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FOR EXCELLENCE IN UNDERGRADUATE EDUCATION

Many Thousands Failed:
A Wakeup Call to Math Educators

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Colorado Math Pathways Convening | Denver, CO | October 20, 2017

About the Non-Profit Organization

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- **Who We Are & What We Do**
  - **And Why . . .**

- **Gateways to Completion**
  - **Dana Center**
  - **Complete College America**

Who Is This Guy? (About the Presenter)

THE GLORIOUS!!!

D-

This Guy – The Poster Child for Why We Need Math Pathways!

The Issue

The Issue

Deplorable rates of failure in college "gateway courses" are limiting possibilities – especially for historically underrepresented and underserved students

Defining our Terms – Gateway Courses

- Foundation-Level
    - Slightly Different Than Colorado Math Pathways Task Force
- High-Risk
- High-Enrollment
- "Killer Courses"

Let's Look at Some Data

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The Data – U.S. History Survey Courses

The Data – College Algebra Courses

- 32 institutions

- Average DFWI Rate = 34.45%

- Range of 5.49% - 59.69%

The Data – College Algebra Courses

College Algebra DFWI Rate by Institution
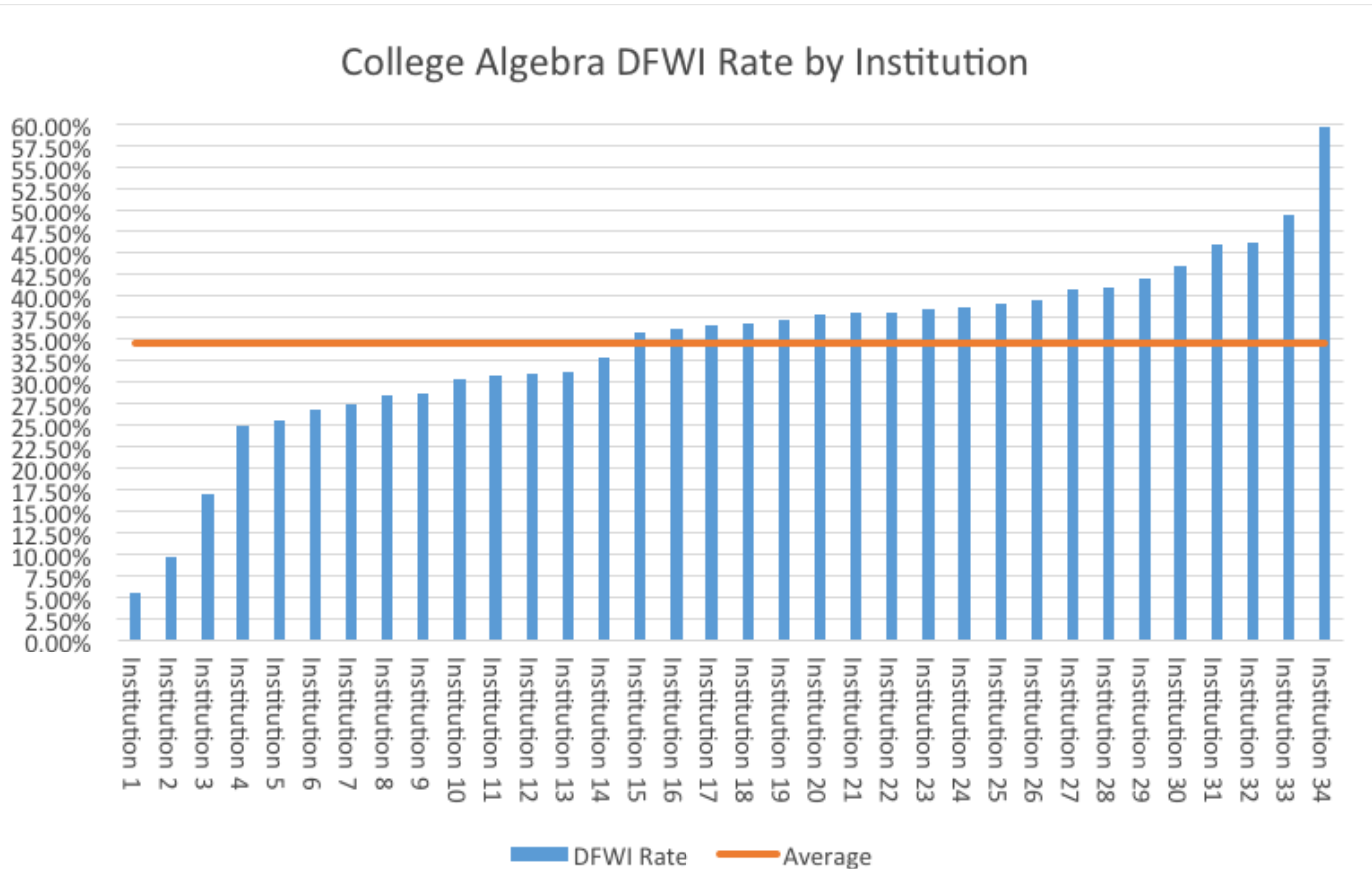
First-Year Students Are Most at Risk (But . . .)

