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Delayed Versus Immediate Feedback in an Independent Study High School Setting

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DELAYED VERSUS IMMEDIATE FEEDBACK IN AN
INDEPENDENT STUDY HIGH SCHOOL SETTING

by

Duane Charles Lemley

A dissertation submitted to the faculty of

Brigham Young University

In partial fulfillment of the degree of

Doctor of Philosophy

Department of Instructional Psychology and Technology

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BRIGHAM YOUNG UNIVERSITY

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This dissertation has been read by each member of the following graduate committee and by majority vote has been found to be satisfactory.

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As chair of the candidate's graduate committee, I have read the dissertation of Duane Charles Lemley in its final format and have found that (1) its format, citations, and bibliographical style are consistent and acceptable and fulfill university and department style requirements; (2) its illustrative materials including figures, tables, and charts are in place; and (3) the final manuscript is satisfactory to the graduate committee and is ready for submission to the university library.

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ABSTRACT

DELAYED VERSUS IMMEDIATE FEEDBACK IN AN INDEPENDENT STUDY HIGH SCHOOL SETTING

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Doctor of Philosophy

Although there is general agreement that feedback plays an important role in student performance, the majority of the studies found in the research literature explore the impact of different types of feedback in a traditional and university-level setting. In order to explore the impact of different feedback types in a non-traditional distance learning setting, 352 high school students enrolled in courses offered through BYU's Independent Study (IS) department received either delayed feedback or immediate feedback generated by *Speedback*TM, BYU's automated grading and feedback program, depending on whether they had opted to submit end of unit assignments by mail or computer.

Results of a comparison of final exam scores indicated that those students receiving immediate feedback performed significantly better on course final exams, but surprisingly those who received delayed feedback completed course in significantly less time.

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Chapter 1

Introduction

Educators today are in general agreement with Chickering and Gamson (1991) who asserted, as one of their seven principles for good practice in undergraduate education, that one good practice to enhance student learning is to provide prompt feedback to students. These educators perceived that appropriate feedback received during a learning experience helps to keep a student on track by offering suggestions for improvement in areas where he or she is not performing well. A student also finds such information useful when plotting an individual study strategy. Even at the completion of a course, feedback can indicate to a student how much has been learned as well as what areas of knowledge still need to be pursued.

From an independent study perspective, it is unfortunate that the majority of the research literature in existence today reflects studies of the impact of different types of feedback in a typical—and usually university-level—classroom setting. While these studies support the view that feedback plays an important role in a student's performance, they ignore the role of feedback to the non-traditional independent learner—especially those on the high school level.

Students who participate in a traditional classroom course typically work together in a continuing group or cohort. Each member of the class receives the same instruction in the same format at the same time from the same instructor. The group moves as a unit from the beginning of the instructional program to the end. On the other hand, students who participate in distance learning programs are typically not members of a traditional educational cohort. Each of these students potentially receives his or her instruction by

means of a different format such as by paper, over the internet, by cable television broadcast, and so forth. These students also typically receive their instruction at a location that is located away from the physical institutions that provide it. These distance learners are often referred to as independent study students as that course instruction they receive is generally delivered to a single student who functions as an independent learner who typically completes lessons and assignments at his or her own pace within a specified course completion deadline.

In addition, it is often the case that the feedback received following a graded assignment or exam is the only consistent communication a distance learning or independent study student might have as he or she progresses through a course. This emphasizes the importance that feedback plays in an independent study setting and suggests that the impacts of different types of feedback need to be examined in light of that setting.

Independent Study at Brigham Young University

Beginning in the mid-1990s, the Independent Study (IS) department at Brigham Young University (BYU) began to implement an automated grading and feedback program known as *Speedback*TM in their distance learning courses. BYU's Division of Continuing Education provided the following description of *Speedback*TM in their 1994-95 annual report (Henstrom & Oaks, 1997):

*Speedback*TM allows Independent Study to take advantage of current computer technology to provide students a high-quality education at a distance with the fastest turn-around time possible.

In courses that use Speedback™ technology, students provide written responses to assignments on a Speedback™ form which is submitted to Independent Study for grading. On the day that it arrives at Independent Study, the Speedback™ form is scanned into a computer which grades the answers and generates personalized feedback. The feedback on the lesson is mailed to the student the same day (p. 196).

