The California State University

Course Equity Portal Methodology

www.calstate.edu/dashboard

Course Equity Portal

Contents

Introduction

What happens in the classroom matters. We know both from the research and an empirical review of CSU institutional data that there is a strong connection between receiving two or more non-passing grades and not completing a college degree.[1] The data further indicate that these negative consequences are disproportionately experienced by students of color and those from low-income families.[2] Observations such as these reinforce the need to **support faculty** in their efforts to explore their connections to, and impact on, student outcomes.

To this end, we've created a new tool (the "Course Equity Portal") that allows faculty to access the grade data from the sections they taught and to identify patterns in the grades received by their students over the years. More than just direct and comprehensive data access, the Portal leverages statistically valid algorithms to identify salient trends and insights in patterns of non-passing grades received by students overall, as well as by students of color, from low-income families, and for those who are the first in their family to attend college. The portal is updated each term, after final grade data is received and verified by the Chancellor's Office. It is our hope that by reviewing the data prior to each new term, faculty can better estimate the impact of their past pedagogical practices and decide how they would like to calibrate their approach for the new term.

The algorithms utilized consider statistical significance and effect size, and search for changes over time that hold for at least 5 consecutive terms. Common sense thresholds are applied to draw out cases where non-

passing rates are well above or below the course or department average. The insights that are identified are meant to support faculty in their efforts to draw meaning from the data. In the end, it is up to each faculty member and their department to determine what non-passing rates are appropriate for a given course. Viewing these data in context may help provide further insight into where those rates should be for any given course.

Reviewing your own connections to student outcomes is necessary but sometimes daunting. For an individual faculty member, finding evidence of inequity in the grades received by their students can be personally disheartening. It might also lead to fear of retribution rather than support from others. **To ensure this tool supports faculty, it**

- Allows faculty to review their students grade data privately (no other faculty or administrator can see your dashboard or its data-based insights).
- Provides:
    - Constructive and reflective prompts tailored to the course-level insights
    - Connections to proven, inclusive pedagogical strategies
    - Links to faculty-supporting resources on their own campus

While the faculty member's views of their own data in the dashboard are private, we hope that review of their data will prompt shared meaning-making and collaborative, constructive, and supportive discussions with colleagues and campus leaders. Course outcomes reflect both academic and non-academic factors experienced by our students. No one, working on their own, will be able to solve the challenges of racial and economic inequity that our students face. We must all work together to find innovative ways that better meet the needs of our students. Application of the insights and data in the Course Equity Portal will help faculty participate more fully in the larger, collective effort to look across the CSU at all levels that impact student life. When each of us holds a mirror to our own practices, supports each other, and works together, we can eliminate equity gaps.

Methods

As described above, the Course Equity Portal applies a set of statistical algorithms in order to present a curated set of findings that are tailored to each user and that focus on areas where the data are believed to be reliable. Below are descriptions of the specific data sets, variables, and methods employed.

Data Sets and Variables

Data for this portal come from 5 files sent from each campus' Institutional Research department:

1. **Campus grade file**, which contains end of term data including the final grades each student received in a course and section. The grade file contains a record for each course and section taken in a given year and term by each student enrolled in that given year and term. For example, a student who is taking 5 courses in a given year and term will have 5 different rows of data, one corresponding to each course, in the grade file.
2. **Enrollment Reporting System Student (ERSS) data file**, which reports campus enrollment data (including student demographics) and is based on the census date for each term. The census date for regular sessions of summer, fall, and spring terms is the 20th day of actual instruction after a term starts, or at the end of 4 weeks of instruction for semester campuses. For regular sessions of summer, fall, winter, and spring for quarter campuses, the census date is the 15th day of instruction or at the end of 3 weeks of actual instruction. For more information please refer to the CSU's Enrollment Reporting System Data Dictionary.

3. **Enrollment Reporting System Applicant (ERSA):** from which we pull social security number (SSN) and Parent/Guardian #1/#2 Education to determine first generation status.
4. **A custom-made file that identifies the courses and sections taught by each faculty on campus**. The file was pre-processed and pulls the following variables from PeopleSoft: faculty emplid, year, term, course code, and section.
5. **A custom-made file that identifies college and department alignments for each course on campus**. In instances where the Institutional Research department was not able to provide the college-department-course alignment, it was compiled by a staff member at the Chancellor's Office using the campus' website.

Data from the grade files are compiled for each campus with the following variables: year, term code, course abbreviation/prefix, course suffix, course number, course section, grade received in course, course title, and units.

Variables

- **Course ID** is generated by concatenating course abbreviation, course number, and course suffix.
- **Year-Term** is generated by concatenating the year and term code variables into one variable.
- **"D, F, Wu, or NC Grade rates",** also referred to as "DFW rate" is computed by dividing the sum of "D+" "D" "D-" "F" "NC" (no credit), and "WU" (unauthorized withdrawal) grades by the count of enrolled students for each course level type at a given campus or in a given college, and then multiplying by 100. Note: campus records include grades that were originally incompletes, but later resolved. If this resolution occurred after the deadline for submitting grades to the Chancellor's Office, then the Chancellor's Office records will not include this resolution. For this reason, we treat incomplete grades as missing grades and exclude them from the calculation of the DFW rate.

