# Minute Paper and Interdisciplinary Studies: Pre-Test / Post-Test Study

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*A common challenge many college instructors face is that students come to class unprepared, especially when it comes to assigned pre-reading. The first portion of this study used a pre-test / post-test methodology to determine whether or not using a "minute paper" on a random basis at the beginning of an Introduction to Business class produced higher concept retention. The second portion of this study used the same methodology to determine whether or not the use of interdisciplinary criteria within a class led to greater concept retention.*

## BACKGROUND INFORMATION

One of the challenges colleges instructors often face in the classroom is that many times students do not read the assigned materials in the textbook or handouts prior to the class period in which it will be discussed, although it is specified in the syllabus that reading should be done in advance of the lecture. One consideration is to incorporate a variation of the instructional technique of "minute papers" (asking students to write down the key points and/or what they can remember from a specific reading or topic within a specified period of time, usually two to five minutes) into the curriculum to encourage students to do the assigned reading in advance. In Spring of 2013, the same instructor taught three sessions of the same course (Introduction to Business), making this an ideal time to do some experimentation.

In addition, the same instructor noticed over the past few years of teaching both "regular" and "interdisciplinary studies" sections of the same class that, overall, those in the "interdisciplinary studies" sections seem to have higher attendance ratings and earn better grades than those in the "regular" sections. Again, with having multiple sections of the same class, one of which was interdisciplinary studies, Spring of 2013 was an ideal time to do a comparison to determine if the curriculum components of an interdisciplinary studies course contribute to these differences or if the students who typically sign up for this type of class already have a higher level of knowledge.

## SECONDARY RESEARCH: ONE-MINUTE PAPERS

The Harvard Assessment Seminars describe minute papers as "modest, relatively simple and low-tech innovations [that] can improve students' learning and active participation in class" (qtd in Chizmar & Ostrosky, 1998). Although much has been written about one-minute papers, as the tool has been described as a significant pedagogical innovation over the years, the research appears to be focused on the "traditional" use of the minute paper, whereby students were asked to respond to two questions at the end of each class period:

1. What is the most important thing you learned today?
2. What is the muddiest point still remaining at the conclusion of today's class?

Source: Chizmar & Strosky, 1998, p. 4

It does not appear that research has been conducted regarding the use of one-minute papers at the beginning of class to encourage students to complete the required assigned reading prior to class. Some research describes the limitations of one-minute papers. In his research, Kwan (2011) suggests that a daily or frequent quiz is preferable to the use of the minute paper because it supports a more focused retrieval of specific information. The scope of this research was much less specific, however, in that the objective was to encourage students to read the assigned materials in advance of the class period to determine if this would impact their learning.

## SECONDARY RESEARCH: INTERDISCIPLINARY STUDIES

An integrated definition of the term "interdisciplinary studies" is as follows:

> …a process of answering a question, solving a problem, or addressing a topic that is too broad or complex to be dealt with adequately by a single discipline and draws on disciplinary perspectives and integrates their insights to produce a more comprehensive understanding or cognitive advancement.
>
> Source: Repko, 2012, p. 12

While much has been published about interdisciplinary studies and its importance, particularly in a liberal arts education, none has been found related to specific research comparing like courses of a traditional section with its interdisciplinary counterpart. This was the focus of this portion of the research.

## RESEARCH QUESTIONS

The research was designed to answer the following general questions:

- Does use of frequent "minute papers" – included as quiz/activity scores in a student's grade – contribute to greater learning / concept retention?
- Does use of interdisciplinary criteria contribute to greater learning / concept retention?