As described above, one of the key features of *Speedback™* is the quick turn-around of graded assignments. Traditionally, turn-around time for assignments varied from a few days to several weeks for students enrolled in a paper-based course. Today, however, because of the availability of the internet and e-mail capabilities, students enrolled in either a traditional paper-based or newer web-based course option are able to receive an immediate response on their submitted assignments. Students who enroll in a paper-based version of a course continue to have the option to both submit and receive graded assignments through the mail. By selecting one method of submission (paper vs. computer) over another, a student creates an immediate versus delayed feedback setting. Students submitting assignments and unit exams by computer receive immediate feedback. Those who choose to submit assignments by mail receive delayed feedback if for no other reason than the required turn-around time in the mail.

In addition to the quick turn-around feature, *Speedback™* also includes several instructional aid features for the student, including an automated feedback program that responds to each question on *Speedback™* graded assignments and exams. The feedback responses are identical for both the paper and computer-based courses. These responses, drawn from a pre-prepared database, provide *elaborative feedback* that indicates whether

a response is right or wrong and offers a hint or even further instruction as to why an incorrect answer selection was incorrect. Feedback responses in this study are distractor specific and provide a relevant comment for every possible answer as opposed to item specific feedback that provides a general comment for each question.

Statement of the Problem

Three factors define the problem this study addresses: First, independent study students are not traditional students. Rather than working together in cohorts, they work independently and at their own pace. Second, as a result, feedback should be especially valuable to independent study students as it is often the only communication they have with the course instructor—albeit asynchronous communication. Feedback helps these students assess their progress through a course and to develop a personal study plan. Third, since independent study students need feedback in a usable format, it is important to understand how different types of feedback impact student performance in an independent study setting. Available research focuses on the impact of feedback in traditional university-level classroom settings rather than on independent study or distance learning settings. It is especially lacking for those independent study settings involving high school students.

The quick turn-around element of *Speedback*TM has greatly improved the capacity of student service efforts at BYU Independent Study by allowing for a faster response to students who have submitted assignments for grading. Use of computerized automated grading has reduced instructor time by eliminating the need to grade and respond to each assignment by hand. Corresponding costs for this task have also been reduced by eliminating the need for teaching assistants and postage required in mailing assignments

back and forth between instructors and the Independent Study department. At the same time, student satisfaction has increased because they receive a timely response to assignments they have submitted. However, the impact of *Speedback*TM and, in particular, of the automated feedback feature, on student performance in an independent study setting has not been examined.

Statement of Purpose

The purpose of this study was to evaluate the impact of both immediate and delayed feedback on the performance of students enrolled in high school-level independent study programs at BYU. This was accomplished in two ways. First, the relation of both types of feedback to course final exam scores was examined. Second, the relation of both types of feedback to the amount of time required to complete a course was compared.

Research Hypotheses

The study focused on the following hypotheses:

1. Students receiving immediate feedback will obtain higher mean scores on the course final exam than students who receive delayed feedback.
2. The elapsed time between submission of the first course assignment and course completion will be significantly less for students who receive immediate feedback than for those who receive delayed feedback.

Organization of the Study

Chapter 1: Introduction. The current chapter contains the rationale and explanation of the study, Statement of Purpose, and Research Hypotheses. An explanation of the organization of the study and a summary statement are also included.

Chapter 2: Review of Literature. This chapter reviews the current literature comparing studies that discuss the different types of feedback and how it is used in educational settings. It is important to note that the majority of these studies are placed in a traditional university-level classroom. The unique distance learning and independent study settings are by and large not explored.

Chapter 3: Method. This chapter discusses the method used for the study. A description of the study sample population, design, instrumentation, analysis used, and procedure is included.

Chapter 4: Results. This chapter reports the results of the statistical analyses used in the study.

Chapter 5: Discussion and Conclusion. This chapter discusses the ramifications of the study's findings. A discussion of the study's limitations and resulting questions for further research are also included.

Summary

In seeking to test the hypotheses outlined above, this study may provide designers and instructors of high school independent study courses with valuable information as to what type of feedback might be most effective in an independent study setting. If providing feedback really does enhance student learning as has been previously mentioned, it would also seem to be a better practice to make feedback responses as timely and available to the student as possible. As a quasi-experimental study, however, this research does not lead directly to causal claims, but does support continuing research and innovation in the hope of contributing to improved practice.

Chapter 2

Review of Literature

This chapter reviews the available literature as it pertains to the use of feedback in education. It describes what feedback is as well as how it might best be used to enhance student learning. In addition, feedback will be discussed in terms of what information it provides the student and when it is provided. Finally, other considerations that impact the effectiveness of feedback such as applications of its use and student motivation will be discussed.

Feedback: What It Is

In an instructional setting, the term *feedback* describes one of the many procedures that inform a learner whether a response is right or wrong. In addition, feedback can be used to provide instructional information to the student that explains why a response was correct or incorrect (Morey, 1992).