The Data – College Algebra Courses

Average Algebra DFWI Rate by Classification
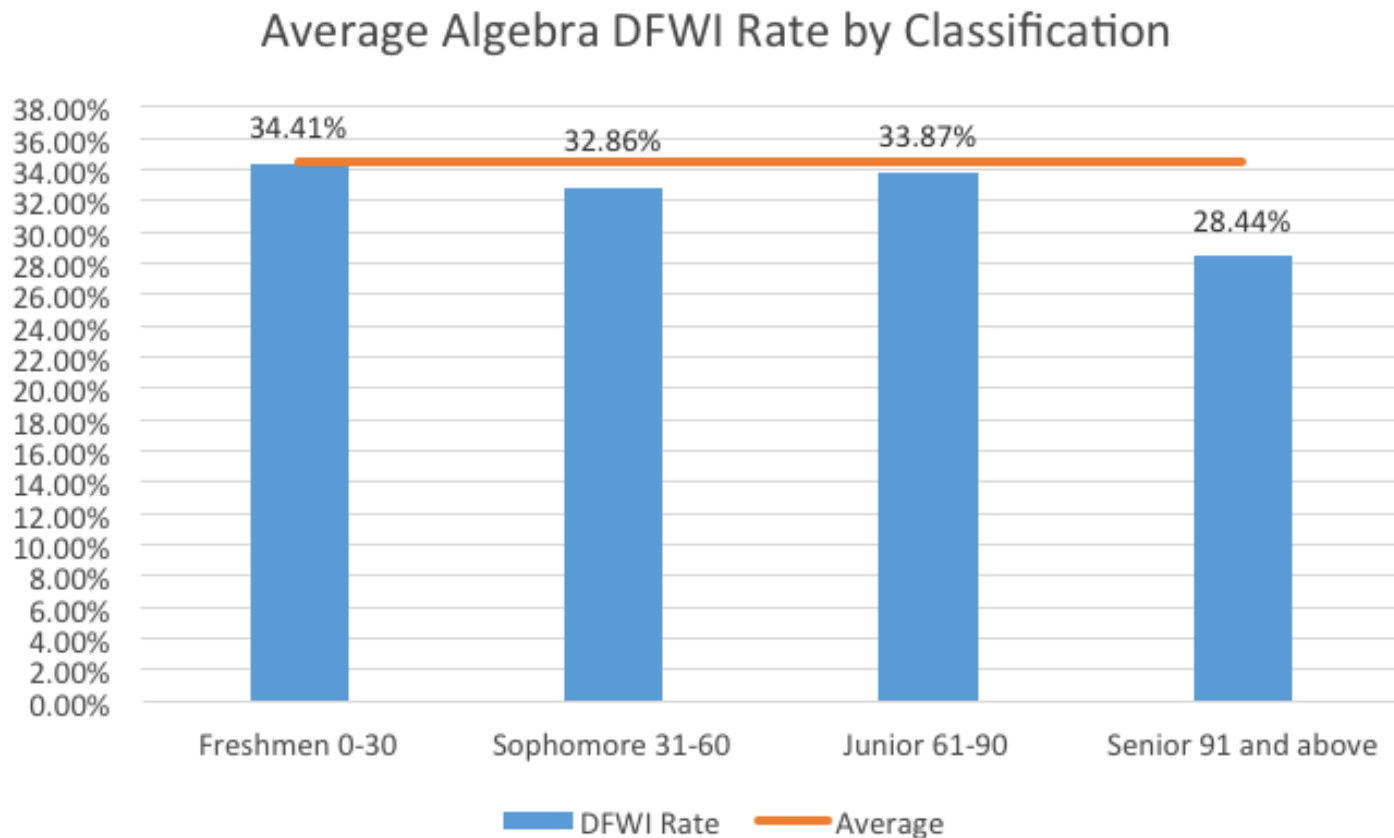
The Data – A Comparison (Algebra & US History)

