

Idaho State University

General Education Assessment Plan - 2nd 5-Year Cycle

Course:	MGT 2216	GERC Decision:		Date:	
Course Title:	Business Statistics				
Objective:	3	Mathematical Ways of Knowing			
GERC Notes:					
Department:	Marketing & Management			College:	Business
Submitted by:					
Dept. Chair:	Neil Tocher		Original Plan Approval Date:	10/27/2015	
Received by GERC:		Date Processed:		GERC Agenda:	

No changes are to be made above this line.

REVISIONS: by department chair or plan authors.

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CHANGES MADE by Dept.?	Yes or No	Revised by: (Name)		Date:	
Description of Changes:					
Notify GERC Rep:		GERC Rep's Name:		Date:	

For GERC's use:

Need GERC Review?		Substantive changes requiring a new Assessment Plan?		
GERC Rec'd:		Processed by GERC:		GERC Agenda:
GERC Decision:				Date:
UCC Proposal Required?		UCC Proposal Submitted:		UCC Prop #

Assessment Schedule: 2nd Cycle

Scheduled Rotation	Year 1	Year 2	Year 3	Year 4	Year 5	5-Year Report Due
Academic Reporting Year	2021-22	2022-23	2023-24	2024-25	2025-26	January 2025
Assessment Scheduled						
Outcome(s) Scheduled						
Annual Report Filed						
Outcome(s) Assessed						
Dept. to review & use results?	By whom?					
5-Year Report Due						

Objective 3, Mathematical Ways of Knowing:

Minimum of one (1) course. (3 credits)

Upon completion of a course in this category, a student is able to demonstrate the following competencies.

- i. ~~Read, interpret, and communicate~~ mathematical concepts.
- ii. Represent ~~and interpret~~ information/data.
- iii. ~~Select, execute, and explain~~ Use appropriate strategies/procedures when solving mathematical problems.
- iv. ~~Apply quantitative reasoning to~~ Draw reasonable conclusions based on quantitative information, and support appropriate conclusions.

Assessment Plan for MGT 2216 Business Statistics

(satisfies Objective 3, Mathematical Ways of Knowing)

A. Assessment Method(s):

1. **When will each learning outcome of the objective be assessed?** Students in MGT 2216 must take a computer lab exam near the end of each semester that tests both key statistics concepts and statistics software skills. We have reviewed the results of our testing and made changes to this course based upon these outcomes in our process of continuous improvement for our AACSB accreditation.
2. **What direct (e.g. student work such as essays, exams) and indirect (e.g. syllabi, assignment prompts) instruments will be used?** **Describe the type of materials that will be collected, as well as any procedures involved in selecting a representative sample of student work for review and/or retention. (Materials should be retained according to procedures outlined by Academic Affairs.)**

Direct assessment:

Every student's computer lab exam will be graded and assessed on outcomes.

1. Read, interpret, and communicate mathematical concepts.

Students will interpret data based upon descriptive statistics and appropriate graphical display of continuous data and explain their choice of best measures of center and spread.

2. Represent and interpret information/data.

Student will produce JMP output of continuous data and interpret
Student will produce an Excel graph of categorical data
Students will produce appropriate output for relationships
Students will interpret output for relationships

3. Select, execute and explain appropriate strategies/procedures when solving mathematical problems

Students will be presented with a scenario and data and be expected to complete a hypothesis test. This requires that the student select the appropriate test, write hypotheses appropriate for the test, and follow through with appropriate JMP output.

4. Apply quantitative reasoning to draw and support appropriate conclusions

To complete a hypothesis test, students must use appropriate logic and the p-value decision rule to draw an appropriate conclusion. For our exam, this will involve steps 6 and 7 of the hypothesis test.

Indirect Assessment:

All instructors of MGT 2216 will provide syllabi, example JMP/Excel deliverables, and example class activities that are used to scaffold student learning. These will be uploaded into a Moodle GERC College of Business site for the undergraduate curriculum committee to review during the annual evaluation of student outcomes in the course. In addition, instructors will provide a brief discussion of changes implemented in the course and any benefit/detriment seen from these changes.