Feedback is most effective when it provides a basis for correcting mistakes or misconceptions a student may have gained during instruction, and does not appear to have much of an impact as a reinforcing tool (Clariana, 1993; Cohen, 1985). Researchers argue, for example, that in order for feedback to have an impact as a reinforcing agent, the likelihood of repeating correct responses on future review exercises or exams would be higher when feedback is included with initial lesson or unit assignments than it would in a no-feedback setting. However data demonstrates that the probability of repeating an initial correct response on a delayed final exam is high whether or not feedback was given to the student. From this perspective, feedback plays its most important role in correcting an initial student error (Bangert-Drowns, Kulik, Kulik, & Morgan, 1991;

Cyboran, 1995; Kulhavy & Anderson, 1972; Kulhavy, Stock, Thornton, Winston, & Behrens, 1990; Kulhavy, White, Topp, Chan, & Adams, 1985; Lhyle & Kulhavy, 1987; Phye & Andre, 1989; Surber & Anderson, 1975).

Because of its corrective nature, feedback is considered to be critically important in distance learning settings (Azevedo & Bernard, 1995; Cyboran, 1995; Dihoff, Brosvic, Epstein, & Cook, 2004). In these settings a teacher is not physically present to provide instructional direction. Also students do not commonly have the opportunity to come together in a study group setting. Instead, they generally work at their own determined pace. For these reasons, feedback, in a sense, assumes the role of teaching assistant by helping to correct initial student errors and misunderstandings, by indicating where errors were made, and by providing additional information that clarifies a topic or subject matter.

Feedback: What It Contains

Instructional feedback can be defined by the type or amount of information it provides to a student. As such, feedback can generally be divided into verification and elaboration feedback with special applications, such as *multiple-try feedback*, playing a unique role in the learning process.

Verification feedback. The simplest type of verification feedback is *knowledge of results* (KR or KOR) feedback. With KR feedback, the student is only given an indication of the correctness of a response such as “yes/no” or “right/wrong.” *Knowledge of correct response* (KCR) is the next level of verification feedback. Here, a student is given a corrective hint or suggestion in addition to a “right” or “wrong” response such as, “Incorrect. Remember to solve that part of the equation found in parentheses first.”

Elaboration feedback. Elaboration feedback provides the student with an even greater amount of information. This can range from simple hints to substantial amounts of corrective and additional instructional information. It is possible that the material included in elaboration feedback can become so complex that it begins to take on the role of providing new instruction. This can be especially helpful in a distance learning setting where a teacher is not present to readily answer questions or clear up misunderstandings. By offering additional information or by using a fresh perspective, elaboration feedback can often help clarify a concept that was initially misunderstood.

Research findings indicate what many educators have felt intuitively—that any amount of feedback is better than none at all and that, in general, the more information provided by feedback, the greater the impact on the student’s comprehension and resulting performance (Anderson, Kulhavy, & Andre, 1972; Cyboran, 1995; Morrison, Ross, Gopolkrishnan, & Casey, 1995; Olin & Sullivan, 2002; Whyte, Karolick, Nielsen, Elder, & Hawley, 1995). This means that, compared to a setting where a learner receives no feedback, Knowledge of Results (right/wrong) is the least effective type of feedback, followed by Knowledge of Correct Response (correct answer feedback), with some type of elaborative feedback being the most effective (Bangert-Drowns, Kulik, Kulik, & Morgan, 1991; Clariana, Ross, & Morrison, 1991; Kulhavy, 1977; Lee-Sammons & Wollen, 1989; Pridemore & Klein, 1991). This is key information for course designers for, although elaboration feedback requires a greater effort to develop than other types of feedback, it is clear that the extra effort can provide a richer learning experience for the student— especially in a distance learning setting.

Multiple-try feedback. An application of feedback, which can use either verification or elaboration feedback, is *answer until correct* feedback also known as *multiple-try feedback* (MTF). MTF requires students to make multiple tries at answering the same item if—and with the added knowledge that—their previous or initial response was incorrect.

Research findings indicate that MTF, like verification and elaboration feedback, is more effective than no feedback at all. They do not suggest, however, any substantial difference between MTF and other applications of feedback (Clariana, 1993; Morrison, et al., 1995). Still, advocates of MTF believe it has two advantages over other uses of feedback:

First, where multiple-choice questions are used, MTF allows the student to eliminate the most powerful distractor and focus on remaining responses. This elimination process encourages a student to reevaluate the remaining answer options and may increase a student's depth of processing. Second, by tracking the sequence of responses to an item, a teacher can have a quantitative measure of how much a learner really knows about that item.

