Profiles of High School Graduates in American Samoa and the Northern Marianas Islands

3. Using High School Data to Understand College Readiness in the Northern Marianas Islands
Relevance of studies for the Pacific context

These are the first studies to examine college and career readiness in Northern Mariana Islands and American Samoa that:

• Used data from K-12 and college for longitudinal analysis of college readiness
• Documented the academic outcomes of students who enroll in developmental and credit-bearing courses
• Compiled comprehensive profile of college readiness of recent high school graduates
Using high school data to understand college readiness in the Northern Mariana Islands

• College ready = First English or math courses were credit-bearing courses

• Also, examined different levels of credit-bearing English and math courses
  • In math, students placed into one of three developmental courses
  • In English, students placed into one of three levels of developmental reading and one of three levels of developmental writing
Using high school data to understand college readiness in the Northern Mariana Islands (continued)

Variables used in the study included:

• **Academic preparation** = course-taking and achievement
  • Enrolled in Advanced Placement English or math courses
  • Cumulative grade point average
  • Highest math course taken
  • SAT-10 performance

• **Demographic characteristics**
Aligning K-12 and college

- Using high school and college data reinforced the notion that this is shared problem of practice
- There are promising steps for K-12 and college collaboration on these islands:
  - Preparation/planning to teach joint transition courses
  - A commitment to making longitudinal analyses of college and career readiness easier, which involves having a shared unique student identification
Exploring the foundations of the future STEM workforce: K-12 indicators of postsecondary STEM success

- Trisha Borman, Researcher, REL Southwest
Project Context

• REL Southwest

• Texas Hispanic STEM Research Alliance

• Goal: Improve STEM academic and career outcomes for Hispanic students in Texas

  – Identify factors affecting Hispanic students’ preparation for, and achievement in, K-12 STEM subjects
• Alliance Concerns:
  – Low numbers of Hispanic students enrolling and persisting in advanced STEM courses at the K-12 level
  – Low numbers of Hispanic students pursuing and completing STEM postsecondary degrees
  – What are the factors that predict positive postsecondary STEM outcomes, specifically for Hispanic students?
Research Questions

• What K-12 factors are predictive of:
  – Declaring a STEM major
  – Persisting in a STEM major
  – Earning a STEM degree

• What is known about how relationships between predictors and outcomes might differ for Hispanic students, specifically?
Literature Review

• Review studies that explored relationships between K-12 factors postsecondary STEM outcomes
• Disseminate information that can inform decision making and policy
• Inform follow-up studies that examine K-12 factors in Texas public schools.
Literature Review Methods

1. Determine which studies to review (specify inclusion criteria)
2. Scan academic databases and identify articles that meet the inclusion criteria
3. Read, code, and summarize each article
4. Synthesize summaries across articles
Literature Review Methods (continued, part 2)

1. Determine which studies to review (specify inclusion criteria)

2. Scan academic databases and identify articles that meet the inclusion criteria
   - Published in 2000 or later
   - US student population
   - Primary research only
   - Include at least one K-12 factor (e.g., SAT score, course-taking,) and at least one postsecondary STEM outcome (e.g., declaring a STEM major).

3. Read, code, and summarize each article

4. Synthesize summaries across articles
Literature Review Methods (continued, part 3)

1. Determine which studies to review (specify inclusion criteria)

2. Scan academic databases and identify articles that meet the inclusion criteria
   • 23 studies

3. Read, code, and summarize each article

4. Synthesize summaries across articles
1. Determine which studies to review (specify inclusion criteria)
2. Scan academic databases and identify articles that meet the inclusion criteria
3. **Read, code, and summarize each article**
   Code for:
   - Aspects of sample
   - Outcome of interest
   - K-12 indicator examined
   - Research design
   - Statistical analyses applied
   - Study limitations
   - Hispanic student sub-group analysis
4. Synthesize summaries across articles
Key Findings - Overview

• 22 of 23 studies were correlational in nature (cannot infer cause and effect)
• Only 4 studies examined a K-12 predictor of a postsecondary STEM outcome for Hispanic students specifically
• Overall, significant indicators included measures of:
  – Advanced course-taking
  – Measures of K-12 achievement
  – Interest in STEM
Measures of advanced course taking

• High school math and science course-taking: more courses, particularly more rigorous courses, associated with higher rates of enrolling in, persisting in, and pursuing a STEM major.