3. How are the assessment instruments evaluated? Specify the criteria used, and rubrics, if any. Explain how assessment instruments will be used to evaluate achievement of each of the general education learning outcomes. Include specific examples of exam questions, writing prompts, or project descriptions that could yield student work demonstrating each outcome, and describe the process, criteria, and/or rubrics that would be used to assess the achievement of each learning outcome with those instruments.

Find attached both the test choices, the grading rubric, and an actual example computer lab exam. Grading of statistical work applies best practices from the statistics education community. For example, in grading a hypothesis test...if a student incorrectly chooses the hypothesis test, only that portion of the hypothesis test is marked incorrect; the remainder of the hypothesis test is then judged on whether the student followed appropriate reasoning and supplied appropriate JMP output for that choice. Another example would be if a student incorrectly identified the response variable for a problem about relationships; if so, then only that point would be lost for the scatterplot and the remainder of the problem would be assessed on the basis of the student's choice. Source: Best practices from the Advanced Placement Statistics readings where Dr. Sue Schou was a reader and leader.

Specifics:

Hypothesis Testing

Hypotheses: Student must have both the parameter and direction correct for hypothesis test choice.

Choice of test: Student must choose the correct test.

JMP output: Student must provide output that matches test choice

Decision: the student must choose the correct p-value, apply the p-value decision rule correctly, and arrive at a conclusion that matches reject H_0 or do not reject H_0

Graph and reporting statistics – continuous data

Graph: student must produce correct JMP output

Interpret graph: student must correctly identify the data as skewed versus symmetric

Descriptive statistics: student must produce summary statistics using JMP

Report statistics: student must correctly report appropriate measures of center and spread

Explain: student must explain choice of measures of center and spread by checking the interpretation of their graph

Graph – categorical data

Graph: student can produce a graph using Excel

Correlation and regression:

Scatterplot: student must produce a scatterplot to show a relationship between two continuous variables. 1 point for correct response versus predictor variable. 1 point for knowing to graph data for a relationship using a scatterplot

Correlation: student must produce JMP correlation output

Regression: student must produce JMP regression output

Explain: student must explain the relationship with the following characteristics: strength, direction, whether the relationship is linear or not.

B. What is the method for compiling/tabulating assessment results? What threshold of performance do you define as adequate achievement of a learning outcome, and what quantitative results will ultimately be tabulated?

Each instructor will be sent a reporting spreadsheet template and will produce a spreadsheet reporting the number of students who correctly for each item tested using the assessment instrument. The spreadsheet will be uploaded in Moodle for the use of the Director of Accreditation. The reporting will entail determining the percent of students who are successful in each category and by outcome.

C. What is the process for evaluating and interpreting those results?

Annually, the instructors teaching MGT 2216 will meet with the Director of Accreditation to discuss the results of the assessment. We will look at percentage of students showing competence (correctly answering) in each outcome and compare that to the previous year's data; the expectation is that the percentage of students showing competence would be similar or better than the previous year's results. If this is not the case, then the instructors will do item analysis to determine where improvement to the course is needed or if changes to the instrument are required.

The course materials, student assessment data, and instructor discussion of changes to MGT 2216 will be uploaded into the CoB GERC Moodle site will be reviewed by the undergraduate curriculum committee and recommendations for any needed additional changes will be made based upon the review.

D. How will the department translate the findings into curriculum changes or adjustments to the assessment process?

Because the College of Business applies continuous improvement to its courses as a part of its accreditation process, MGT 2216 has applied those metrics for curriculum change for a number of years. This process will continue with changes in how we teach, in course requirements, and in our assessment instruments. For example, we discovered students were having issues with correctly identifying appropriate measures of center and spread so

we now include a class activity that dramatically demonstrates the differences in mean and median when the data is severely skewed. After this change, a higher percentage of students can report appropriate statistics.

E. Do you have any suggestions for changes to the learning outcomes that would simplify their use in the assessment process while retaining their original intent?