There may also be some drawbacks to MTF. A student can become frustrated after making several incorrect attempts to answer a question. Further tries can then become nothing more than a random guess. In addition, if a student goes through the process of merely picking an answer until the correct one is discovered, he or she essentially short circuits the learning process by not taking the opportunity to go through the necessary thought process to arrive at the correct answer on his or her own.

Feedback: Timeliness of Delivery

Feedback is also classified according to how soon it is provided after a student responds to a question or completes an exercise or exam. Researchers are essentially divided into two camps. First, are those who argue that immediate or instant feedback (where feedback is supplied as soon as a student has responded to a question or completed an assessment exercise) is the superior format. The second group includes those who believe that delayed feedback (where feedback is withheld for a period of time after the student's completion of an assessment exercise) is more advantageous to learning.

Immediate feedback. Proponents of immediate feedback have developed a procedure known as the *Immediate Feedback Assessment Technique* or IF AT. The IF AT, which utilizes previously developed teaching-testing machine technology, allows immediate feedback to be provided to a student on an item-by-item basis. This is something that is not usually possible in a classroom exam setting without the use of computer technology.

The IF AT uses a multiple-choice answer form somewhat similar in appearance to a machine scored answer sheet with which many students are familiar. The student scratches off an opaque, waxy coating covering an answer space to indicate a response. If the student uncovers a symbol such as a star or asterisk, immediate feedback is received and he or she knows that a correct response had been chosen. If the answer space is blank, the student also receives immediate feedback indicating that an incorrect response was selected. If an incorrect selection was made, the student, following an MTF format,

then reviews the remaining selections and continues to respond until the correct answer is uncovered. At this point the student moves on to the next question.

Epstein, Epstein, and Brosvic (2001) compared the test results of two groups of students taking multiple-choice unit tests and a final exam. Unit tests were administered to one randomly assigned group using the IF AT format and to the second randomly assigned group using a standard machine scorable bubble sheet. In this study, the time between the students being given the initial feedback on the unit tests and taking the final exam ranged between 3 to 10 weeks later. The study found the following. First, overall scores on the final and unit tests did not differ significantly between students using the IF AT and machine scorable answer sheets. Second, use of the IF AT format enhanced retention and student performance on unit test items that were repeated on the final exam. Third, students using the IF AT format were more likely to respond correctly to those same items found on the final exam that had been initially answered incorrectly on the unit tests. Some 60% of previous errors were corrected on the final by those students using the IF AT format compared with only 30% of errors being corrected by those using the machine scorable answer sheets. Students also gave the IF AT format higher evaluation marks in test-taking comfort, learning, acceptance of feedback, and satisfaction over the standard machine scorable answer sheets.

A second study by Epstein, et al. (2002) determined that mean test scores on the final exam administered after delays of one day and one week were significantly higher than initial unit test scores for students evaluated using the IF AT format while final scores did not differ from initial scores for those students evaluated with the machine scorable answer sheets. Also, as seen in Epstein, et al (2001), students evaluated with the

IF AT responded correctly to items on a final exam that had been previously answered incorrectly on unit tests, while those in the machine scorable answer sheet group continued to respond to the same items incorrectly.

In a third study that has particular interest for computer-based instruction (CBI) applications, Epstein, et al. (2002) compared student final exam results of two groups ($N = 36$), one of which was provided immediate feedback through the IF AT format and the other received identical and immediate feedback using a computer-based program. While the mean scores of the initial unit tests did not differ between the two groups, final exam results administered after delays of one day and one week were significantly higher for those students in the IF AT group than for those using the CBI program. Epstein hypothesized that these results might be due to the similarity of the IF AT format with normal classroom activity coupled with the students' lack of confidence in using computer technology, rather than the difference in the type of feedback.

Others who have examined the use of computers in learning and testing settings argue, however, that there are either no differences in student performance between computer-based and traditional paper-based programs (Azevedo & Bernard, 1995; Bugbee, 1996; Clarke, 2000) or that any differences encountered are not significant (Bunderson, Inouye, & Olsen, 1998; Stephens, 2001) and are only due to inherent differences in the two formats such as time on task and the inability to skip or return to previous questions (Mason, 2001).

Dihoff, Brosvic, and Epstein (2003) agree with Epstein's earlier findings and purport that a test procedure that does not employ immediate feedback is more likely to promote misconception rather than further learning. Final exam results in a study

comparing the effects of varying delays in providing student feedback on the retention of material presented in a classroom setting indicate that immediate feedback enabled students to recall more of their initial (unit test) responses and to be more confident in the identification of those responses. Their findings indicate that immediate feedback, coupled with an answer-until-correct MTF format in unit tests, was the preferred arrangement and promoted the “most learning and retention, facilitated the most involvement in the testing process, and corrected the most inaccurate assumptions” (p. 542). These findings suggest that the advantage of immediate feedback appears to be a quick confirmation of a student’s correct understanding of a concept as well as a rapid indication of where a misunderstanding has occurred and further clarification might be needed.

