Frederick Community College

Assessment of Student Learning

Mathematics Department

3rd Assessment Cycle 2012-2015

Assessment Plan

General Education Competency

MA206 Elementary Statistics

Prepared By

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Background

The Mathematics Department will measure student learning in the general education competencies:

(1)Scientific/Quantitative Reasoning and
(2) Critical Thinking.

These competencies allow the college to meet the requirements of the Middle States Commission on Education.

The Gen Ed course chosen for the study is MA206 Elementary statistics. MA206 has the largest enrollment of Gen Ed math courses (approximately 400 students each semester). The high enrollments of the course will allow the data to be generalized to the college as a whole.

Methodology

MA206 – Elementary Statistics is an introductory non-calculus statistics course. Topics include descriptive analysis and treatment of data, probability, statistical inference, linear regression and correlation. MA206 students learn by engaging in classroom and homework activities that investigate statistical concepts from the graphical, symbolic, numerical, and verbal points of view. Responses to a pre-post test with 14 questions will be collected (Appendix A) and submitted to a database using a FCC web portal. Fall 2012 and Spring 2013 semesters will be used to collect a baseline and only four sections of MA206 will participate during the pilot period. The OAC representatives will devise a grading rubric and a point system to ensure consistence in grading during the pilot phrase. In addition, we plan to make improvement to the assessment tool (test) and grading scheme based on feedback from all MA206 instructors and the department. Beginning at 2013 fall, all MA206 classes will participate in the third assessment cycle. (See Appendix B Instructions for gathering assessment artifacts.)

Each instructor involved will answer an "Instructor Questionnaire" (Appendix C), where the instructor will report what learning strategies are used and to what extent to improve student learning. We want to ensure all instructors are actively using data to improve student learning.

Neither individual students nor instructors will be identified in reports.

Analysis of Data

The artifact (test) is designed so that the sequence of required responses is natural and easy for the student. Each competency is evidenced at places throughout the artifact (test). This presents two challenges for the team, who are required to align separate learning evidence by competencies, as well as assure consistency in scoring.

We feel that both of these requirements can best be met by the use of **example artifacts**. The team will devise and revise a point grading scheme in 2012 fall and 2013 spring, up until the scoring process begins. The collection of examples, when agreed upon by the team, will serve as the main resource for answering a scorer's question: "How should I score something like this?" They will serve as the definitive scoring calibrator--even should the makeup of the assessment team change.

To further ensure consistency, team members will be working together to score each test question. The team will discuss any discrepancy of more than one point (i.e. 4 vs. 2) or "1 vs. any other score" and, if necessary, revise the Examples to reflect their agreed-upon resolution of the "correct" score.

In each report, student competency distribution will be organized by assessment question and by total possible point per outcome assessed, comparing pre- and post- results. Based on our experience from second assessment cycle, we have found this scheme effective to analyze student learning and identify strategies for helping students to learn.

Recommendations

The department will discuss possible learning innovations and interventions to address weak area(s). The team and the department will include these additional strategies and encourage their implementation in all sections. The 2014 round of data-gathering and analysis should reveal statistical evidence of improvement (or not) of student learning. This will determine whether new strategies must be sought. These results will be described in the final report.

Assessment Timeline

Semester	Assessment Objectives
Fall 2012	1. Design and present a plan to OAC. 2. Deploy initial **Pilot Assessment.** 3. Design, Research and Implement an effective assessment tool. 4. **Collect data**.
Spring 2013 **(PRR Status Report is due April 1, 2013)**	1. Deploy **Pilot Assessment** if not completed in the fall. 2. **Analyze** initial Pilot Data. 3. Implement instructional and organizational strategies to improve the assessment project. 4. **Reassess** students and **collect data**.
Fall 2013	1. **Analyze** Pilot Data. 2. Develop strategies based on that data to help improve student learning. 3. **Begin 1st Assessment**. 4. **Collect data**.
Spring 2014	1. **Analyze** Assessment Data. 2. Develop strategies based on that data to help improve student learning. 3. **Reassess students**. 4. **Collect data**. 5. Present a **progress report** to the OAC.
Fall 2014 **(Self-Study Begins)**	1. **Analyze** Assessment Data. 2. Develop final strategies based on lessons learned over the course of the assessment. 3. **Conduct Final Assessment.** 4. **Collect Data.**
Spring 2015	1. **Analyze** Data Collected over the course of the entire assessment. 2. **Prepare Final Assessment Report**.

