Course Content Project : An Alternative Instrument to Assess Students' Learning and Retention in a Teacher Education Statistics Course

Mohammad A. Yazdani, Ph.D. †

Abstract

We designed and implemented a research project to examine the usefulness of assigning a Course Contents Project on learning and retention of statics concepts and skills in a senior statistics and probability course for pre-service teachers. Sixty three students as one control group and two experimental group participated in this study. The statistical analysis of students pretest, posttest, and retention test indicated that Course Content Project is an effective alternative reinforcement in learning and retention of statistics.

Reinforcing the learning and internalization of concepts and skills in statistics is one of the most exigent tasks facing mathematics educators. The widespread perception is that to achieve mastery of any concept or skill, students are required to carry out homework. Without performing homework the acquired knowledge or skills would be lost to one's memory or the ability to recall those concepts or skills effectively would be reduced. The challenge for educators is to explore the most effective strategy in conducting and performing reinforcement assignments.

The objective of the present study was to explore how to help the students assimilate particular concepts or skills that will be useful for their future education and further studies, help them to commit the new information to memory, and recall the new learning. Reinforcement is important at several stages of learning. National Council of Teachers of Mathematics, NCTM, (1996) states learning is conceived of as a process in which students absorb information and store it in easily retrievable fragments as a result of repeated practice and reinforcement (p. 10).

The information received in short-term or working memory must be mentally retrieved and utilized repeatedly until it is established in long-term memory. One's ability to remember the concepts or skills for long periods of time and recall them is referred to as "retention". Lindgren and Suter (1985) define retention as "the ability of the organism to reproduce behavior or material after it has been learned" (p. 568).

A review of theories of learning suggests that the educator should apply the behavioral theories of learning concerning reinforcement to motivate the students. In addition, the educator should utilize the information processing

theories as well as cognitive learning theories concerning how the learners construct a knowledge system to their learning in statistics.

The phenomenon of the Course Content Project refers to conceptions and finding that the probability of learning and retention increases if acquire through investigation of real life or (emulating real life) applications of those concepts and skills. Gravetter and Wallnau (1996) State that statistics have become a part of everyday life.

Design of the Study

We design a study to apply the principles of Course Content Project to a group of the students enrolled in a statistics and probability for teachers course and compare their achievement to the achievement of another group of students who were taking the same course but they were using reinforcing their learning as a result of weekly homework.

Sixty three students participated in this study. The design consisted of three groups: one control group and two experimental group. The control group did not relieved any treatment. One of the experimental groups received reinforcement through traditional homework strategy for seven weeks (which is the normal duration for statistics part of the course). The other experimental group was assigned a Course Content Project. Although, the Concept Content Project was only one actual real life problem but it consisted of the all concepts and skills needed to solve the homework problems and the students were encouraged to follow it gradually.

The control group consisted of 23 students who were not enrolled in any statistics class. There were 21 students in traditional homework group. The Course Content Project group consisted of 20 students. The setting was a senior course class of a teacher education program. The students in the two experimental group were informed of the objective of the study and they were selected based on convenience. the researcher delivered instruction to both group.

The course content included statistical graphs, measures of central tendency (means, medians, modes) and measures of dispersion (range, variance, standard deviation). The instruments used in this study were selected from the course textbook publisher's recommended assessments. The instrument was consistent with the course weekly lessons. We concluded that the assessment instrument was valid because it measured exactly what it supposed to measure. The pretest and posttest were administered to all three groups and after seven weeks of instructions. The posttest was administered to two treatment group seven weeks after the posttest.
The following two null hypothesis were tested:

1. First null hypotheses: there is no significant differences between the traditional homework strategy group and Course Content Project Group in learning statistics.
2. Second null hypotheses: there is no significant differences between the traditional homework strategy group and Course Content Project Group in retention statistics.

Analysis and Result of Study

The following tests statistics were performed on the data obtained from pretest, posttest and retention test:

- A repeated measure t-test indicated that there was no significant difference between the result of pretest and posttest of the control group at $\alpha = 0.05$. Because there were no significance difference between the result of the same test administered to the same students in a seven week time interval with no treatment, it was occluded that the instrument was reliable.

