# USING DATA TO IMPROVE CURRICULUM ... AND EQUITY

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# OUTLINE FOR OUR TIME ...

- USING DATA: ANECDOTES OR ANALYSIS?
- WHAT DO WE SEE?
- CLARIFYING: PREREQUISITES TO PRE-CALCULUS; TO CALCULUS
- CLARIFYING: PLACEMENT INTO PRE-CALCULUS
- EQUAL EFFECTS FOR STUDENTS: MEASURING 'EQUITY' IN OUR CURRICULUM

#### USING DATA ... ANECDOTE OR ANALYSIS?

- MUCH OF THE DATA WE SEE IS ANECDOTAL: HEY, WE DID 7495 ... AND WE SAW 74A7!
- ANALYSIS INVOLVES LOOKING FOR PATTERNS IN DATA
- FIND NEW QUESTIONS ABOUT THE DATA
- HYPOTHESIZE POSSIBLE CAUSE & EFFECT RELATIONSHIPS

#### WHAT IS DIFFERENT: DATA ANALYSIS

- DATA ANALYSIS IS OPEN-ENDED BY ITS NATURE!
- CLASSROOM RESEARCH IS NARROW IN PURPOSE
- DATA ANALYSIS ON A MATHEMATICS CURRICULUM IS PART OF A PROCESS

IMPROVE AND MAINTAIN COURSES WHICH SERVE NEEDS IDENTIFIED FOR THEM, AT REASONABLY EQUAL LEVELS FOR ALL STUDENTS

#### WHAT DO WE SEE?



#### DID WE SEE ACCURATELY?



#### LOOK AGAIN ... THE 2<sup>ND</sup> TREATMENT EFFECT



7 instructors have 'significant difference from mean'

#### **MEASURING "INSTRUCTOR EFFECT"**

- WITH SIGNIFICANT DIFFERENCES ... WE NEED A MEASURE OF THE EFFECT
- EACH INSTRUCTOR HAS A PASS RATE (OVER TIME) IN EACH COURSE ... THIS IS THE 'EXPECTED VALUE'
- LOOK AT THE 'GAIN' (STUDENT OUTCOME VS EXPECTED VALUE)
- EXAMPLE: HAD INSTRUCTOR WITH MEAN PASS RATE .62 STUDENT WHO PASSED ... GAIN=+.38 STUDENT WHO DID NOT PASS ... GAIN=-.62

#### A BETTER VIEW OF THE PATTERN



#### PATHS TO PRE-CALCULUS

- LANSING CC OFFERS TWO COURSES AS PREREQUISITE
- MATH112 IS "INTERMEDIATE ALGEBRA" (ACT MATH 20-21)
- MATH109 IS "FAST TRACK ALGEBRA" (ACT MATH 18-19)
- ACT MATH 22 QUALIFIES FOR MATH121

#### UNEQUAL PATHS (AT THIS POINT)



#### CONFIRMING: "GAIN121"



#### DELIVERY METHODS IN PREREQ

- MATH112 (PREREQUISITE TO MATH121) IS OFFERED:
  "LECTURE"
  "MATH LAB" (DIRECTED SELF STUDY, F2F)
  "ONLINE" (VIRTUAL; PROCTORED EXAMS)
  "COMBO" (BEGINNING & INTERMEDIATE IN ONE) ... PRIOR TO THE AGE OF MATH109 (FAST TRACK)
- WITHIN EACH OF THESE ... INSTRUCTOR EFFECT
- FIRST ORDER RESULTS ON NEXT PAGE

#### HOW DID THEY TAKE PREREQ?



Individual standard deviations are used to calculate the intervals.

#### PATHS TO MATH151: CALCULUS I

- LANSING CC OFFERS TWO OPTIONS FOR PREREQUISITES TO MATH151 (CALCULUS I)
- MATH121 & MATH122 TWO SEMESTER PRECALCULUS
- MATH126 'ACCELERATED PRECALCULUS'

#### PASS RATES IN CALCULUS I



Individual standard deviations are used to calculate the intervals. Results exclude rows where Prereq="MATH121MATH126".

#### GAIN: PASS VS. EXPECTED VALUE (CALCULUS I)



Individual standard deviations are used to calculate the intervals.

#### **GRADES IN PREREQ VS CALC I**



Results include rows where Prereq="MATH121".