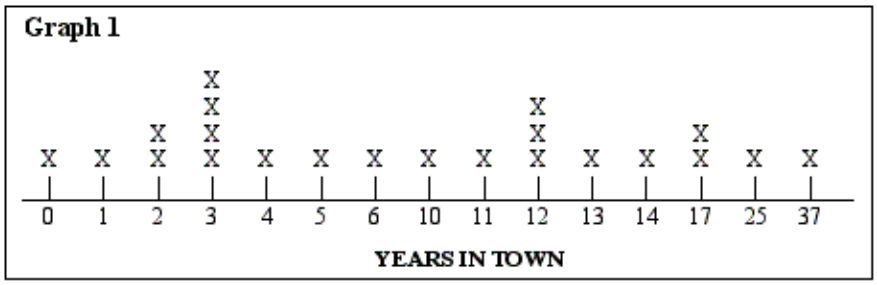
Appendix I

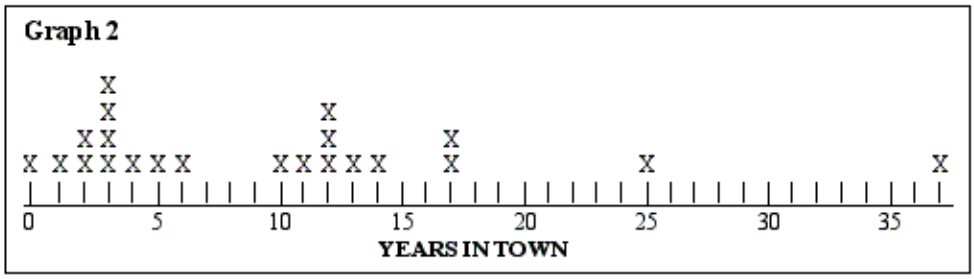
Appendix I: MA206 Instrument for assessing student learning
Note: The General Education competency that each question assesses (QR or CT) is indicated in *Italics*.

1. Suppose a particular outcome from a random event has a probability of .02. Which of the following statements represent correct interpretations of this probability? **(probability, literacy)** - ***QR***

   a. The outcome will never happen.
   b. The outcome will certainly happen two times out of every 100 trials.
   c. The outcome is expected to happen about two times out of every 100 trials.
   d. The outcome could happen, or it couldn't, the chances of either result are the same.

2. A class of students recorded the number of years their families had lived in their town. Here are two graphs that students drew to summarize the data. Which graph gives a more accurate representation of the data? _____
   Why? **(data representation, reasoning)** - ***CT***





3. Four students at a local high school conducted surveys. **(samples and sampling, thinking)** - ***CT***
   - Shannon got the names of all 800 children in the high school and put them in a hat, and then pulled out 60 of them.
   - Jake asked 10 students at an after-school meeting of the computer games club.
   - Adam asked all of the 200 children in Grade 10.
   - Claire set up a booth outside of the school. Anyone who wanted to stop and fill out a survey could. She stopped collecting surveys when she got 60 students to complete them.

   Who do you think has the best sampling method?
   a. Shannon b. Jake c. Adam d. Claire
   Why?

4. The IQ (intelligence) scores of thirty-three students from the same third grade classroom are presented. One set is for boys and the other set is for girls. Summary statistics (mean, standard deviation, median, and quartiles) are provided for each set of children. Use the stems below to create a back-to-back stem-and-leaf plot so that you can visually compare the IQ scores of the boys with the IQ scores of the girls. **(data representation comparing group, reasoning)** – ***CT&QR***

BOYS	GIRLS
113 113 122 116 122 134 134 105 122 126 129 133 122 133 108 120 144 104	115 102 119 114 108 111 122 113 125 118 96 112 124 122 115
$\bar{x} = 122.2$ $Q_1 = 113$ sd = 11.09 Median = 122 $Q_3 = 133$	$\bar{x} = 114.4$ $Q_1 = 111.5$ sd = 8.05 Median = 115 $Q_3 = 120.5$

BOYS		GIRLS
	9	
	9	
	10	
	10	
	11	
	11	
	12	
	12	
	13	
	13	
	14	
	14	

Write a comparison of the distribution of IQ scores for the boys and girls that includes comparisons of shape, center, and variability.