Equity Measures

- The term "**Pell**" refers to students who received a Pell grant in their first term of enrollment. "**Non-Pell**" refers to any student who is not classified as "Pell". Counts of **Pell** recipient and **Not Pell** recipient students were pulled directly from the ERSS file.
- **Male** and **Female** students were pulled directly from the ERSS file.
- **First generation** counts were based on the student's Parent Education Level variable, which is derived using an aggregation of the Parent/Guardian #1 and Parent/Guardian #2 Education Code variables from the ERSA file. For this analysis, we code a student as First Generation if they reported both parent's education code as 1 (No High School), 2 (Some High School), or 3 (High School Graduate). All other students were coded as **Not First Generation**.
- **Underrepresented Minority (URM)** and **Non-Underrepresented Minority (Non-URM)** counts were created from the IPEDS Race/Ethnicity Reporting Category variable as follows. We began by first excluding those students whose Citizenship Code value included any of these options:
    - Non-U.S. citizen, F visa (student)
    - Non-U.S. citizen, J visa (exchange visitor)
    - Non-U.S. citizen, other visa
    - Non-U.S. citizen, undetermined status or no visa required because not entering U.S.

    From the remaining students, we summed all who identified as African American, Hispanic/Latino/a (Latinx), or American Indian and classified them as **URM**. All other students (including those with the Citizenship Codes listed above) were classified as **Non-Underrepresented Minority (Non-URM)**.

Statistical Analyses and Measures

Various types of statistical analyses and modeling techniques were used to derive meaningful insights for each faculty member. The following methods were used:

- **Effect Size** statistics, in general, are used to quantify the direction and strength of an association between two variables, timepoints, or groups of interest (Borenstein, 2009)[3].
    - **Cohen's d** is an effect size used with continuous data to describe the magnitude of difference between two groups on a given outcome. To adjust for upward bias in Cohen's d associated with small samples, effect size estimates are transformed into **Hedge's g** using a small-sample adjustment procedure (Lenhard, 2016)[4].
    - **Odds ratios** is an effect size statistic that quantifies the association between dichotomous variables in terms of the odds of an outcome from group 1 compared to the odds of the same outcome for group 2 (Lenhard, 2016)[4].
- **Ordinary least squares (OLS) regression** is a modeling technique used to measure the relationship between two variables. OLS is also used in time series analysis to model trends (Hyndman, 2018)[5].
- **Chow test** is a statistical significance test that is used to determine if coefficient estimates from 2 linear regression models are equal. For a time series data set, the Chow test will determine if 1 regression line or 2 regression lines best fit the data (Chow, 1960)[6].

Deriving Insights

Course DFW Rate Trend

For faculty who've taught a course for more than 5 terms, the goal of this insight is to determine where there is an increasing or decreasing trend in their DFW rates. To determine the statistical significance of the trend, OLS regression and Chow test were used on the DFW rates by term.

1. A statistical significance test (Chow test) is used to determine if a time series has a change over time.
2. Linear Regression was used to determine the direction and strength of the trend.

Procedure

Step 1: Calculate the DFW rate by term for the faculty's course/section for the specific time period.

Step 2: Test structural break of DFW rates over time using Chow test.

- If the p-value of breakpoint < .10, then proceed to step 3.
- If the p-value of breakpoint >= .10, then proceed to step 4.

Step 3: Fit a linear regression model on the DFW rates from the breakpoint in step 2 through the most recent term.

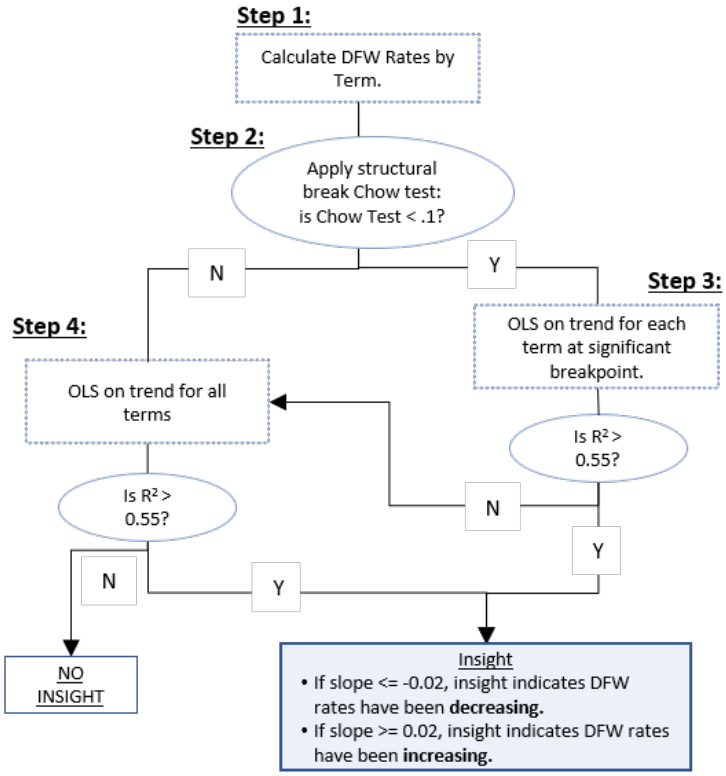
- If $N < 5$ or $R^2 < .55$, then skip to step 4.