College Algebra

Average Algebra DFWI Rate by Classification

34.41% (Freshmen 0-30), 32.86% (Sophomore 31-60), 33.87% (Junior 61-90), 28.44% (Senior 91 and above)

Legend: DFWI Rate, Average
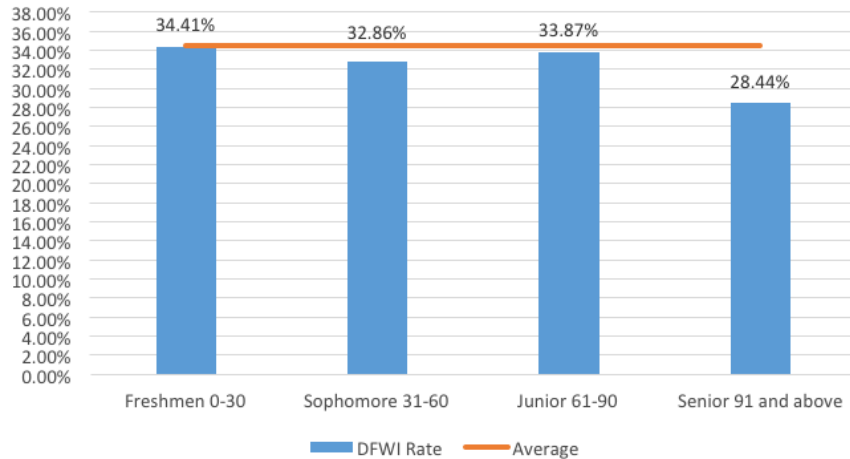
U.S. History

Average DFWI Rate by Classification

29.01% (Freshmen DFWI Rate), 21.16% (Sophomore DFWI Rate), 16.65% (Junior DFWI Rate), 13.80% (Senior DFWI Rate)

Legend: DFWI Rate, Average
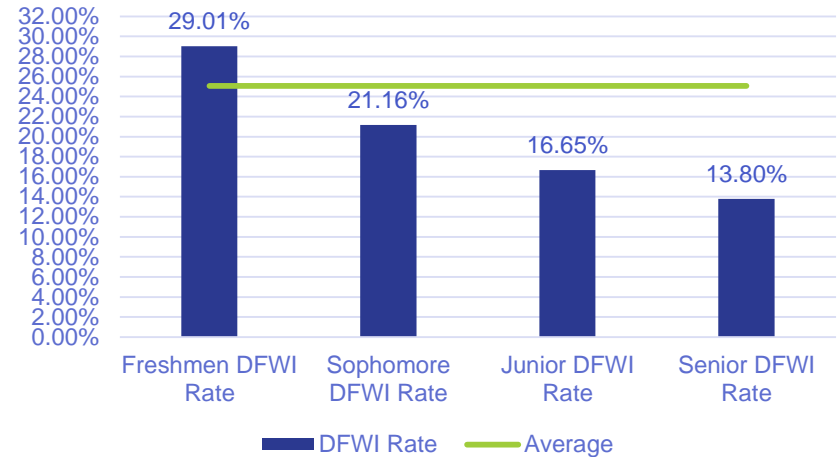
Gender, Income & First-Generation Status Matter

The Data – College Algebra Courses (Gender)

