PBS TeacherLine Course Syllabus

Title

Making Comparisons with Data Analysis for Grades 6-8

Target Audience

This course is intended for pre-service and in-service middle school teachers.

Course Description

This course provides educators with a deeper understanding of the data analysis concepts that are integral to making comparisons, including distribution and measures of spread, measures of center, graphical representation and interpretation, and communication of data-based conclusions. Learners gain insight into middle school students' learning experiences by analyzing their work for evidence of understanding and misconceptions and observing their strategies and communication by watching videos of students investigating data analysis concepts. They also solve mathematical problems firsthand and use that experience to reflect upon the misconceptions the problems generate. In facilitated online discussions, learners will collaborate with one another to develop strategies for helping students overcome common misconceptions about data analysis. Learners will study NCTM standards for teaching data analysis and practice applying them to their teachings. As a final task, learners will design a sequence of two lessons that incorporates their knowledge of the mathematics, student learning, and instructional practices explored in this course.

Facilitator

See instructor/facilitator sheet

Credits

To be determined by college or university

Goals and Objectives

By the end of this course, learners will:
- Build a deeper understanding of the data analysis concepts that are integral to making comparisons, including distribution and measures of spread, measures of center, graphical representation and interpretation, and communication of data-based conclusions.
- Reflect on their own experiences and apply this understanding to their instructional practices for students.
- Gain insights into middle school students' learning experiences by analyzing their work for evidence of understanding and misconceptions and observing their strategies and communication by watching videos of students investigating data analysis concepts.
- Read research on common student misconceptions and ways to address them, and incorporate these strategies into their teaching practices.

Outline of Assignments

MATH 150 Making Comparisons with Data Analysis for Grades 6-8

A summary of course content and assignments is outlines below.

Session I: Understanding Data Analysis

The learners will:
- Introduce themselves to other learners through the discussion board.
- Read the standards related to Data Analysis.
- Read the current educational research related to student's understanding of statistical concepts.
- Identify the process of statistical investigation, which includes: pose a questions, collect the date, analuze the data, and interpret the results.

Read
- NCTM *PSSM for Data Analysis Standards, Grades K-12, 6-8, and 9-12*
- "Improving Student Achievement in Mathematics, Part 2: Recommendations for the Classroom"
- "Data Analysis Questions in State and National Assessments"
- "The Statistical Investigation Process," which provides background information on four stages of statistical investigation: posing the question, collecting the data, analyzing the data, and interpreting the results.
- "Making Comparisons with Data Analysis," which contains the most current research on the content and pedagogy related to the mathematics of making comparisons with data analysis.

Watch
- "Teacher Reflections" video to find out about powerful practices for teaching data analysis.

Explore
- The problems presented in the interactive "Data Analysis Questions in State and National Assessments"

Respond in Online Journal
- Expectations for this course
- What is your prior knowledge of teaching statistics?

Participate in Online Discussions
- Introduce themselves
- Collaborate on what statistics to consider when choosing a vacation spot.

Session 2: Comparing Distributions

The learners will:
- Describe and compare the shape of various distributions;
- Identify what a distribution shows about the variation in a data set;
- View data sets as entities that are distributed within a space of possible values;
- Interpret and compare line plots, dot plots, and bar graphs;
- Use visual and numeric strategies to make comparisons and draw conclusions;
- Reflect on their experiences comparing distributions

Read
- "Exploring Distribution." This article provides background information on the concept of distribution.

Explore
- Compare the distributions and make a recommendation in the "8th Grade Graduation Trip" activity.
- The "Mystery Graphs" problem by reasoning about distributions.
- Chocolate Chip Distributions activity.

Participate in an Online Discussion
- Read and post responses on the discussion board. Discuss different methods used to explain decisions and recommendations for the "8th Grade Graduation Trip" activity.

Complete the Assignments
- Write an explanation for how they decided which survey question matched the mystery graph.
- Write a rationale for a recommendation for a specific cookie-making method.

Extend the Activity (not required)
- Create their own student survey questions and graphs.

Session 3: Using Histograms to Compare Data
The learners will:
- Interpret histograms;
- Transform line plots into histograms;
- Experiment with changing the interval size of histograms to see the effect on the shape of the distribution;
- Identify ways that students compare histograms;
- Analyze what it means to make a fair comparison by using guiding questions for evaluating the statistical investigation process;
- Discuss questioning strategies for helping students compare data and communicate their conclusions.

Read
- "Histograms: What are they and What do they Show?" This article provides background information on histograms.
- "Graph Comprehension." This article describes different levels of reading and interpreting graphs. It also describes differences between ungrouped and grouped data and ways to represent them.

Watch
- Students comparing data from the "Time Getting to School" video.
- Students communicating their interpretations and comparisons in the "Examining Student Language" video.
- "Mathematical Goals" video to find out more about comparing groups.

Explore
- An animation that shows how to transform a line plot into a histogram.
- Create their own histogram in the "Graph Transformation" activity.
- How different interval sizes affect the shape of the distribution by working with the "Histograms" interactive.
- Examine and compare histograms of data in the "Time Getting to School Project."

Participate in an Online Discussion
- Read and post responses to the observation of students in "Travel Time to School" video.

- Collaborate on the "Examining Student Language" video.
- Reflect on both videos on how students compared data.