- If R^2 >= 0.55 and slope <= -0.02, an insight is produced indicating that DFW rates have been decreasing since the significant breakpoint.
- If R^2 >= 0.55 and slope >= 0.02, an insight is produced indicating that DFW rates have been increasing since the significant breakpoint.

Step 4: Fit a linear regression model on the DFW rates for all terms.

- If R^2 < 0.55, then no insight is produced.
- If R^2 >= .55 and slope <= -0.02, an insight is produced indicating that DFW rates have been decreasing.
- If R^2 >= .55 and slope >= 0.02, an insight is produced indicating that DFW rates have been increasing.

Figure



Course DFW Rates Comparison to Other Sections or Courses

The purpose of this insight is to determine how high or low a faculty's course DFW rate is in comparison to the DFW rates of other sections of the same course within a specified time period. The faculty's course DFW rate was compared to (1) the overall DFW rates of other faculty members who taught the same course/section and (2) all other same-level courses within the department. The magnitudes of difference for both comparisons were estimated using effect size statistics.

Procedure

For a series of time periods, starting with the most recent term taught then sequentially iterate back each term (i.e. time periods: Spring 2019, Fall 2018 - Spring 2019, Spring 2018 -Spring 2019, etc.), repeat the following steps:

Step 1: Calculate the DFW rate by term for the faculty's course/section for the specific time period, DFW_1.

- If total number of students taught < 10, then repeat with a larger time period.
- If total number of students taught >= 10, then proceed to step 2.

Step 2: Calculate the aggregate DFW rate for all other faculty members who taught the same course, DFW_2.

- If total faculty members < 4 or total number of students taught < 10, then go back to step 1 with a larger time period. If total faculty members and total number of students taught never exceed 4 and 10, respectively, then no insight is produced.
- If total faculty members >= 4 and total number of students taught > 10, then proceed to step 3

Step 3: Calculate the odds ratio using DFW_1 and DFW_2 with the following formula:

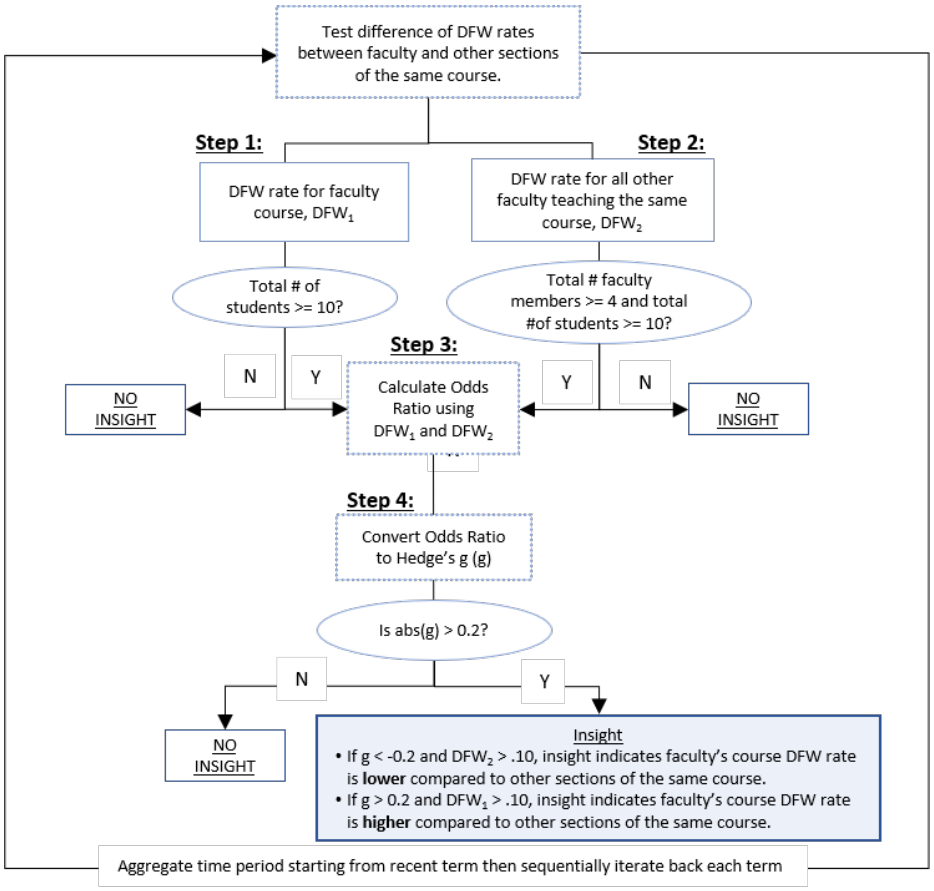
$$OR = \frac{DFW_1\ (1 - DFW_2)}{DFW_2\ (1 - DFW_1)}$$

Step 4: Convert the odds ratio into Hedge's g using the following formula:

$$Hedge's\ g = \ln(OR) \cdot \frac{\sqrt{3}}{\pi} \cdot \left[1 - \frac{3}{4(n1 + n2) - 1}\right]$$

- If Hedge's g > 0.20 and DFW_1 > .10, then the faculty's course DFW rate is higher compared to other sections of the same course and an insight is produced.
- If Hedge's g < -0.20 and DFW_2 > .10, then the faculty's course DFW rate is lower compared to other sections of the same course and an insight is produced.
- If -0.2 <= effect size <= 0.2, then no insight is produced.