Average Algebra DFWI Rate by Gender
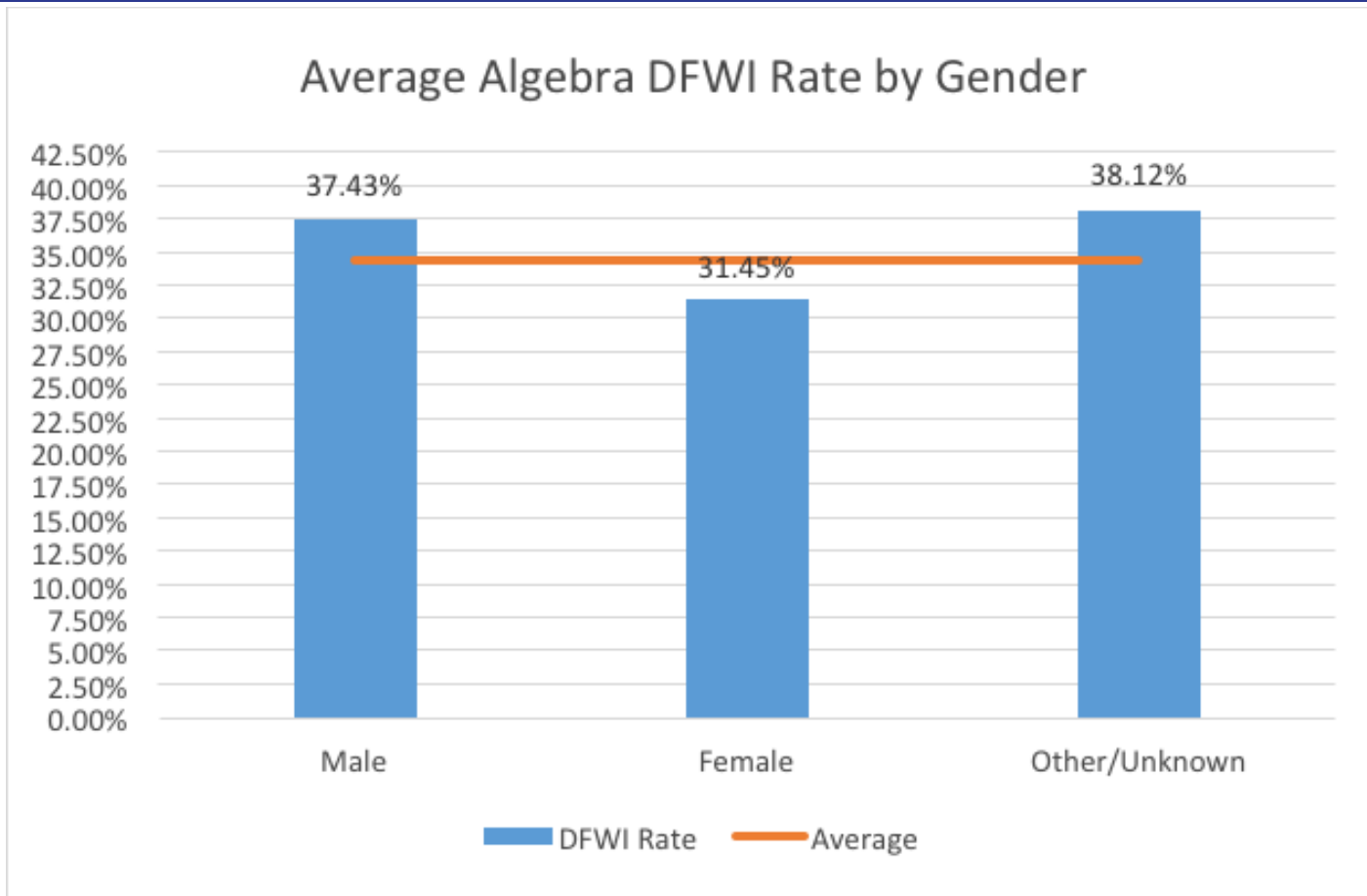
The Data – College Algebra Courses (Income)