#### PLACEMENT INTO PRE-CALCULUS I

- ACT MATH ≥ 22
- SAT MATH ≥ 550 (INSUFFICIENT 'N' TO SUMMARIZE)
- ACCUPLACER CLM ≥ 55 [COLLEGE LEVEL MATH]
- 2.5 OR HIGHER IN MATH112 (INTERMEDIATE ALG) OR MATH109 (FAST TRACK ALGEBRA)

#### EQUAL PLACEMENT INTO MATH121?



#### ACT MATH ... TRENDS



#### **EQUITY ISSUES**

- AT FIRST GLANCE ... "HAVE THEM ALL TAKE THE PREREQUISITE ONLINE!!" (BECAUSE ONLINE PREREQ HAD BEST RESULTS IN MATH121)
- ACROSS COURSES AND INSTRUCTORS ... ARE THERE DIFFERENT OUTCOMES FOR 'RACIAL' GROUPS?
- DO THESE PATTERNS CHANGE OVER TIME?

### MATH121 EQUITY



# **ACROSS COURSES**

#### Pass Rate (2.0 +) by Select Courses



#### ACROSS TIME ...

Annual Pass Rates (2.0 +) by Academic Year



#### EQUITY ... QUALIFIED FOR COURSE



#### SEX IN MATH CLASS ③



# DISAGGREGATING ... LEVEL 2



"Risk" is highest in online: Largest outcome gap for African-American students

#### WHY? FACTORS IN LOWER PASS RATES ...

- CULTURAL ... 'CRITICAL RACE THEORY' MIGHT HELP US UNDERSTAND THAT
- STEREOTYPE THREAT ... IS REAL, BUT IS VALIDATED ON INDIVIDUAL ASSESSMENTS (VERSUS COURSE LEVEL)
- POVERTY ... PLACES STUDENTS AT HIGHER RISK
- WE DON'T HAVE DIRECT MEASURES OF 'POVERTY'; THE VARIABLE WE HAVE IS "PELL ELIGIBLE" (FILED FAFSA AND HAD LOW OR NO INCOME)

# PASS RATE (ALL MATH COURSES) 2011-2016



In each group, 'poverty' places students at risk ... but not equal risk across groups

#### "RACE", "SEX", "POVERTY" **INTERACTIONS**



... Four large enrollment courses by category (2011-16) ...

### DATA ANALYSIS TO IMPROVE CURRICULUM

- LOOKING FOR PROBLEMS ... EVEN WHERE WE DID NOT THINK WE HAD ANY
- LOOKING FOR PLEASANT SURPRISES
- SEEKING TO UNDERSTAND WHAT STUDENTS EXPERIENCE
- NOT "ONCE AND DONE"

# **RESOURCES NEEDED**

- A GOOD DATA EXTRACTION TOOL WE USE "ARGOS" <u>HTTPS://EVISIONS.COM/PRODUCTS/HIGHER-</u> <u>EDUCATION/ARGOS/</u> DATA EXTRACTION (DATA WAREHOUSING) IS AN INSTITUTIONAL COMMITMENT
- SOFTWARE FOR COMBINING SPREADSHEETS
- SOFTWARE FOR STATISTICS (I USE "MINITAB")
- A STARTING LEVEL OF EXPERTISE
- SOME TIME (PROBABLY MORE THAN YOU THOUGHT BUT LESS THAN YOU WORRIED ABOUT)

# FOCUS ON FLEXIBILITY

- DON'T EXPECT "THEM" TO WRITE A REPORT THAT GIVES YOU THE DATA YOU THOUGHT YOU NEEDED
- FLEXIBILITY ... DATA EXTRACTED AS SPREADSHEETS WITH IDENTIFIERS ALLOWING DATASETS TO BE COMBINED
- JOINING SPREADSHEETS CAN BE DONE IN MS EXCEL ... WITH
   CODING. EASIER IN STATISTICAL SOFTWARE

# YOUR DATA ... YOUR WORK

- MY DATA HAS NOTHING TO DO WITH YOUR SITUATION
- WORK WITH YOUR IT AND INSTITUTIONAL RESEARCH OFFICE TO GET DIRECT ACCESS TO DATA
- NOBODY STARTS AS AN EXPERT
- YOU WILL NEED TO LEARN SOME STATISTICS THAT YOU MAY HAVE NEVER HEARD OF

#### WRAP-UP

• OTHER QUESTIONS?

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