Figure



Course DFW Rates Comparison by Department

The purpose of this insight is to determine how high or low a faculty's course DFW rate is in comparison to the DFW rates of all other same level courses in their department within a specified time period. The faculty's course DFW rate was compared to all other same-level courses within the department. The magnitude of difference for the comparison was estimated using effect size statistics.

Procedure

For a series of time periods, starting with the most recent term taught then sequentially iterate back each term (i.e. time periods: Spring 2019, Fall 2018 - Spring 2019, Spring 2018 -Spring 2019, etc.), repeat the following steps:

Step 1: Calculate the DFW rate by term for the faculty's course/section for the specific time period, DFW_1.

- If total number of students taught < 10, then repeat with a larger time period.
- If total number of students taught >= 10, then proceed to step 2.

Step 2: Calculate the aggregate DFW for all other same level courses within the department, DFW_2.

- If total number of students taught < 10, then go back to step 1 with a larger time period. If total number of students taught never exceed 10, then no insight is produced.
- If total number of students taught >= 10, then proceed to step 3

Step 3: Calculate the odds ratio using DFW_1 and DFW_2 with the following formula:

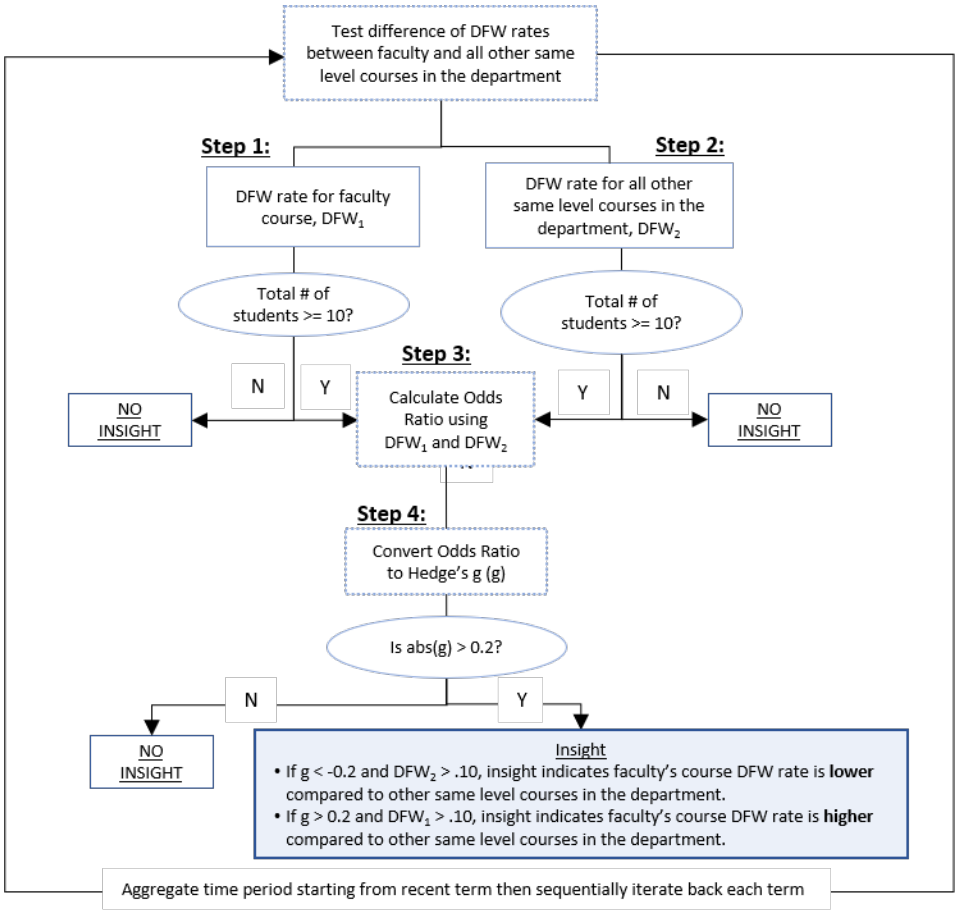
$$OR = \frac{DFW_1\ (1 - DFW_2)}{DFW_2\ (1 - DFW_1)}$$

Step 4: Convert the odds ratio into Hedge's g using the following formula:

$$Hedge's\ g = \ln(OR) \cdot \frac{\sqrt{3}}{\pi} \cdot \left[1 - \frac{3}{4(n1 + n2) - 1}\right]$$

- If Hedge's g > 0.20 and DFW_1 > .10, then the faculty's course DFW rate is higher compared to all same level courses in the department and an insight is produced.
- If Hedge's g < -0.20 and DFW_2 > .10, then the faculty's course DFW rate is lower compared to all same level courses in the department and an insight is produced.
- If -0.20 <= Hedge's g <= 0.20, then no insight is produced.