5. One of the items on the student survey for an introductory statistics course was "Rate your intelligence on a scale of 1 to 10." The distribution of this variable for the 100 women in the class is presented below. What is the probability of randomly selecting a woman from the class who has an intelligence rating that is LESS than seven (7)**?** **(probability computation, literacy)** - ***QR***

a. (12 + 24)/100 = .36

b. (12 + 24 + 38)/100 = .74

c. 38/100 = .38

d. (23 + 2 + 1)/100 = .26

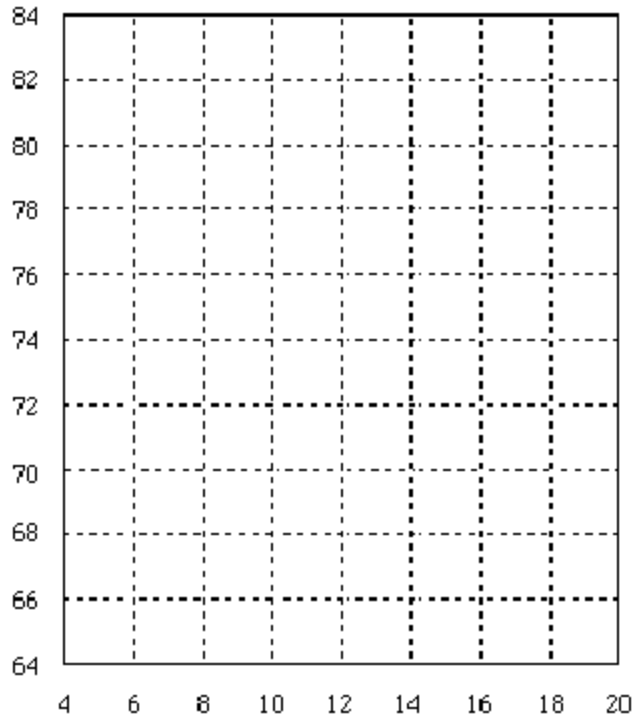
e. None of the above.

Intelligence Rating	Count
5	12
6	24
7	38
8	23
9	2
10	1

6. Ten states were randomly selected from among the 50 United States. This data set presents the percentage of households in each state that were below the poverty level (Poverty Rate) and the percentage of adults in the state who had earned a high school degree or higher (HS and Above). In the table is the mean and standard deviation for each variable, and the correlation for the two variables. You do not need to calculate these values. **(Bivariate data, quantitative literacy) – *QR&CT***

Variable	Mean	Standard Deviation	Correlation
Poverty Rate	12.33	3.117	-.796
% HS and Above	76.11	6.176	

Poverty Rate	HS and Above
8.7	77.5
19.0	64.7
13.1	76.7
10.2	82.5
10.2	78.8
13.0	70.0
12.5	75.6
11.9	83.1



(a) Draw a scatterplot of the two variables using the grid provided.

(b) Use data above to get a linear regression equation. (You can either use your calculator or use the points (19, 64.7) and (10.2, 78.8) and the slope-intercept formula $y = mx+b$ to the get the equation.) Write the equation here.

(c) Using your regression equation, predict the percentage of adults with HS and above given a poverty rate of 9%. _____ Does this prediction make sense? Why or why not?

(d) Using your regression equation, predict the percentage of adults with HS and above given a poverty rate of 25%. _____ Does this prediction make sense? Why or why not?

7. a. Give an example of a research study that illustrates the placebo effect. **(data production, literacy)**

   b. What is the purpose of the placebo in the context of the research study?