• **Important sub-finding:** Number of courses was a stronger predictor for White students than for Hispanic students only when rigor was not accounted for. When measured, rigor was similarly predictive for all student groups.
Measures of K-12 achievement

• Grade Point Average, class rank, SAT/ACT scores, high school math and science standardized achievement measures result in significantly related to postsecondary STEM achievement.

• **Important sub-finding:** Grades were less predictive of STEM outcomes for minority students.
Measures of interest in STEM

- Interest in STEM (as young as in middle school), enjoyment of math/science in high school, positive perceptions of math/science abilities are significantly related to postsecondary STEM pursuits.

- **Important sub-finding:** Despite similarly positive dispositions towards math/science, women and Hispanic students persist in STEM at lower rates.
Implications

• Increase enrollment in high-level math and science courses
  – Ensure rigor/quality in those high-level courses
• Turn youth interest in STEM into college STEM majors
• Focus research on Hispanic students’ STEM success
Indicators of early college success

- Lyzz Davis, Senior Researcher, REL Midwest
Overview

1. Who we are
2. Why this study
3. What we measured
4. What we found
5. What now
REL Midwest

* The Pacific Region contains Hawaii, pictured on the map, and American Samoa, the Commonwealth of the Northern Mariana Islands, the Federated States of Micronesia (Chuuk, Kosrae, Pohnpei, & Yap), Guam, the Republic of the Marshall Islands, & the Republic of Palau, not pictured on the map.
College and Career Success Research Alliance

**Goal:** To build capacity for evidence-based policies through research

**Guiding questions:**
1. What predicts being on track for success?
2. What interventions increase college success?
Why this study?
A bit of context
Education, income, and unemployment

Postsecondary education increasingly required by U.S. workforce

<table>
<thead>
<tr>
<th>Year</th>
<th>High school graduates</th>
<th>Some college</th>
<th>Associate's degree</th>
<th>Bachelor's degree</th>
<th>Master's degree or higher</th>
</tr>
</thead>
<tbody>
<tr>
<td>1973</td>
<td>32%</td>
<td>10%</td>
<td>12%</td>
<td>9%</td>
<td>7%</td>
</tr>
<tr>
<td>1992</td>
<td>34%</td>
<td>19%</td>
<td>19%</td>
<td>8%</td>
<td>10%</td>
</tr>
<tr>
<td>2007</td>
<td>30%</td>
<td>17%</td>
<td>21%</td>
<td>10%</td>
<td>11%</td>
</tr>
<tr>
<td>2018</td>
<td>28%</td>
<td>17%</td>
<td>23%</td>
<td>12%</td>
<td>10%</td>
</tr>
</tbody>
</table>

Postsecondary reform is a priority.
Indiana’s efforts

- **College Preparation Curriculum Act (2006)**
- **Core 40 Graduation Requirements (2007)**
- **American Diploma Project**
Indiana’s efforts

• Indiana Commission for Higher Education (ICHE): Intended to **better identify students** likely to succeed in college.

• High schools can **use available data** to identify students and provide support.
Logic model
Similar to a response to intervention model:

1. REL Midwest identifies predictors
2. Schools and districts obtain data
3. Schools and districts use predictors to identify students
4. Schools and districts provide support to identified students

Progress Monitoring
What we measured

Technical aspects of the study
Defining early college success

Three separate indicators:

- Taking only non-remedial classes
- Earning all attempted credits
- Continuing to a second year

...and a composite.
Full analytic sample

33,000 students:
- Graduated in 2010
- Enrolled in Indiana public college fall 2010
Research questions

1. What percentage of enrollees arrived at college ready to succeed?
2. Do the percentages vary by student, high school, or college characteristics?
3. Do the percentages vary by indicator of success?
Data sources

- Indiana’s Student Information System
- Barron’s Profile of American Colleges
- National Center for Education Statistics Elementary and Secondary Information System (ElSi; formerly Common Core of Data)
- Publicly available data from Indiana Department of Education
Analysis