Figure



Course DFW Rates by Equity Measures

The purpose of this insight is to look at the differences in DFW rates for historically underserved students. This was done by looking at various time periods by Underrepresented Minority (URM) status, Pell recipient status,

first generation status, and gender. We compared the DFW Rates for each group (e.g. Male) to the DFW Rates of each group's counterpart (e.g. Female) and tested the magnitude of difference using effect size statistics.

Procedure

For each group (URM, Pell, First Generation, and Gender) and for a series of time periods, starting with the most recent term taught then sequentially iterate back each term (i.e. time periods: Spring 2019, Fall 2018 - Spring 2019, Spring 2018 -Spring 2019, etc.), repeat the following steps:

Step 1: Calculate the DFW rate of the URM, Pell, First Generation, and Male subgroups by term for the faculty's course/section for the specific time period, DFW_1.

- If total number of students in each group < 10, then repeat with a larger time period.
- If total number of students in each group >= 10, then proceed to step 2.

Step 2: Calculate the DFW rate of the non-URM, non-Pell, non-First Generation, and Female subgroups by term for the faculty's course/section for the specific time period, DFW_2.

- If total number of students in each group < 10, then repeat with a larger time period. If total number of students taught never exceed 10, then no insight is produced.
- If total number of students in each group >= 10, then proceed to step 3.

Step 3: Calculate the odds ratio using DFW_1 and DFW_2 with the following formula:

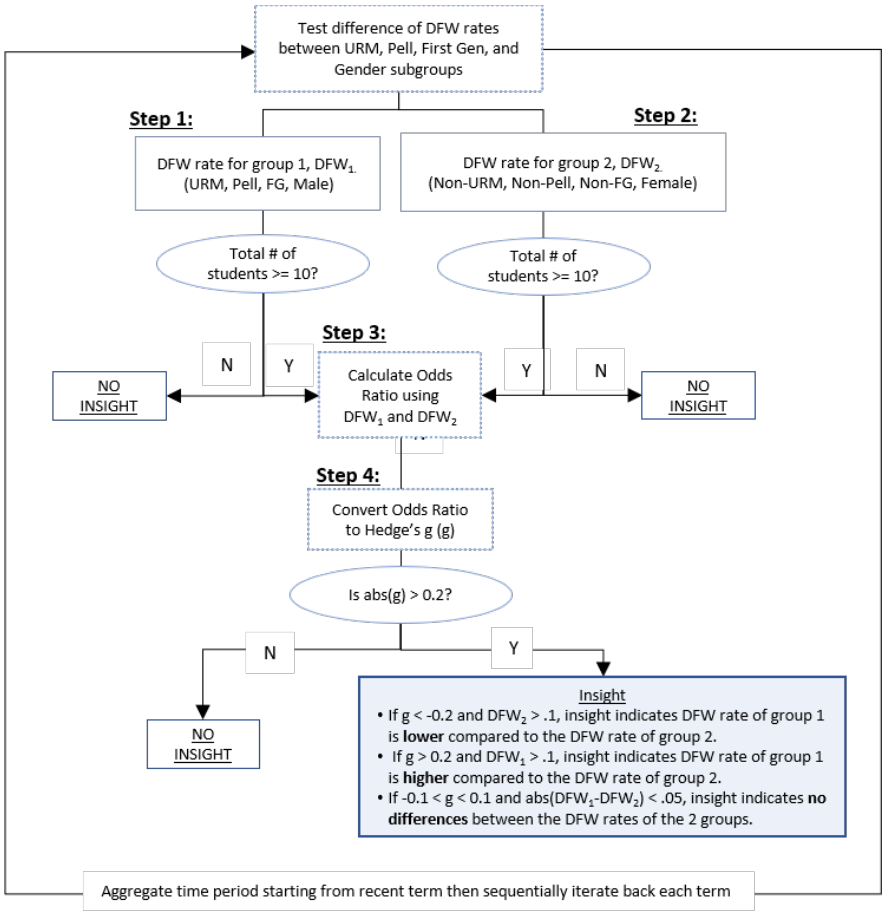
$$OR = \frac{DFW_1\ (1 - DFW_2)}{DFW_2\ (1 - DFW_1)}$$

Step 4: Convert the odds ratio into Hedge's g using the following formula:

$$Hedge's\ g = \ln(OR) \cdot \frac{\sqrt{3}}{\pi} \cdot \left[1 - \frac{3}{4(n1 + n2) - 1}\right]$$

- If Hedge's g > 0.20 and DFW_1 > .10, then the URM, Pell, First Gen, or Male DFW rate is higher compared to the DFW rate for their counterpart and an insight is produced.
- If Hedge's g < -0.20 and DFW_2 > .10, then the URM, Pell, First Gen, or Male DFW rate is lower compared to the DFW rate for their counterpart and an insight is produced.
- If -0.10 <= Hedge's g <= 0.10 and percent point difference of $DFW_1$and DFW_2 is less than 5 percentage points, then there is no differences in the URM, Pell, First Gen , or Male DFW rate compared to their DFW rate for their counterpart.
- If Hedge's g, DFW_1, and DFW_2 do not meet the criteria, then no insight is produced.