Average Algebra DFWI Rate by Pell Eligibility
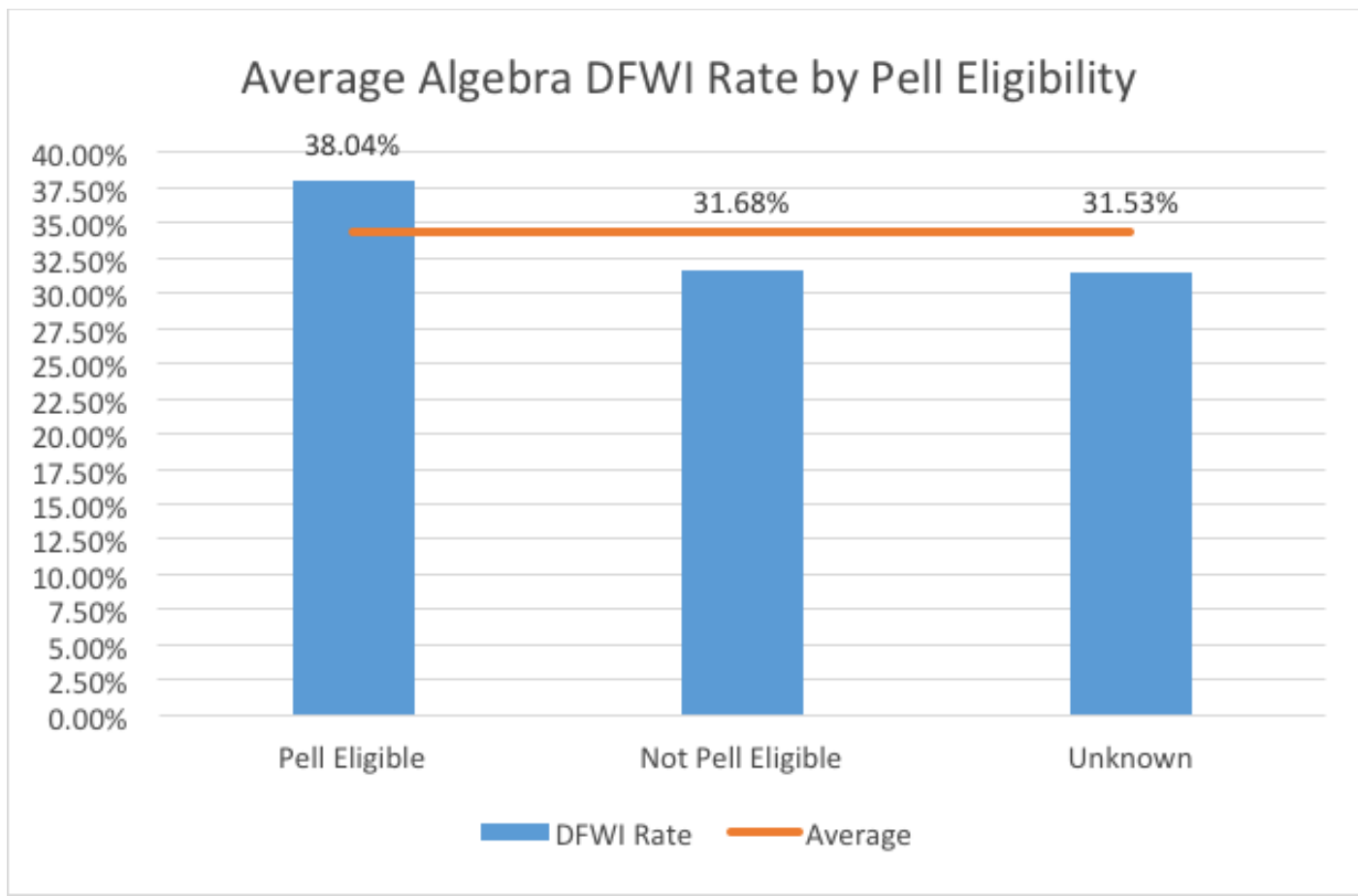