Complete the Assignment
- Write responses to three questions in connection with the "Graphing Comprehension" reading.

Extend the activity (not required)
- Students are often unsure about how to select a scale for their graphs. Do the "Animal Comparisons" activity to practice selecting and comparing scales for bar graphs
- To find out more about histograms, read the materials at the Exploring Data Web site.
- The article on the Old Faithful geyser includes 21 histograms of the data to show how changing the interval size (bin width) affects the shape of the distribution of the data set.

Session 4: Exploring Measures of Center and Spread
The learners will:
- Explore the stability of the mean and the median and the relationship between the two measures;
- Examine common student misconceptions of measures of center and plan instructional strategies for addressing them;
- Use measures of center to compare data;
- Recognize that data sets with different distributions can have the same mean;
- Conclude that both measures of center and measures of spread are needed to describe, analyze, and compare data sets.

Read
- The "Dr. Math Letter" from the *Math Forum* defines mean, median, mode, and range. This article describes student misconceptions about measures of center and instructional practices for addressing them.
- "Misconceptions in Data Analysis"

Explore
- An interactive that explores the relationship and stability of the mean and median. Learners can experiment with changing values to see how this affects the mean and median. Read the background mathematical information that is included in the example.
- Explore ways to address common misconceptions about means, medians, and modes in the Jumping to Conclusions activity.
- Use the mean, median, and mode to make new comparisons of the cookie-making methods in the Chocolate Chip Distributions, Part 2 activity.

Participate in an Online Discussion
- Discuss the ideas and rationale for whether some prior activities would be good choices to use with students as a way of addressing students' misconceptions.

Extend the activity (not required)
- Create data sets that have particular characteristics in the Mystery Data activity from the *Mathscape* unit "Looking Behind the Numbers," Lesson 3.
- Create data sets that would make each conclusion correct for problems 1-3 in the Jumping to Conclusions activity.

Session 5: Examining Student Communication and Understanding
The learners will:
- Determine whether a mean is representative for different distributions;

- Understand that both measures of center and measures of spread are needed to describe, analyze, and compare data sets;
- Look at the ways students compare distributions and interpret measures of center;
- Examine student communication to identify evidence of understanding and misconceptions;
- Plan questioning techniques to help students clarify their ideas and further their thinking.

Read
- An excerpt from the "Encouraging Mathematical Thinking" video essay by the Math Forum's Bridging Research and Practice Group. This paper provides strategies for fostering student discourse about mathematics and gives examples of leading and non-leading questions.
- Read the pages on Interventions (Approaches, Leading Questions, Non-Leading Questions, Paraphrasing, Summarizing, and Listening) and Decisions (Balance).
- "Improving Data Analysis through Discourse." *Mathematics Teaching in Middle School.* (April 2000). This research article describes the ways students compare distributions. Kay McClain, et al.

Watch
- "Making Comparisons" video. Look at student work as a means for examining the students' strategies.
- "Questioning the Mean" video. Observe the students' interpretations of the mean.

Explore
- Compare the data and consider whether the means are representative of the data sets in the Couch Potatoes or Sports Nuts?

Participate in an Online Discussion
- Read and post comments on the discussion board. Reflect on the observations of the students in the videos and of the student work. Cite evidence and different questions or instructional strategies that could be used to clarify and further the students' thinking.

Complete the Assignments
- Write about one student's understanding of the data analysis concepts underscored in this course.
- What would you do next? What strategies would you use? Why?

Extend the activity (not required)
- Decide which measure (mean, median, mode, or range) would be the best choice for describing the number of times a popular song was played on the radio. Solve the problem and then compare your solution with Dr. Math's explanation.
- Apply your understanding of means to explain these TV viewing statistics:
    - The average viewing time for teens 12-17 years old is 11 hours, 01 min a week.
    - The average viewing time for teens 12-17 years old is 3 hours a day.
- How can the averages for weekly viewing times and daily viewing times fit together?

Session 6: Pulling it All Together (Part 6)
The learners will:
- Reflect on the mathematical concepts, processes, and skills that you have learned in the course;
- Apply your knowledge of the mathematics and of effective instructional practices in this course to plan a sequence of lessons.

Participate in an Online Journal

- Learners will reflect on their experiences in the course, the goals for the data analysis strand from the *PSSM* 2000, and the recommendations in the reading, "Improving Student Achievement in Mathematics."
- Learners will discuss some new things learned (or affirmed, if current practice) and how ideas from the course apply to the classroom.

Complete the Final Project
- Choose two sequential lessons and offer a rationale for the sequence.
- State mathematical goals and rationale for them.
- Provide lesson plans and example materials.
- Provide the assessment and answer key
- Provide ideas and explanation for chosen teaching strategies.
- Explain how you would look for evidence of student's understanding.
- Cite references.

Schedule
This course is scheduled to take approximately 30 hours to complete readings, activities, video, assignments, reflections and a final project.

Requirements
Learners are expected to:
Complete all assignments
Participate regularly in all discussion boards

Materials (hardware, software, plug-ins)
Technical Requirements
Word processor
Internet service provider
Email

Academic Dishonesty Policy
To be inserted by university institution only

Evaluation
This course can be taken for graduate credit on a pass/fail basis, or for a letter grade and graduate credit.
See graduate credit details pertaining to specific graduate credit institutions.