Figure



Course DFW Rates Trend by Equity Measures

For faculty who've taught a course for more than 5 terms, the goal of this insight is to determine if the trend of differences of DFW rates for historically underserved students are increasing or decreasing over time. This was done by looking at Underrepresented Minority (URM) status, Pell recipient status, first generation status, and gender. To determine the significance of the trend, simple linear regression and a Chow test was used on the DFW rates by term.

1. A statistical significance test (Chow test) is used to determine if a time series has a change over time.
2. Linear Regression was used to determine the direction and strength of the trend.

Procedure

For each group (URM, Pell, First Generation, and Gender), repeat the following steps:

Step 1: Calculate the DFW rate difference for each group for the faculty's course/section for each term.

Step 2: Test structural break of DFW rate difference over time using Chow test.

- If the p-value of breakpoint < .10, then proceed to step 3.
- If the p-value of breakpoint >= .10, then proceed to step 4.

Step 3: Fit a linear regression model on the DFW rate difference from the breakpoint in step 2 through the most recent term.

- If N < 5 or R^2 < .55, then skip to step 4.
- If R^2 >= 0.55, then skip to step 5.

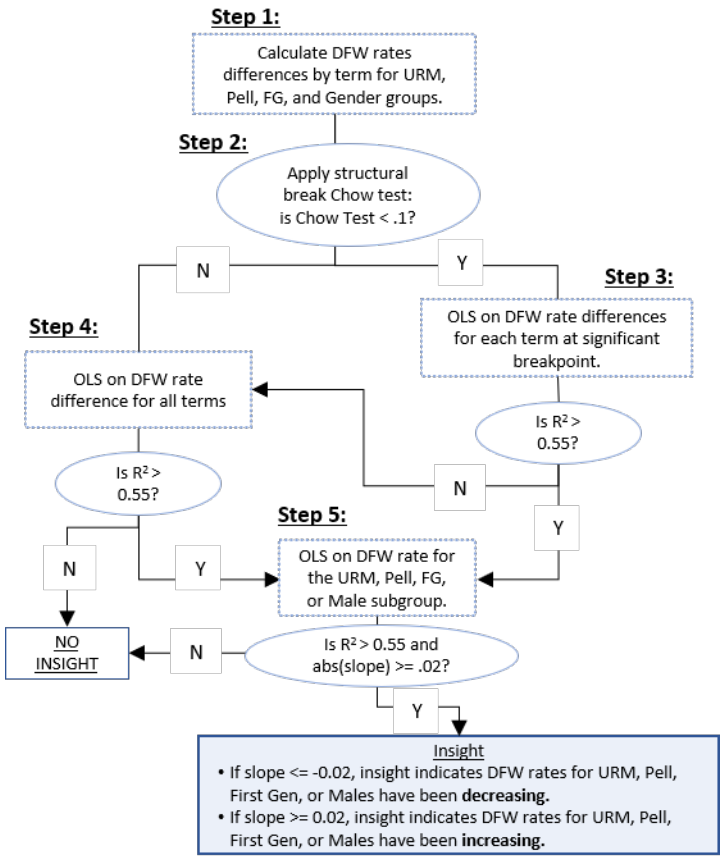
Step 4: Fit a linear regression model on the DFW rate difference for all terms.

- If R^2 < 0.55, then no insight is produced.
- If R^2 >= .55, then skip to step 5.

Step 5: Fit a linear regression model on the DFW rate for the URM, Pell, First Generation, or Male subgroup.

- If R^2 >= .55 and slope >= 0.02, then the URM, Pell, First Generation, or Male DFW rate is increasing and an insight is produced
- If R^2 >= .55 and slope <= -0.02, then the URM, Pell, First Generation, or Male DFW rate is decreasing and an insight is produced
- If R^2 < 0.55 or if R^2 >= 0.55 and absolute value of slope < 0.02, then no insight is produced.

Figure



Course DFW Rates Comparison To Other Sections or Courses and by Equity Measures

The purpose of this insight is to determine how high or low a faculty's course DFW rate for their URM, Pell, Gender, and First-Generation students is in comparison to the DFW rates of other sections of the same course within a specified time period. The faculty's course DFW rate was compared to the overall DFW rates of other faculty members who taught the same course. The magnitudes of difference for the comparison were estimated using effect size statistics.

Procedure

For each group (URM, Pell, First Generation, and Gender) and for a series of time periods, starting with the most recent term taught then sequentially iterate back each term (i.e. time periods: Spring 2019, Fall 2018 - Spring 2019, Spring 2018 -Spring 2019, etc.), repeat the following steps:

Step 1: Calculate the DFW rate of the URM, Pell, First Gen, and Male groups by term for the faculty's course/section for the specific time period, DFW_1.