No

F. Additional comments or clarifications.

Computer Lab Exam (a test of JMP/Excel skills and statistics concepts)

Student will have 4 problems to work during the exam....one from each of the options listed under each topic (1-4).

- 1) Hypothesis test (one sample t-test, one sample proportion test, 2 sample t-test, Levene's test of equal variance, 2 sample proportion test, chi-square test of independence)
Graded based upon the following:
 - Hypotheses
 - Choice of test
 - JMP output
 - Decision with correct logic
- 2) Graph of continuous data
 - Boxplot
 - Histogram
 - Stem and leaf plot
 - Interpretation: skewed versus symmetric
 - Descriptive statistics output
 - Report 5 number summary
 - Report measures of center and spread – correct choice based upon graph from above list (remember to report mean and standard deviation when symmetric, median & IQR if skewed)
- 3) Graph of categorical data or time series data using Excel:
Graded on the following characteristics: title, axis labels, source, correct graph type & not 3D
 - Bar chart
 - Pie chart
 - Time series chart
- 4) Correlation & Regression
 - Scatterplot – just points, no lines and no density ellipse
 - Correlation
 - Linear regression
 - Interpretation: describe the relationship between the two continuous variables to include: direction, strength, & linearity

Grading Rubric for Computer Lab Exam Fall 2015

		<i>HYPOTHESIS TEST</i>
	1	Hypotheses
	1	Choice of test
	2	JMP output
	1	Decision with correct logic
		<i>GRAPH & REPORTING STATISTICS – CONTINUOUS DATA</i>
	2	Graph
	1	Interpreting graph (skewed versus symmetric)
	2	Reporting appropriate statistics
		<i>GRAPH – CATEGORICAL DATA</i>
	2	Graph
	1	Title
	1	Axis labels
	1	Source
		<i>CORRELATION & REGRESSION</i>
	2	Scatterplot
	1	Correlation
	1	Regression
	1	Interpretation of the relationship

Example Computer Lab Exam

1. The amount of a certain chemical in the raw material used to produce linoleum is a critical factor in the linoleum's durability. A researcher for a linoleum manufacturer believes that the mean concentration of the chemical is different in the raw material obtained from two suppliers. To find out whether or not this belief can be supported by objective data, the researcher takes random samples from the raw material provided by the two suppliers and determines the concentration in each specimen. The results are as follows. Do the data support the researcher's belief? Use a .05 level of significance and assume the variances are not equal.

Supplier A: 60.9 49.8 65.3 40.6 51.6 69.7 58.0 59.6 47.8 46.9 47.6 67.3

Supplier B: 72.9 67.3 81.4 89.4 86.5 51.5 72.9 74.0 77.8 86.4 82.0 77.6 74.8 50.7 61.0 57.8 74.7 89.4

DECISION: If the durability of linoleum increases as the concentration of the chemical increases, which of the suppliers would you use to ensure the durability of your product?

2. Using the data for supplier A only, produce a histogram of the data and report the shape of the data. Produce the descriptive statistics and report the best measure of center and spread for these data. Explain how you decided upon the choice of statistics to report.

3. The Atlanta Post, December 3, 2014 reports the following top five cities having the highest median income for 2013:

Washington, DC \$102,340

Bridgeport, CT 98,118

San Jose, CA 96,443

Bethesda, MD 90,751

San Francisco, CA 90,343

Using these data, prepare a bar chart for a marketing executive who is interested in prospective locations for luxury clothing stores.

4. Develop a model to predict assessed value (in \$000) of a home based upon the square footage (in thousands of square feet) of the home. Produce an appropriate graph of the data to show the relationship between assessed value and square footage. Then show the output for the correlation between the two variables as well as the appropriate regression output. Discuss what the scatterplot and correlation tell you about the relationship.

Value	84.4	77.4	75.7	86.0	79.1	70.4	75.8	85.9	78.5
SqFt	2.00	1.71	1.45	1.95	1.87	1.20	1.55	1.93	1.69