The Data – College Algebra Courses (First Generation)
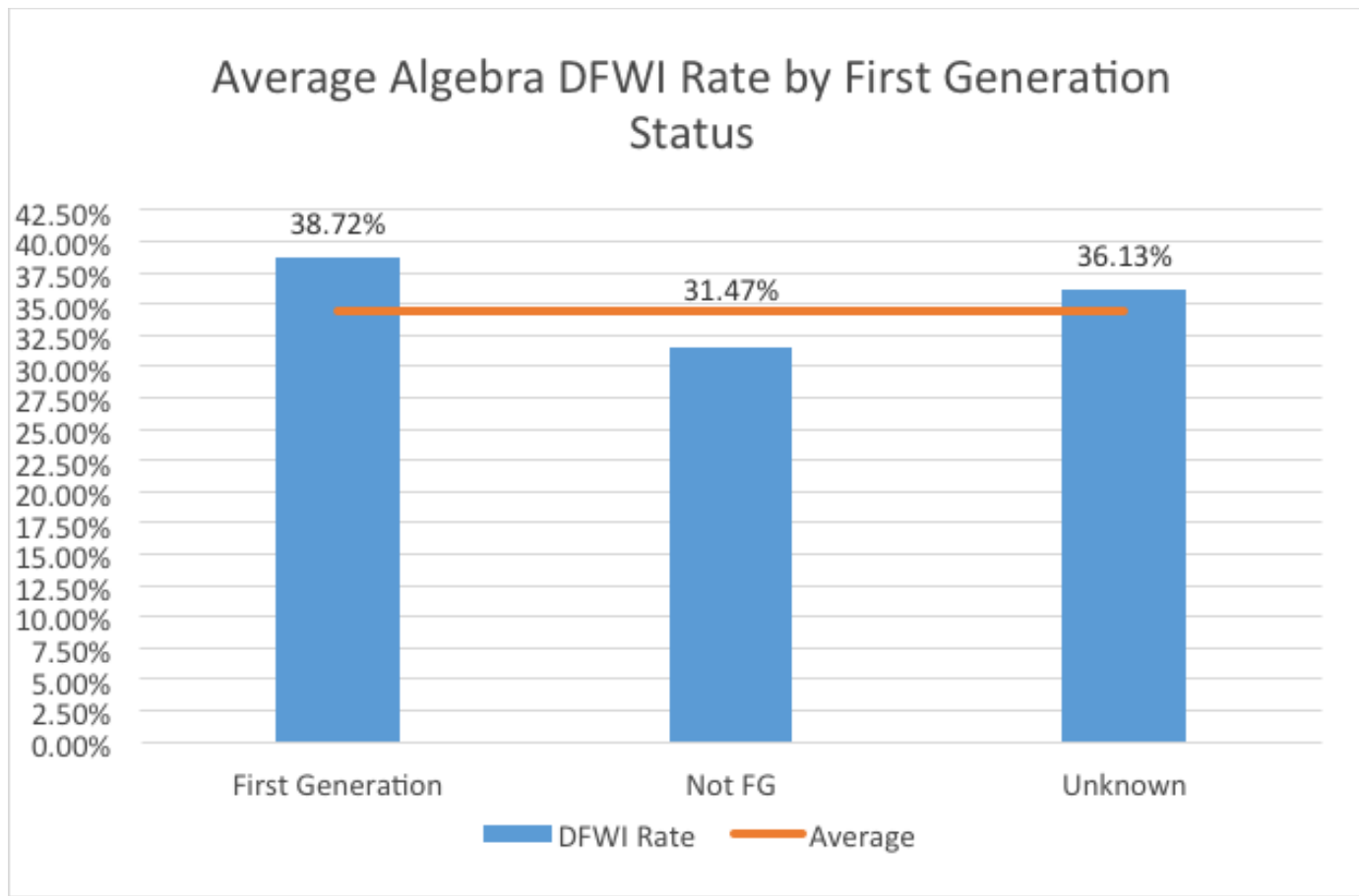
Race Matters