Dihoff, Brosvic, Epstein, and Cook (2004) followed this initial study with one that examined the proactive use of feedback during academic test preparation and a second study that reviewed the differential effects of immediate and delayed feedback during preparation for academic testing. In both of these studies, exams were prepared using publisher-supplied test banks that were designed to test a learner’s recognition and discrimination skills. The findings indicated that the likelihood of identifying a test item on a final exam and responding correctly to it after responding correctly to the same item on the initial unit test were highest when immediate feedback was provided during unit tests. The likelihood of responding with a correct response on the final exam after responding incorrectly on a unit test was also higher when immediate feedback was provided during unit tests. Finally, the likelihood of an incorrect response on a final exam

item after responding correctly on a unit test was lowest when immediate feedback was provided during the unit tests.

Delayed feedback. Advocates of delayed feedback believe that it is more effective than immediate feedback because of the *Delay Retention Effect* (DRE), a phenomenon in which learners who have feedback delayed for some period purportedly recall significantly more than subjects who see the feedback immediately following a learning assessment activity (Kulhavy, 1977; Scroth & Lund, 1993; Swindell & Walls, 1993). These proponents hypothesize that DRE occurs essentially because the memory of an original incorrect response acts to block or interfere with a learner's ability to grasp the correct answer when corrective feedback is presented. If the learner is first given the opportunity to forget those initial incorrect responses, however, it becomes more certain that the learner will be able to substitute the correct response for the original incorrect one. Building a period of time or delay between a learner's initial response and the receiving of feedback serves to accomplish this. Kulhavy and Anderson (1972) have termed this the *interference-perseveration hypothesis*.

In a supporting study, Surber and Anderson (1975), using materials and procedures found in a typical high school classroom, determined that the probability of a student giving a correct response on a follow-up test after giving an incorrect response on an initial test were higher in a delayed feedback group than in an immediate feedback group and that the probability was higher in both feedback groups than it was in a no-feedback control group. They were also quick to emphasize that delayed feedback is most beneficial in long-term retention, which they claimed was of greater educational interest than providing a rapid response to students by means of immediate feedback.

Additionally, in a study partly designed to re-examine DRE, Swindell and Walls (1993) compared the results of both immediate feedback and delayed feedback groups across different types of verification and elaboration feedback. They found that students in the group that received delayed feedback performed significantly better on a delayed test than those students who had received immediate feedback.

Other research findings have questioned the impact of DRE on student retention and performance. Peeck, van den Bosch, and Kreupling (1985), for example, demonstrated, as has been stated previously, that student results in a no-feedback control group were lower than results of both an immediate feedback and delayed feedback group. However, their study findings also show that final exam scores in the immediate feedback and delayed feedback groups were very similar. Additionally, while members of the no-feedback control group were likely to repeat initial errors, members of both the immediate feedback and delayed feedback groups tended to correct initial errors on a delayed final test. As a result of this and a previous study (Peeck & Tillema, 1979), some doubt was cast on the prevailing interference-perseveration theory as data indicated students do not necessarily forget incorrect responses over time. This may not be all bad, however, as remembering that a response was incorrect might be just as beneficial as remembering that a response was correct in the long run.

In support of this conclusion, Dihoff, Brosvic, and Epstein (2003) also reasoned that their study data indicated incorrect responses are not forgotten. Rather they argued that the memory of these initially incorrect responses facilitate the student's acquisition of correct responses during a feedback phase.

In addition, Phye and Andre (1989) found, in a study examining error perseveration, that DRE was observed when subjects were not required to immediately re-respond to items missed on an initial test, but was not observed in settings where subjects were required to re-respond. In other words, students forgot when they did not have to remember. A proposed explanation was that, because immediate feedback follows right after a test or exercise question, a learner might be inattentive due to frustration, boredom, or fatigue. The learner's attention, however, could be refocused by requiring him or her to re-respond to items that have initially been answered incorrectly. Lack of attention was also identified as a factor contributing to DRE by Kulhavy and Anderson (1972). These findings indicate that, while both the timing and the type of feedback may be factors in the student learning experience, another perhaps even more insightful element might be the motivation of the individual student to use the feedback he or she receives.