- An Analysis of Variance, ANOVA, was applied to the scores obtained from the pretest administered to the control group, traditional homework strategy group , and Course Content Project group. The mean sores the control group, traditional homework strategy group , and Course Content Project group were 2.61, 2.87, 2.85 respectively. The analysis of variance indicated that prior to the treatment no two group were significantly different at the 0.05 level.

- After the treatment, an Analysis of covariance, ANCOVA, was performed on the scores obtained from the posttest administered to the control group, traditional homework strategy group , and Course Content Project group and the mean score were 2.96, 17.10, 19.00 respectively. The ANCOVA indicated:

  1. a significant difference between the control group, traditional homework strategy group

  2. a significant difference between the control group and Course Content Project group

  3. a significant difference between the traditional homework strategy group and Course Content Project group. The analysis of the means of the three groups indicated that the traditional homework strategy group and Course Content Project group strategy were both effective. The test statistics indicated a mean difference of 1.90, in favor of the Course Content Project group. The standard deviations for the traditional homework strategy group and Course Content Project group were 1.41 and 1.05 respectively. The first null hypothesis was rejected, because there were significant differences between the traditional homework strategy group and

Course Content Project Group at α = 0.05. We concluded that the students who were assigned to Course Content Project group achieved 9.5% better scores than those who were in the traditional homework strategy group.

- The retention test was administered to the traditional homework strategy group and Course Content Project group seven weeks after the posttest. A repeated measure t-test for dependent samples was used to compare the results of the posttest and retention test of the traditional homework strategy group the mean difference (mean loss) was 1.48 at α = 0.05. A repeated measure t-test for dependent samples was employed to compare the results of the posttest and retention test of the Course Content Project group. Here the mean difference (mean loss) was 1.1 at α = 0.05. The comparison of the mean loss for the traditional homework strategy group and Course Content Project Group during the same period Group indicated a difference of 0.36 of a point, which is not significant at α = 0.05. The second null hypothesis was retained because there were not significant differences between the traditional homework strategy group and Course Content Project group at α = 0.05. We concluded that the students who were assigned to Course Content Project group retained same percentage of their learning's as those who were in the traditional homework strategy group.

Conclusion

The results of test statistics (pretest, posttest, and retention test) pointed toward effectiveness of the Course Content Project approach as a very effective alternative reinforcement method in learning and retention of statistics. It remains clear that the participants indeed learned more statistics through a Course Content Project protocol and they indeed retained it for a long term. We highly recommend, to mathematics educators, the integration of Course Content Project strategy into students assignment.

† *Mohammad A. Yazdani Ph.D.,* University of West Georgia. USA

Appendix A

The Following is the project assigned to the Course Content Project group:

Direction: The following are my students' test scores in 2 different mathematics classes who were taking the same course in spring 2016. The students were assigned randomly to each class and were initially at the same level. To improve students' performance one class received treatment A and the other class received treatment B.

	Treatment A	Treatment B
1	90	88
2	56	66
3	76	78
4	87	88
5	91	88
6	81	88
7	78	96
8	88	88
9	78	84
10	94	88
11	77	67
12	56	46
13	48	52
14	9	77
15	83	85
16	6	8
17	88	88
18	5	11
19	88	77
20	97	88

Answers to the following 10 questions:

1. calculate the standard deviation for students who received treatment A.
2. calculate the standard deviation for students who received treatment B.
3. Explain how you examine which treatment, A or B, was more effective.
4. Write a null hypotheses to test which treatment, A or B, was more effective in learning mathematics.
5. Write an alternative hypotheses to test which treatment, A or B, was more effective in learning mathematics.
6. Test your null hypotheses (show your calculation).
7. Test your alternative hypotheses.
8. explain any Type I error
9. Explain any Type II error
10. Write a conclusion.

References

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Lindgren, H. & Suter, W., (1985) *Education psychology in classroom*. Belmont, California: Wadsworth, Inc.

National Council of Teachers of Mathematics (1996). Curriculum and evaluation standard for school mathematics. Reston, Virginia: The National Council of Teachers of Mathematics Inc.