DFWI Rates & Demographic Subpopulations

Average Algebra DFWI Rate by Ethnicity

Ethnicity	DFWI Rate
Nonres Alien	23.13%
Hispanic/Latino	38.33%
American Indiana or Alaska Native	39.04%
Asian	30.53%
Black or African American	49.90%
Native Hawaiian or Other Pacific Islander	34.81%
White	30.63%
Two or More Races	37.94%
Unknown	24.24%

DFWI Rate — Average
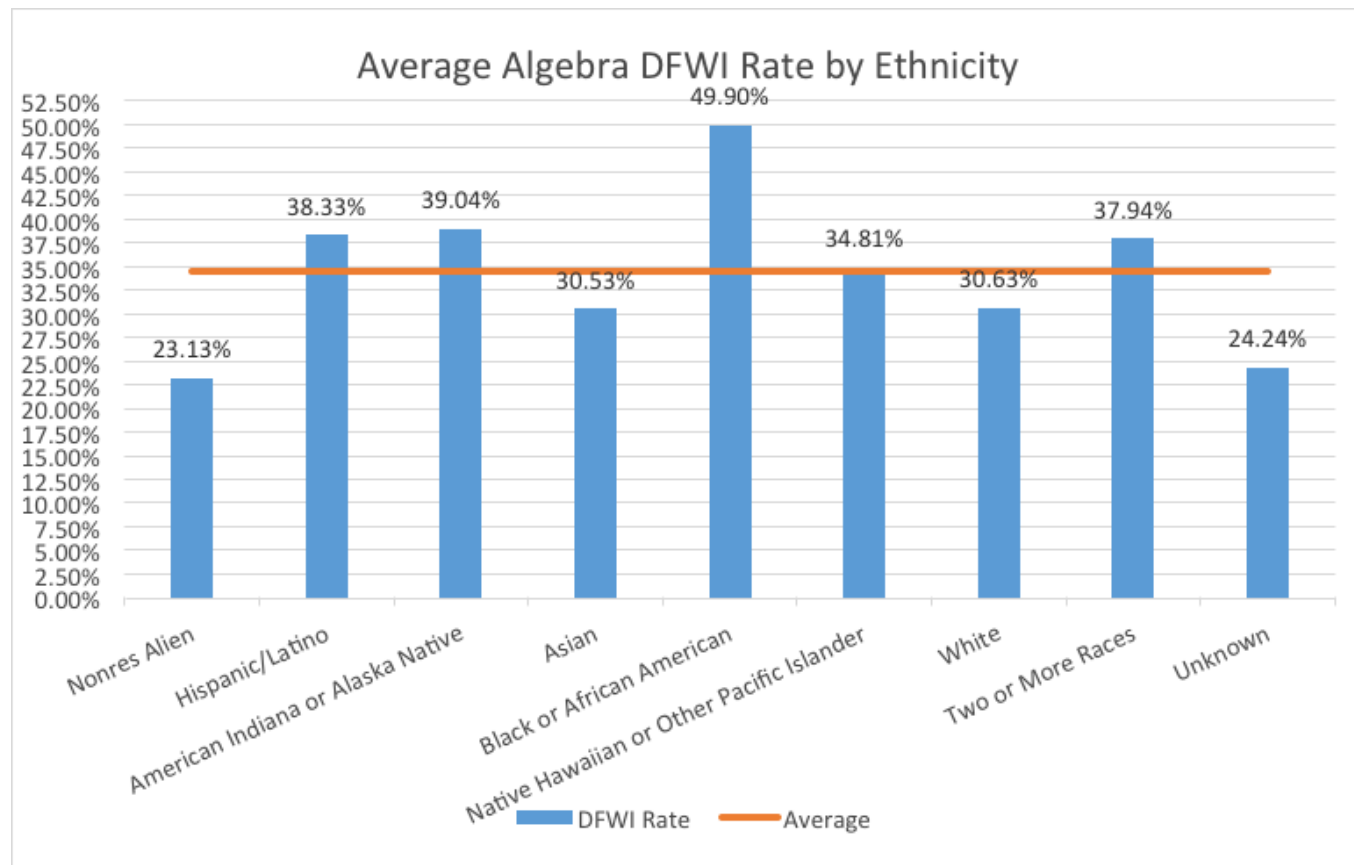
Gateway Course Performance is a DIRECT Predictor of Retention

Lessons Learned

Average Algebra DFWI Rate by Retention Status

- Retained: 30.99%
- Student Choses to Leave: 52.54%
- Institution Required Student to Leave: 81.35%
- Graduated: 18.60%
- Unknown: 37.67%

Legend: DFWI Rate, Average

Lessons Learned

Average Algebra DFWI Rate by Retention Status

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Legend: DFWI Rate, Average

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Summary – Gateway Course Outcomes

- Are Stumbling Blocks for All Students
- Especially
    - Low-Income
    - First-Generation
    - Males
    - Racial Minorities

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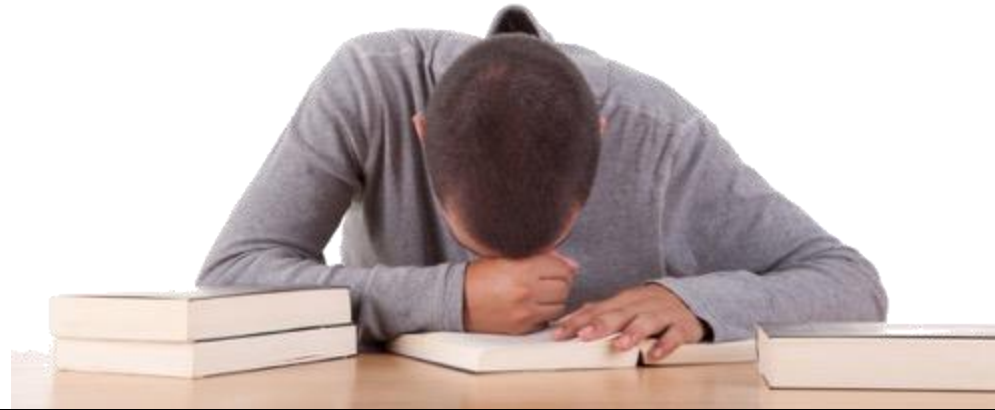
Think / Pair / Share

1. Why Do These Outcomes Happen?

2. What Role Can Math Pathways Play to Alleviate Them?

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Pathways As A Part of the Solution But Only A Part . . .