How Students Use Feedback

An important factor in determining how a student might approach or use feedback is the level of a student's confidence in an initial answer. While changes in response between an initial unit test and final exam are attributed to the effects of feedback, data also shows that a learner's confidence in an original response influences his or her willingness to forget or recall the specific response as well as whether it was correct or incorrect (Butler & Winne, 1995; Flannelly, 2001; Kulhavy, Stock, Hancock, Swindell, & Hammrich, 1990; Stock & McCarthy, 1994; Swindell & Walls, 1993).

In addition, Dempsey and Driscoll (1996) and Stock, Kulhavy, Pridewater, and Krug (1992) demonstrated that students spend more time reviewing feedback when their

initial response was incorrect than when their answer was correct. Time spent in reviewing feedback was found to be related to a student's confidence in his or her answer. The more confident a student felt that his or her initial answer was correct, the more time he or she spent in reviewing feedback when the answer was found to be incorrect. Conversely, if a student was confident in his or her original answer, attention to feedback was found to decrease when the initial response was, in fact, correct. A proposed explanation was that learners try to reduce the discrepancy between what they think they know and what they know. In other words, students typically spend more time trying to figure out what went wrong when they discover that an answer they felt sure was correct was actually incorrect.

Another aspect of how a learner uses feedback tends to neutralize the argument between the immediate feedback and delayed feedback groups. For example, Webb, Stock, and McCarthy (1994) reported that the results of their studies involving learner response confidence indicated that delayed feedback was superior to immediate feedback in allowing a greater probability for more correct responses on a delayed final exam. However, they also learned that this may not have been due to the likelihood of either remembering or forgetting an initial response, but rather because of the tendency on the part of the learners in the delayed feedback group to study the feedback for longer periods of time. These students simply may have taken the opportunity to study for a sufficient period of time to learn the material well enough to be able to identify the right answer on the final exam regardless of their performance on earlier unit tests.

Summary

While there appears to be a general agreement that following up graded assignments and exams with feedback of any type facilitates learning, how best to do so remains debatable. Proponents of immediate and delayed feedback have both presented evidence suggesting which type of feedback might produce better student results in the traditional classroom. The advent of distance education, however, has brought a new perspective to the old argument. With its necessarily innovative methods of instructional delivery, proponents of distance learning make the point that feedback implementation must be tailored to the needs and characteristics of the delivery format as well as the individual and independent learner (Keenan & Langer, 1993; Morrison, et al., 1995).

As pointed out in Chapter 1, a critical element in any independent study or distance learning course is that the student typically works alone outside of the traditional educational cohort setting. Thus individual student motivation in the use of feedback would seem to be an even more vital factor in its effectiveness in the learning experience for independent learners. For this reason, I propose that immediate feedback is the most effective type of feedback in an independent study setting if, for no other reason, than the fact that the feedback is readily available for student use. The following chapter outlines the methods and procedures that were used in attempting to substantiate this hypothesis.

Chapter 3

Method

This was a retrospective study based on archival data maintained by the Independent Study department at Brigham Young University. This study used a quasi-experimental design to examine the impact of immediate and delayed feedback on high school independent study course final exam grades and the amount of time required by a student to complete a high school independent study course.

Sample

The sample ($n = 352$) for this study was taken from the set of students enrolled in the following high school-level courses offered through the BYU Independent Study program:

1. Character Education: Exploring Values 1 (XPLR 041)
2. Twelfth-Grade English I (ENGL 055)
3. United States History from 1851 (HIST 043)
4. Basic Health: Choose to be Healthy (HLTH 041)

These courses were selected because they reflected higher enrollment numbers and therefore offered a larger sample.

Students who completed these courses between January and July, 2005 were divided into two groups. The first group consisted of all those students enrolled in the paper versions of the courses who elected to submit and receive graded assignments by mail. The second group consisted of an equal number of students who were identified from a larger population of students enrolled in the web versions of the courses using a simple random selection process. The students in this second group submitted and

received graded assignments by computer. Assignments for both groups were identical and graded using the BYU *Speedback*TM program. Identical feedback responses were also generated by *Speedback*TM and returned to each student via the selected delivery method.

Students making up both groups were drawn from a larger population of students enrolled in BYU high school independent study courses. The Independent Study program at BYU utilizes an open enrollment system which allows anyone who desires to enroll in a course to do so. There are no requirements as to GPA, class standing, or other academic qualification though students are encouraged to counsel with an academic advisor if they are planning on using a course to meet graduation requirements.

Registration information that students are asked to provide includes only that which is necessary to identify a student and provide requested course materials such as name, address, and birth date. No ethnic or religious preference information is requested.

