



# Teaching Soil Conservation in an Introductory Soil Science Laboratory

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## BACKGROUND

Soil conservation lessons suggested by literature:

- Rainfall simulators
- Computer models
- Long term erosion measurements

Mamo and Kettler tested two soil conservation lessons in 2004:

- Compared USLE computer model with paper and pencil lesson
- No significant difference in test scores
- Students preferred the USLE model

Goal for this experiment:

- Test the effectiveness of large scale simulators versus the effectiveness of in laboratory lecture and small group activities

## MATERIALS AND METHODS

Learning objectives:

- Define erosion
- Understand the “spiral” of soil erosion
- Types of water and wind erosion
- Effects of water and wind erosion
- Factors of the USLE and WEQ
- Control of water and wind erosion

The laboratory sections were separated into two groups.

**Simulator Group:**

- Collected sediment from treatments using a rainfall simulator and wind tunnel
- Post lab calculations and questions

**Lecture Group:**

- Received an in laboratory, PowerPoint lecture and performed small group activities to test factors of the USLE
- Post lab calculations and questions

Pre-Test and Quizzes Administered:

- Ten question pre-test based on the ten learning objectives
- Two quizzes to assess knowledge retention which covered the ten learning objectives, four weeks apart

Surveys:

- Two surveys using a Likert-type scale
- First survey assessed if students felt that they understood the learning objectives
- Second survey assessed student preference between the two groups after the groups switched at the end of the semester.

The first trial was conducted in the Fall semester and the second in the Spring. Procedural changes occurred for the Spring semester, so the results were analyzed separately.

## MATERIALS AND METHODS CONTINUED

### Sample Quiz Questions

- For the wind erosion equation,  $E=f(IKCLV)$ , the K factor predicts greater erosion by wind \_\_\_\_\_.
  - When the erodible fraction is increased
  - When prevailing winds are above 15 mph
  - When the soil surface is smoother.
- Which of the following is a detrimental effect of water erosion?
  - Sedimentation
  - Saltation
  - Salinization
- Changes in the LS factor in  $A=RKLSCP$  has the potential to \_\_\_\_\_.
  - Decrease raindrop impact
  - Decrease water velocity
  - Decrease soil cover

### Sample Survey Questions

Number your response to the questions below.  
1 = No, definitely not 2 = No 3 = Neutral 4 = Yes 5 = Yes, definitely

- \_\_\_ Do you feel that you learned a lot during this lab?
- \_\_\_ Do you understand the definition of erosion?
- \_\_\_ Do you understand the detrimental effects of water erosion?
- \_\_\_ Do you know the factors of the Universal Soil Loss Equation?

### ANALYSIS

Pre-test and quiz scores:

- Analyzed using the Mann-Whitney test to determine the effect of group on the pre-test, quiz scores, and quiz score retention.
- Analyzed using the Wilcoxon Signed Rank Test to determine if there was a significant difference between the pre-test and quiz scores and between the two quiz scores.

Quiz questions corresponding to learning objectives:

- Analyzed using the Mann-Whitney test to determine the effect of group on individual quiz questions

Survey One:

- Analyzed using the Mann-Whitney test to determine the effect of group on individual survey responses

Survey Two:

- Analyzed using a Binomial test to determine student preference for simulator or lecture group based on individual survey questions

## RESULTS

Results are shown for fall and spring semesters in parentheses.

Pre-test and quiz scores:

- Pre-test not significantly different between groups (P = 0.708, 0.170)
- Quiz scores were not significantly different between groups (P = 0.108, 0.393; 0.193, 0.359)

Quiz questions corresponding to learning objectives:

- Across both semesters, the **simulator group** performed better on questions relating to the three types of water erosion (P <0.001, <0.001)
- During the Spring semester, the **lecture group** performed better on the quiz question relating to the spiral of soil erosion (P = 0.016)

Survey One:

- Across both semesters the **lecture group** reported that they learned more (P = 0.007, 0.011)
- In the Spring semester, the **simulator group** reported that they understood the effects of wind erosion better and the lecture group felt that the information was more important to their life outside of academics (P < 0.05).