## DESIGN OVERVIEW

Participants were asked to participate in a pre-test of course topics. The pre-test consisted of 24 multiple choice questions regarding topics that were to be covered during the course of the semester. While all sections received the same pre-test, for research purposes, the sections were identified as follows:

- Section 1: Control Group (no intervention)
- Section 2: Experimental Group A (intervention = minute papers)
- Section 3: Experimental Group B (intervention = interdisciplinary studies section)

Experimental Group A received the intervention of "minute papers" as previously described. In addition to the same curriculum covered as in the Control Group, students in Experimental Group A were administered six minute papers during the course of the semester. It should be noted that this was a variation of the traditional concept of "minute papers" which are typically administered at the end of a class period. Each minute paper was administered at the beginning of a class and asked students to write about one or more concepts from the assigned reading. Each minute paper was worth a maximum of ten points. These minute papers were graded on a scale as follows:

- 3 = attended class; name on paper
- 5 = articulated at least one concept from the chapter specified with minimal detail
- 7.5 = articulated at least one concept with sufficient detail and accuracy
- 10 = articulated two or more concepts with sufficient detail and accuracy

Experimental Group B received the intervention of being in the interdisciplinary studies section. While the overall scope of the course, including assignments, exams, and other required deliverables, was not substantially different, the interdisciplinary studies component incorporated many guest speakers and topics beyond typical business information to make the class truly interdisciplinary. Speakers incorporated multiple aspects into the classroom, including library research techniques, writing and communication skills, business and government roles, the non-profit sector, international business and cultural and language appreciation, the sociology of entrepreneurship, engineering in business, and health care management. It should be noted that this was not a "new" intervention; at least one interdisciplinary studies section of Introduction to Business had been taught each semester since Fall 2010 (by this instructor). The new component was the incorporation of the pre-test/post-test aspect of the course for research purposes.

Eight of these 24 questions were on each of three different exams that were administered to each section during the course of the semester. These exams provided the post-test data (as they were the same questions). The pre-test results by question were tracked by individual and compared to exam results by question. Individual results were then aggregated to determine if either intervention appeared to have had an impact. It should be noted that, since scores were tracked by individual student, Institutional Research Board approval was obtained in advance; students were given the choice to participate and, if so, did sign the appropriate consent form. Students under 18 years of age were excluded, as parental permission would have been needed.

## RESULTS: MINUTE PAPERS

As expected, improvements resulted in all sections. In general, the improvement was about 30%, as pre-test results were in the 50-53% range and post-test results were in the 83-86% range. Although this experimental group (which received the treatment of minute papers) showed an average improvement of 3.3% greater than the control group, these differences were not found to be statistically significant ($p>0.05$). These results are summarized in Table 1, at the top of the next page.

**TABLE 1**
**CONTROL VERSUS EXPERIMENTAL GROUP A (MINUTE PAPER) RESULTS**

| | | Pre-Test Average | | Post-Test Average | | Average Difference | |
|---|---|---|---|---|---|---|---|
| Group | N | # Correct | % Correct | # Correct | % Correct | # Improve-ment | % Improve-ment |
| Control | 20 | 12.8 | 53.3% | 19.9 | 82.9% | 7.1 | 29.6% |
| Exp. A | 29 | 12.0 | 50.0% | 19.9 | 82.9% | 7.9 | 32.9% |

Anecdotal observations suggest that the intervention of the minute paper did impact student behavior, as observations appeared to indicate that more students were "cramming" prior to class (i.e. scanning the book just prior to the start of class). Note, however, that this does not necessarily prove that they read the chapter in advance of the class. It could merely indicate that the behavioral impact changed their behavior immediately preceding class time. However, students did frequently ask if a minute paper was going to be administered that day, so this was something they did pay attention to.

## RESULTS: INTERDISCIPLINARY STUDIES

As previously indicated, improvements of approximately 30% were noted in each of the sections. Experimental Group B (those in the interdisciplinary studies section) showed an average improvement of 2.9% greater than the control group. However, these differences were not found to be statistically significant ($p>0.05$). These results are summarized in Table 2, below.

**TABLE 2**
**CONTROL VERSUS EXPERIMENTAL GROUP B**
**(INTERDISCIPLINARY STUDIES) RESULTS**

| | | Pre-Test Average | | Post-Test Average | | Average Difference | |
|---|---|---|---|---|---|---|---|
| Group | N | # Correct | % Correct | # Correct | % Correct | # Improve-ment | % Improve-ment |
| Control | 20 | 12.8 | 53.3% | 19.9 | 82.9% | 7.1 | 29.6% |
| Exp. B | 34 | 12.8 | 53.3% | 20.6 | 85.8% | 7.8 | 32.5% |

Although these findings were not statistically significant, the instructor noted that those in the interdisciplinary studies section of the course "seemed" to do better in class than those in the control group. As a result, final grades were retrieved and converted to a numerical scale to do statistical analysis. For clarification, the numerical grades assigned are listed at the top of the next page in Table 3.