- If total number of students taught < 10, then repeat with a longer time period.
- If total number of students taught >= 10, then proceed to step 2.

Step 2: Calculate the aggregate DFW of the URM, Pell, First Gen, and Male groups for all other faculty members who taught the same course, DFW_2.

- If total faculty members < 4 or total number of students taught < 10, then go back to step 1 with a longer time period. If total faculty member and total number of students taught never exceed 4 and 10, respectively, then no insight is produced.
- If total faculty members >= 4 and total number of students taught > 10, then proceed to step 3

Step 3: Calculate the odds ratio using DFW_1 and DFW_2 with the following formula:

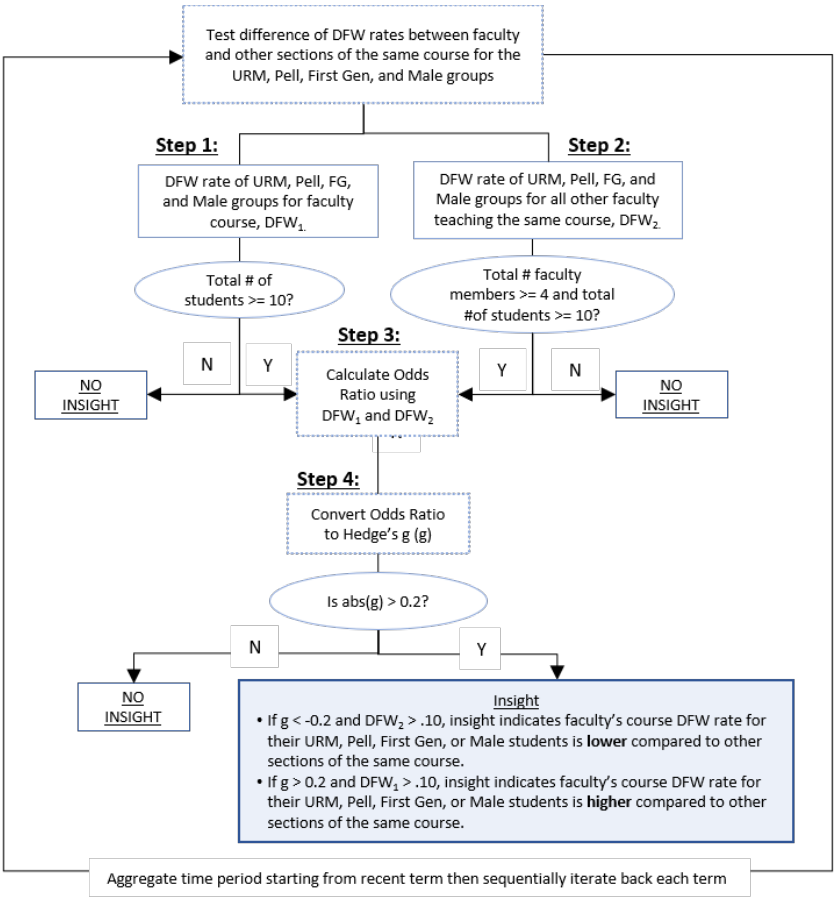
$$OR = \frac{DFW_1\ (1 - DFW_2)}{DFW_2\ (1 - DFW_1)}$$

Step 4: Convert the odds ratio into Hedge's g using the following formula:

$$Hedge's\ g = \ln(OR) \cdot \frac{\sqrt{3}}{\pi} \cdot \left[1 - \frac{3}{4(n1 + n2) - 1}\right]$$

- If Hedge's g > 0.20, then the faculty's course DFW rate for their URM, Pell, First Gen, or Male students is higher compared to other sections of the same course and an insight is produced.
- If Hedge's g < -0.20, then the faculty's course DFW rate for their URM, Pell, First Gen, or Male students is lower compared to other sections of the same course and an insight is produced.
- If -0.20 <= Hedge's g <= 0.20, then no insight is produced.

Figure



Course DFW Rates Comparison by Department and by Equity Measures

The purpose of this insight is to determine how high or low a faculty's course DFW rate for their URM, Pell, Gender, and First Generation students is in comparison to the DFW rates of all other same level courses in their department within a specified time period. The faculty's course DFW rate was compared to all other same-level courses within the department. The magnitudes of difference for the comparisons were estimated using effect size statistics.

Procedure

For each group (URM, Pell, First Generation, and Gender) and for a series of time periods, starting with the most recent term taught then sequentially iterate back each term (i.e. time periods: Spring 2019, Fall 2018 - Spring 2019, Spring 2018 -Spring 2019, etc.), repeat the following steps:

Step 1: Calculate the DFW rate by term for the faculty's course/section for the specific time period, DFW_1.

- If total number of students taught < 10, then repeat with a longer time period.
- If total number of students taught >= 10, then proceed to step 2.

Step 2: Calculate the aggregate DFW of each group for all other same level courses within the department, DFW_2.