   CT

8. If you flip a fair coin and get heads 5 times in a row, what is the chance of getting tails on the next flip? **(probability, computation reasoning)**

   a. Greater than 50%

   b. 50%

   c. Less than 50%

   QR

9. The correlation between two scores on tests was found to be exactly 1. Which of the following would **NOT** be true, regarding the corresponding scatterplot? **(bivariate data, linear regression, reasoning)** - ***CT***

   a. Every point would lie along a perfect straight line, with no deviations at all.

   b. The slope of the best fitting line would be 1.

   c. The best fitting line would have an uphill (positive slope).

   d. All of the above are true.

10. The distributions of SAT and LSAT scores are both approximately normal and symmetric. Veronica took both tests (at different times) and would like to know on which test her performance was better. Use the data given on each test to decide which score was better, relative to other people who took each test. **Explain your answer.** (**measurement of position, reasoning**) - ***QR***

Test	Veronica's score	Mean score	std. deviation
SAT	875	998	203
LSAT	145	150	9

11. Sara and Jerry took a math exam. Sara's percentile score on the exam was 35; Jerry's percentile score on the same test was 70. We know that (choose all the apply) **(measures of position, reasoning)** - ***QR***

   a. Sara scored better than 35 of her classmates.

   b. Sara correctly answered half as many items as Jerry did.

   c. They both scored better than average on the math exam.

   d. Jerry correctly answered more items than Sara did.

12. (CT)Which of the following is most sensitive to outliers? **(measures of spread, literacy)** - ***CT***

    a. interquartile range

    b. standard deviation

    c. median

    d. mode

13. (CT) If sample means are examined for samples of size 1, 5, 10, 16 and 50, you will notice that as *n* increases in size, the average of the sample means will estimate the samples and sampling **(samples and sampling, reasoning)** - ***CT***

    a. sample mean

    b. population mean

    c. median

    d. population proportion

    e. sample proportion

14. (CT) A card company claims that 80% of all American college students send a card to their mother on Mother's Day. Suppose you plan to gather your own data to test this claim. You select a simple random sample of 400 American college students to determine the proportion of them who send a card to their mother on Mother's Day. Your sample indicates that 70% of the students sampled send a card to their mother on Mother's Day. Does this make you accept or reject the card company's claim? **Justify your answer**. **(test of significance, one sample proportions, literacy)** – ***CT&QR***

Appendix II

Appendix II
Instructions to instructors for gathering data and submitting data though FCC web portal

Dear MA206 instructors:

The Mathematics Department is assessing student learning, and MA206 has been chosen based on its enrollment size. The sole purpose of the project is to identify learning strategies that we can use to improve student learning. Although the result of this assessment project will not impact you in any other way, you must take part in this assessment.

Please use the following steps while conducting this assessment:

1. Administer the **assessment instrument (attached)** to your students on the first day of class. **Note: Please do not change or rephrase any question**

2. Collect the completed assessment from students and grade the returned work using the point system on the assessment instrument.

3. Input the point that each student earned for each question electronically. You can find the direction on MA206 **Outcome Assessment Step-by-step Training (attached)**

4. Most importantly, you must complete the **Instructor Survey Questionnaire (attached)** and email it to Pei.

Thank you so much for being a part of the department's ongoing effort to improve student learning. Please feel free to ask questions or make comments.

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Appendix III

Appendix III

Instructor Survey Questionnaire (to be included with student responses to assessment instrument)

Part I— Learning Strategies employed

Rate the extent of your use of the following learning strategies in your MA206 class on a scale of 0 to 4 (0 => Never, 1=> up to 25% of class time, 2 => between 25% to 50%, 3 => between 50% to 75% , and 4 => all the time).

1. Lecture 0- 4
2. Group activities 0- 4
3. Student presentations 0- 4
4. Group presentations 0- 4
5. Peer assistance 0- 4
6. Or any other learning strategies used, or listed on your syllabus under "Instructional Methods", and rate the extent of their use on the same scale.

Part II

Did the assessment help you to identify students' weakness? How did you use the assessment result from pretest to improve your student learning? Were you successful in your attempt? Based on your experience during this assessment cycle, what will you do differently to improve student learning?