Data included:

- **Student, high school, and college** characteristics
- Indicators for three measures of early **college success** and their composite

**Descriptive statistics**

Cross-classified **Hierarchical Linear Modeling**
What we found

Study findings
Half achieved success by all indicators, varied by type of college

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Full Sample</th>
<th>First Entering Four-Year Colleges</th>
<th>First Entering Two-Year Colleges</th>
</tr>
</thead>
<tbody>
<tr>
<td>Only nonremedial</td>
<td>72</td>
<td>89</td>
<td>33</td>
</tr>
<tr>
<td>Earned all credits</td>
<td>69</td>
<td>48</td>
<td>50</td>
</tr>
<tr>
<td>Persisted to second year</td>
<td>77</td>
<td>57</td>
<td>13</td>
</tr>
<tr>
<td>Composite</td>
<td>50</td>
<td>66</td>
<td></td>
</tr>
</tbody>
</table>
Double digit gaps in early college success by race/ethnicity...
...and double digit gaps in early college success by socioeconomic status

- Only nonremedial
  - Eligible for school lunch program: 58%
  - Not eligible for school lunch program: 76%

- Earned all credits
  - Eligible for school lunch program: 56%
  - Not eligible for school lunch program: 73%

- Persisted to second year
  - Eligible for school lunch program: 66%
  - Not eligible for school lunch program: 80%

- Composite
  - Eligible for school lunch program: 33%
  - Not eligible for school lunch program: 55%
Attendance in high school predicts early college success

(Compared with absent less than 15 days)
Standardized test scores predict success
Among two-year college goers:

![Graph showing the relationship between Grade 10 ISTEP+ Composite Test Score (Number of Standard Deviations From Mean) and success indicators such as Enrolled in Only Nonremedial Courses, Earned All Attempted Credits, Persisted to Second Year, and Success by All Individual Indicators.]
Taking an Advanced Placement (AP) class predicts success among students in four-year colleges

- Took and passed AP exam
- Took AP exam but did not pass

<table>
<thead>
<tr>
<th>Category</th>
<th>Took and passed AP exam</th>
<th>Took AP exam but did not pass</th>
</tr>
</thead>
<tbody>
<tr>
<td>Only nonremedial nonremedial</td>
<td>0.6</td>
<td>1.2</td>
</tr>
<tr>
<td>Earned all credits</td>
<td>3.7</td>
<td>7.7</td>
</tr>
<tr>
<td>Persisted to second year</td>
<td>3.5</td>
<td>5.4</td>
</tr>
<tr>
<td>Composite</td>
<td>11.3</td>
<td>5.2</td>
</tr>
</tbody>
</table>
Predictors together explain little variance in the outcomes

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Percent Variance Explained</th>
</tr>
</thead>
<tbody>
<tr>
<td>Students First Entering Two-Year Colleges</td>
<td>--</td>
</tr>
<tr>
<td>Enrolled in Only Nonremedial Courses</td>
<td>35%</td>
</tr>
<tr>
<td>Earned All Credits Attempted</td>
<td>7%</td>
</tr>
<tr>
<td>Persisted to Second Year</td>
<td>8%</td>
</tr>
<tr>
<td>College-ready by all individual indicators</td>
<td>31%</td>
</tr>
<tr>
<td>Students First Entering Four-Year Colleges</td>
<td>--</td>
</tr>
<tr>
<td>Enrolled in Only Nonremedial Courses</td>
<td>25%</td>
</tr>
<tr>
<td>Earned All Credits Attempted</td>
<td>19%</td>
</tr>
<tr>
<td>Persisted to Second Year</td>
<td>22%</td>
</tr>
<tr>
<td>College-ready by all individual indicators</td>
<td>26%</td>
</tr>
</tbody>
</table>
What now?

Three implications to note for predictors of early college success
1. Focus resources on supporting low income students and racial/ethnic minorities
2. Use **multiple** student, high school, and college characteristics to predict early college success
3. Use caution when interpreting predictors of early college success
Thank you!
Resources from the Regional Educational Laboratories (RELs)


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  • REL Southeast: @REL_SE
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