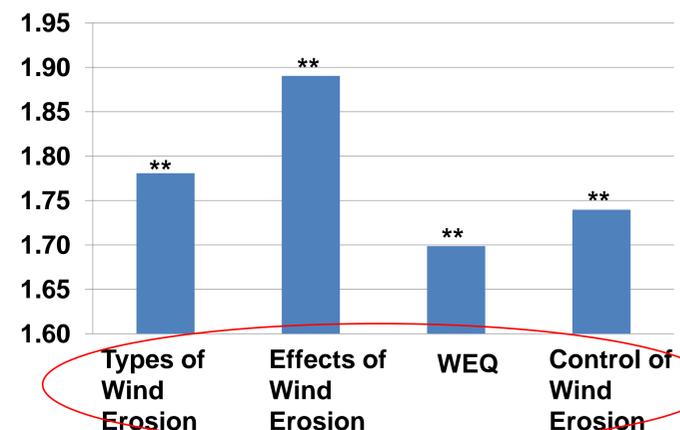
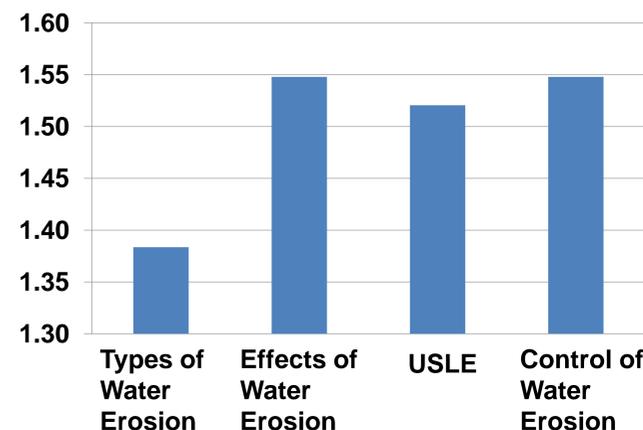
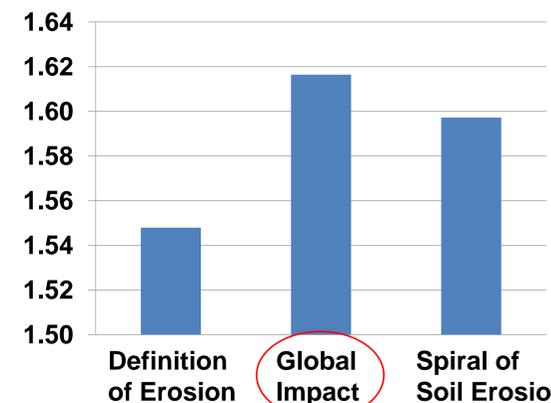
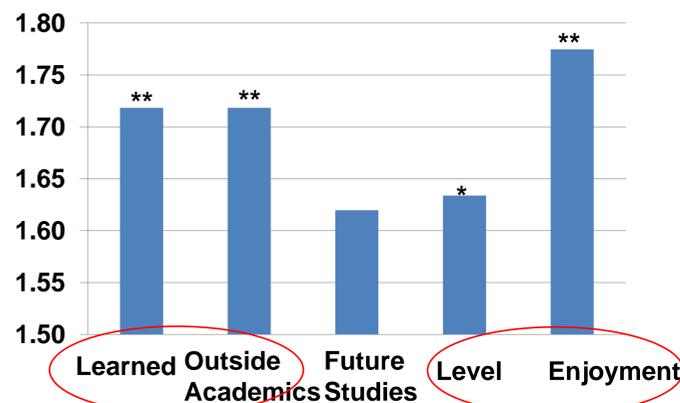
Survey Two:

- Significant preference shown on eight of sixteen items.
- None of the items statistically favored the **lecture group**.
- Results can be seen on the bar graphs

## RESULTS

Trial Two, Survey Two Results: The circles indicate survey responses that show a statistically significant preference for the simulator group as rated by the students.

\* P < 0.05 \*\* P < 0.005



## CONCLUSION

Quiz scores did not show a significant difference based on group, and until the groups switched, there were few preferences reported in the survey based on group. After the groups switched, students showed a strong preference for the simulator group.

## References

Mamo, M., & Kettler, T. (2004). Assessment of an on-line erosion lesson as a teaching tool in introductory soil science. *NACTA Journal*. 48(3), 47-52.