A breakdown of the students included in each group by gender is shown in Table 1. Both groups were evenly matched in terms of gender with 47% of the immediate feedback group and 48% of the delayed feedback group being male, while 53% and 52% of the respective groups were female.

Table 1

Group Breakdown by Gender

Gender	Immediate Feedback Group		Delayed Feedback Group	
	Number	% of Total	Number	% of Total
Male	83	47%	84	48%
Female	93	53%	92	52%
Total	176	100%	176	100%

Students were also fairly evenly matched in terms of age. A summary of the breakdown of the students included in the study by age is included in Table 2. The majority of the students in both groups indicated they were between 17 and 18 years of age with 71% of the immediate feedback group and 67% of the delayed feedback group falling into this category.

Table 2

Group Breakdown by Age

Age	<u>Immediate Feedback Group</u>		<u>Delayed Feedback Group</u>	
	Number	% of Total	Number	% of Total
14	1	1%	1	1%
15	5	3%	6	3%
16	8	4%	9	5%
17	33	19%	26	15%
18	125	71%	118	67%
18+	4	2%	13	7%
Unknown	0	0%	3	2%
Total	176	100%	176	100%

Students making up the study groups come from different parts of the United States. Those in the immediate feedback group represented 21 states, while students in the delayed feedback group represented 22 states.

As stated previously, students in the delayed feedback group self-selected the

option of submitting assignments by mail. A small sampling of these students ($n = 12$) was contacted by telephone in an effort to determine why they selected what seemed to be an antiquated option. Each of the students contacted indicated they did so because they did not have personal access to a computer and/or the internet.

Instrumentation

Final examinations for the four courses included in the study were designed to use a machine scorable format and tested different levels of learning as found in Bloom's (1968) *Taxonomy of Educational Objectives*. They included the following:

1. The final exam for the English 055 course was made up of 50 questions including 49 multiple-choice questions and 1 true/false question. Questions on the exam tested student learning on the knowledge level of learning and explored knowledge of terminology, knowledge of specific facts, and knowledge of conventions.

2. The History 043 final exam contained 100 questions including 96 multiple-choice and 4 true/false questions. All 100 questions could be categorized as knowledge level questions exploring knowledge of specific facts. An additional 10 questions were included in the exam that dealt with course maintenance issues.

3. The Health 041 final exam consisted of 100 multiple-choice questions. These were designed to explore student learning on the knowledge, comprehension, and application levels. Knowledge level questions tested knowledge of terminology and knowledge of specific facts, while comprehension level questions tested the student's ability to translate one level of abstraction to another.

4. The final exam for the XPLR 041 course contained 55 questions including 54 multiple-choice questions and 1 true/false question. These tested student learning on the

knowledge and comprehension levels. Knowledge level questions explored knowledge of specific facts, knowledge of generalizations, and knowledge of principles.

Comprehension level questions tested the student's skills at interpretation.

Design

This study used a quasi-experimental design as the experimental groups were self-selected making the random assignment of groups impractical (Cook & Campbell, 1979).

A quasi-experimental design typically includes one or more treatment groups who receive some form of treatment or intervention in the course of the study. A control group, which does not receive the treatment or intervention, can also be included for comparison purposes. In this study, the group which received delayed feedback by mail is classified as the control group. The group which received immediate feedback by computer is considered to be the treatment group. Further, a pretest and posttest are also commonly used for comparison purposes. This study utilized a posttest-only control group design as it intended to test the effects of the treatment (type of feedback) on students' scores and time to completion. Figure 1 shows a representative model in which O represents the observation of the dependent variable and X represents the intervention or treatment. The designation G_T and G_C represent the treatment and control groups respectively. The horizontal line indicates that the groups were not randomly assigned.

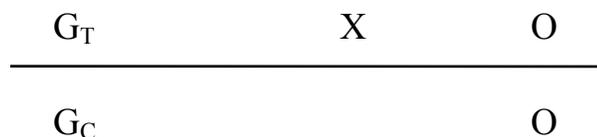


Figure 1. Representation of a Posttest Only Control Group Design.

The data for this study were gathered from archival records maintained by BYU Independent Study. This data included course final exam grades as well as end-of-lesson assignment and final exam submission dates.

Analysis

For data analysis this study used an independent sample *t*-test ($\alpha = .05$) to compare the differences in average final exam scores (Hypothesis 1) and the average number of days students took to complete a course (Hypothesis 2) between high school independent study course groups provided with either immediate or delayed feedback. The *t*-tests were used to determine whether the observed differences in group means were statistically significant.