- If total number of students taught < 10, then go back to step 1 with a longer time period. If total number of students taught never exceed 10, then no insight is produced.
- If total number of students taught >= 10, then proceed to step 3

Step 3: Calculate the odds ratio using DFW_1 and DFW_2 with the following formula:

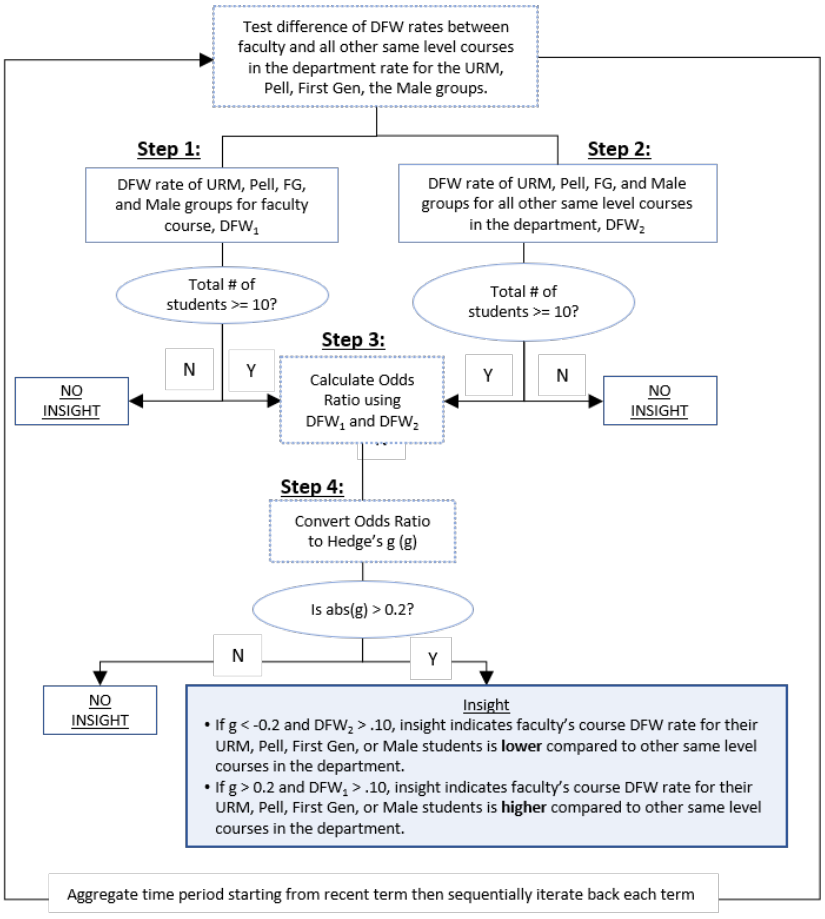
$$OR = \frac{DFW_1\ (1 - DFW_2)}{DFW_2\ (1 - DFW_1)}$$

Step 4: Convert the odds ratio into Hedge's g using the following formula:

$$Hedge's\ g = \ln(OR) \cdot \frac{\sqrt{3}}{\pi} \cdot \left[1 - \frac{3}{4(n1 + n2) - 1}\right]$$

- If Hedge's g > 0.20, then the faculty's course DFW rate is higher compared to all same level courses in the department and an insight is produced.
- If Hedge's g < -0.20, then the faculty's course DFW rate is lower compared to all same level courses in the department and an insight is produced.
- If -0.20 <= Hedge's g <= 0.20, then no insight is produced.

Figure



Notes and References

[1] For example, see

- Bloemer, W., Day, S., & Swan, K. (2017). Gap Analysis: An Innovative Look at Gateway Courses and Student Retention. Online Learning, 21(3), 5-14.
- Spring, G. S., & Schonberg, W. (2001). A study of factors contributing to low retention rates. age, 6, 1.
- Wetzel, J. N., O'Toole, D., & Peterson, S. (1999). Factors affecting student retention probabilities: A case study. Journal of Economics and Finance, 23(1), 45-55.

[2] For evidence from CSU data, see these dashboard pages:

- What Do We Know About Students Who Leave? https://csusuccess.dashboards.calstate.edu/public/gi-campus-students-who-leave
- Which Students Leave Before Graduating? https://csusuccess.dashboards.calstate.edu/public/db-students-who-leave
- Which Early Academic Behaviors Help Most With Closing the Gap? https://csusuccess.dashboards.calstate.edu/public/student-diversity/first-second-year-gaps

[3] Borenstein, M., Hedges, L., Higgins, J., Rothstein, H. (2009). Introduction to meta-analysis. West Sussex: John Wiley & Sons, Ltd

[4] Lenhard, W. & Lenhard, A. (2016). Calculation of Effect Sizes. Retrieved from: https://www.psychometrica.de/effect_size.html. Dettelbach (Germany): Psychometrica. DOI: 10.13140/RG.2.2.17823.92329

[5] Hyndman, R.J., & Athanasopoulos, G. (2018) *Forecasting: principles and practice,* 2nd edition, OTexts: Melbourne, Australia. OTexts.com/fpp2

[6] Chow, G.C. (1960), "Tests of Equality between Sets of Coefficients in Two Linear Regressions," Econometrica, 28, 591-605.