**TABLE 3**
**GRADING SYSTEM**

| Grade | Point Value | Grade | Point Value | Grade | Point Value | Grade | Point Value |
|---|---|---|---|---|---|---|---|
| A | 4.00 | B | 3.00 | C | 2.00 | D | 1.00 |
| A- | 3.67 | B- | 2.67 | C- | 1.67 | D- | 0.67 |
| B+ | 3.33 | C+ | 2.33 | D+ | 1.33 | F | 0.00 |

After converting letter grades to numerical grades using this scale, the "grade point average" for each section was determined as follows:

- Control Group (non-IS section): 2.77 (about a B-)
- Experimental Group (IS section): 3.27 (nearly a B+)

This was found to be statistically significant ($p<0.5$). Although this was observed in the Spring of 2013, was this true for other sections? After retrieving the information dating back to Fall of 2010, collectively it was found that the average grade in the interdisciplinary studies sections of the class was 2.98 (nearly a B) whereas the average grade in the non-interdisciplinary sections of the class was 2.51 (between a B- and a C+). This was found to be statistically significant. Descriptively, by average grade, the students in the interdisciplinary studies courses outperformed those in the non-interdisciplinary studies sections each semester; however, not all results were statistically significant. The specifics can be seen below in Table 4.

**TABLE 4**
**AVERAGE GRADES (4.0 SCALE): NON-INTERDISCIPLINARY STUDIES (NON-IS) VERSUS INTERDISCIPLINARY STUDIES (IS) SECTIONS OF INTRODUCTION TO BUSINESS CLASSES WITH SAME INSTRUCTOR**

| Semester | Non-IS Class Resulting Average Grade | IS Class Resulting Average Grade | Statistically Significant (p<0.05)? |
|---|---|---|---|
| **Fall 2010** | 2.26 | 2.79 | Yes (p=0.033) |
| **Spring 2011** | 2.48 | 3.10 | Yes (p=0.016) |
| **Fall 2011** | 2.56 | 2.90 | No (p=0.144) |
| **Spring 2012** | 2.42 | 2.63 | No (p=0.426) |
| **Fall 2012** | 2.50 | 3.19 | Yes (p=0.008) |
| **Spring 2013*** | 2.99 | 3.27 | No (p=0.085) |
| **ALL SEMESTERS** | **2.51** | **2.98** | **Yes (p=0.000)** |

* Note that these are different from the prior statistics, above, due to the fact that the other experimental (non-IS) section is also included.

What cannot be determined from this research is whether or not the students who chose to enroll in an interdisciplinary section were better students (i.e. had higher cumulative GPAs) to begin with. In hindsight, such an observation should have been asked for as part of the Institutional Research Board permission process. However, without that specific inclusion in the consent form, it was not possible to retrieve that data afterwards.

## CONCLUSION

The use of pre-tests and post-tests can be a valuable tool in assessing student learning from the beginning of a class to the completion of a class. After factoring in the element of chance, it is rewarding to see improvement. However, in this case, the levels of improvement in the experimental groups (minute papers and interdisciplinary studies) were not statistically higher than the control group. While we cannot definitely say, for example, that minute papers make a difference, it is one tool that instructors can use to incent students to complete the assigned pre-reading.

In terms of interdisciplinary studies, further study would be required to determine the reason(s) behind the apparent phenomenon that those in the interdisciplinary studies sections of a specific class tend to outperform those in non-interdisciplinary sections of the same course with the same instructor with respect to final course grade.

## REFERENCES


Chizmar, J.F. & Ostrosky, A.L. (1998). The one-minute paper: some empirical findings. *Journal of Economic Education,* 29, (1), 3-10.

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