The Best Pathways

The Theoretical

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The Best Pathways

The Frequent & Sad Reality
(Without Course Redesign)

Course Redesign Key Components

- **Active, Evidence-Based Pedagogies**
- **Embedded Peer Support**
- **Early and Frequent Feedback**
  - **Predictive Analytics**
- **A Comprehensive Plan**

Active learning increases student performance in science, engineering, and mathematics

Scott Freeman[a,1], Sarah L. Eddy[a], Miles McDonough[a], Michelle K. Smith[b], Nnadozie Okoroafor[a], Hannah Jordt[a], and Mary Pat Wenderoth[a]

Author Affiliations

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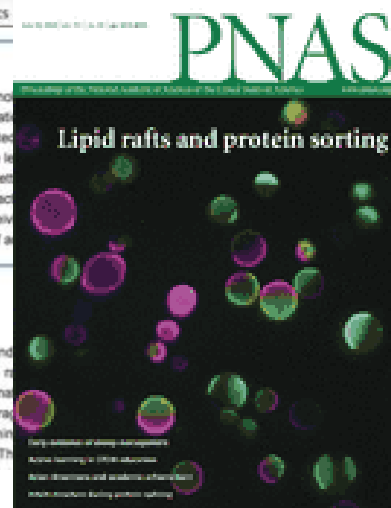
Abstract   Full Text   Authors & Info   Figures   SI   Metrics

Significance

The President's Council of Advisors on Science and Techno... number of science, technology, engineering, and mathemati... per year and recommended adoption of empirically validate... that goal. The studies analyzed here document that active le... performance that would raise average grades by a half a lett... lecturing increase by 55% over the rates observed under ac... claiming that calls to increase the number of students receiv... least in part, by abandoning traditional lecturing in favor of a...

Abstract

To test the hypothesis that lecturing maximizes learning and... studies that reported data on examination scores or failure ... undergraduate science, technology, engineering, and mathema... versus active learning. The effect sizes indicate that on averag... concept inventories increased by 0.47 SDs under active learnin... failing was 1.95 under traditional lecturing ($n = 67$ studies). Th...

PNAS

Lipid rafts and protein sorting

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Outcomes to Date: Retention

	G2C Students	Non-G2C Students
Retention	83%	77%
Good Academic Standing (GPA > 2.0)	74%	65%
Resiliency	54%	41%

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Approaches – What Did They Do at NSC?

- Embedded Support

- Engaging, Evidence-Based Pedagogies

- Predictive Analytics

- A COMPREHENSIVE PLAN

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Outcomes to Date: Grades

College Algebra DFWI Rate Changes 2012-13 Through 2014-15

Year (2012 Baseline)	Success Rate ABC	Below Average Rate D	Fail Rate F	Withdraw Rate W
2012 N= 2009	69%	9%	6%	16%
2013 N= 1900	70%	6%	8%	16%
2014 N= 2129	76%	6%	5%	13%

Outcomes to Date: Grades

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Course Redesign in the Colorado Math Pathways Work
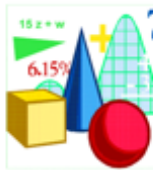
Colorado Math Pathways
Task Force Recommendations

Recommendations for Today

☐ Curriculum

☐ Advising

☐ Support & Professional Development

Course Redesign in the Colorado Math Pathways Work

Colorado Math Pathways
Task Force Recommendations

Recommendations for Today

- ☐ Curriculum
- ☐ Advising
- ☐ Support & Professional Development

Support & Professional Development – 1
Expand instructor base

Currently there are not enough qualified instructors for Math for Liberal Arts and Statistics, leaving sections taught by part-time instructors who may have very little to no experience and/or time to prepare for teaching these courses. In particular, teaching statistics requires intuition that is developed over time.

Recommendations:
1. Have new instructors spend time with a "master" instructor.
2. Supply instructors with well-developed syllabi and materials
3. Have course leaders.

The Who

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Support & Professional Development – 2
Provide system-wide resources

Introductory level math courses are populated by students who are not confident in their math skills. These courses are considered to be some of the most challenging to teach.

Recommendations:

1. Provide a repository of course specific information.
2. Expand faculty professional development opportunities to allow for discussion time about individual courses (i.e., Fac2Fac Conferences)
3. Provide resources to implement common assessments.

The What & The How

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Course Redesign Applied at YOUR Home

1. How Has Course Redesign Been Part of Your Efforts to Date?

2. How Can You Make Course Redesign Even More A Part of What You Do in Your Math Pathway Efforts?

Questions / Discussion

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