

Assessment of Materials for Engaging Students in Statistical Discovery*

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Materials for Statistical Discovery

- Lab and Classroom Activities
 - Working with M&Ms
 - Normal Distribution
 - Designing Simple Random Samples
 - Designing Experiments
 - Using Repeated Sampling to discover
 - Central Limit Theorem and sampling distributions
 - Inference
 - The Importance of Randomization

Implementation of Materials

- Special Section of Statistics 101 - General Introductory Course
- Invited Freshman and Sophomores with ACT Math Scores of 27 or higher
- Expose High Math Ability Students to Statistics Early in Academic Career
- More Challenging Introductory Course for Statistics Majors.

Implementation of Materials

- Spring 2004
 - Working with M&Ms
 - Normal Distribution
 - Designing Simple Random Samples
 - Designing Experiments
- Spring 2005
 - Spring 2004 materials
 - Using Repeated Sampling to discover
 - Central Limit Theorem and sampling distributions
 - Inference
 - The Importance of Randomization

Assessment of Materials

- Spring 2004
 - Experimental Group
 - 100% of Students Agreed to Participate
 - Instructor – Bob Stephenson
 - Control Group
 - Regular Sections of Statistics 101
 - Instructors - 4 Graduate Student TAs
 - 75-80% of Students Agreed to Participate
 - High Mathematics Group
 - Other Students

Assessment of Materials

- Exam #1
 - Distributions (2 questions)
 - Normal Probabilities and Distribution (2 questions)
- Exam #2
 - Regression
 - Experiment
- Final Exam
 - 5 questions

Assessment of Materials

- Course Project
 - Experiment and Regression Analysis
 - Experimental and Control Group Students randomly assigned to project groups.

Assessment of Materials

- Grading of Exam Questions
 - Rubric
 - Graded by at least 2 people
 - Discrepancies resolved by 3rd person
- Grading of Course Project
 - Rubric
 - Independent Consultant – Carl Lee

Assessment of Materials

- Experimental Group
 - 20 students in Special Section with ACT Math Score of 27 or higher.
 - Mean ACT Math Score = 30
- High Math Ability Control Group
 - 39 students in Regular Section with ACT Math Score of 27 or higher
 - Mean ACT Math Score = 29

Assessment of Materials

- Other Students Control Group
 - Students in project groups with high math ability students were eliminated
 - Random Sample of remaining students
 - 48 students
 - Mean ACT Math Score = 22

Assessment of Materials

- Pretest
 - Skill 1 – Calculating Statistics
 - Skill 2 – Describing Distributions
 - Skill 3 – Applied Linear Algebra
- ACT Math Score
- GPA at ISU
- High School Rank

Results of Exam #1 Assessment

- Distributions

Group	Mean Score	St. Dev.	Sig?
Exp.	10.15	1.66	B
C-HM	12.33	1.87	A
C-O	10.71	3.18	B

Results of Exam #1 Assessment

- Distributions
 - Group is significant at 5% level.
 - GPA is significant at 10% level.

Results of Exam #1 Assessment

- Normal Probabilities and Distribution

Group	Mean Score	St. Dev.	Sig?
Exp.	7.90	1.86	A
C-HM	7.91	1.45	A
C-O	4.67	2.93	B

Results of Exam #1 Assessment

- Normal Probabilities and Distribution
 - ACT Math and Pretest – Skill 2 are significant at 5% level.
 - No additional variables were significant at 10% level.
 - Group is not significant at 5% level.

Results of Exam #2 Assessment

- Regression

Group	Mean Score	St. Dev.	Sig?
Exp.	14.20	3.17	A
C-HM	11.87	3.25	B
C-O	9.23	3.88	C

Results of Exam #2 Assessment

- Regression
 - GPA and Pretest – Skill 1 are significant at 5% level.
 - ACT Math and HS Rank are significant at 10% level.
 - Group is not significant.

Results of Exam #2 Assessment

- Experiment

Group	Mean Score	St. Dev.	Sig?
Exp.	8.10	1.39	A
C-HM	7.78	1.68	A
C-O	6.59	1.54	B

Results of Exam #2 Assessment

- Experiment
 - No preliminary variables are significant.
 - Group is not significant at 5% level.

Results of Course Project Assessment

Group	Number	Mean Score	St. Dev.	Sig?
Exp.	n = 7	46.36	2.48	A
C-HM	n = 28	40.38	5.82	B
C-O	N = 18	36.25	8.36	B-C

Limitations of Study

- Instructor Effect
 - Confounded with Group
 - Second Year Assessment: Same Instructor
- Formation of Project Groups
 - Experimental group contained all High Math students
 - Control High math groups contained some High Math students and some other students.

Future Work

- Final resolution of all discrepancies in assessment of exam questions.
- Assessment of Final Exam from First Year (in progress)
- Assessment of Second Year (in progress)