Procedure

Once a student enrolled in either the paper-based or web-based version of one of the courses identified above, he or she was provided with lesson materials. Both sections received the same instructional material delivered in two different formats. At the conclusion of each course lesson, the student submitted an end-of-lesson assignment to BYU Independent Study for grading either by regular mail or secure e-mail via computer consistent with the course section in which the student was enrolled. The assignment was computer scored and feedback, in this case distractor specific elaborative feedback, was generated for each question on the assignment (See Appendices A & B). The graded assignment and feedback responses were then returned to the student again either by regular mail or secure e-mail via computer.

Once the student completed the lesson material and submitted all end-of-unit assignments for grading, he or she requested a final exam. After the request was

processed, exam materials were either mailed directly to a certified proctor by BYU Independent Study or held for the student to take at the Independent Study Testing Center on the BYU campus. Approved proctors for independent study exams include full-time school or public librarians; guidance counselor/counseling staff; full-time teachers, school superintendents, principals, vice-principals, or other administrators; directors, principals, or faculty of an LDS seminary or institute of religion; embassy education officers; military base/station education officers; and local college testing centers. These individuals apply to BYU Independent Study to serve as a proctor. Upon verifying their application information, the BYU Independent Study testing personnel certify the individual as a qualified proctor.

The student met with the proctor and completed the final exam under the proctor's direct supervision. Once the student completed the exam, the proctor collected and returned the exam materials to BYU Independent Study by mail. When received, the exam was computer graded and the grade was posted and made available to the student. BYU Independent Study kept the hard copy of the exam on file.

Chapter 4

Results

This chapter reports the data gathered and reports of the analyses of the two research hypotheses introduced earlier.

The high school independent study courses used in this study were (a) English 055, (b) History 043, (c) Health 041, and (d) Exploring Values 041. Students who were enrolled in the traditional, paper-based sections of these courses and chose to submit assignments by mail rather than online constituted the delayed feedback group. An equal number of students were then randomly selected from larger populations enrolled in computer-based sections of each course. These students received immediate feedback provided via computer upon submission of their assignments and constituted the treatment or immediate feedback group in the study.

Hypothesis 1

The first research hypothesis stated that students who receive immediate feedback would obtain higher mean scores on the course final exam than students who receive delayed feedback. The mean scores, standard deviations, *t*-test results, and effect sizes are summarized in Table 3.

A visual comparison of the pre-treatment and post-treatment means indicate that the difference is positive for each course. The results of the *t*-tests indicate that the mean difference between the immediate and delayed feedback groups was statistically significant for the English 055 and Exploring Values 041 courses, but not for the History 043 and Health 041 courses. The entries in the far right column of table 3 are effect sizes and provide a way for describing the practical significance of the mean difference

Table 3

Mean Score on Final Examination by Course of Study and Type of Feedback

Course	<i>n</i>	Immediate Feedback		Delayed Feedback		<i>t</i>	<i>df</i>	<i>p</i>	Effect Size
		<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>				
English 055	29	82.14	11.94	70.62	15.83	3.13	56	.003*	.822
History 043	28	74.96	9.09	70.32	12.58	1.58	54	.120	.423
Health 041	29	86.48	10.80	83.76	10.15	.99	56	.327	.260
Exploring Values 041	90	83.50	9.97	76.78	12.05	4.08	178	.0001*	.608

between the two types of feedback. The effect sizes indicate that students in English 055 who received immediate feedback scored .82 of a standard deviation higher on the final exam than those students who received delayed feedback. Similarly, students in the Exploring Values 041 course who received immediate feedback scored .61 standard deviations higher on the average than students in the same course who received delayed feedback.

Cohen (1988) has recommended the following guidelines for interpreting effect sizes in terms of their relative magnitude:

Observed Effect Size	Magnitude of Effect
$d = .2$	Small
$d = .5$	Medium
$d = .8$	Large

Accordingly, the size of the effect for the English 055 course should be considered large, while the effect size for the Exploring Values 041 course would be medium. The effect sizes for the History 043 and Health 041 courses would be considered small.

Hypothesis 2

The second research hypothesis asserted that the elapsed time between submission of the first course assignment and course completion would be significantly less for students who received immediate feedback than for those who received delayed feedback. Because independent study students at BYU are given up to one year to complete a course, they could potentially take a substantial amount of time between registration and actually submitting the first completed lesson. As this is essentially dead time, for the purposes of this study, completion time was defined as being the number of days between the submission of the first course assignment and final exam. The mean number of days required for completion, the standard deviations, *t*-test results, and effect sizes for the independent study courses included in this study are displayed in Table 4.

Visual comparison of the pre-treatment and post-treatment means is negative and shows that students in the delayed feedback group tended to complete their coursework in less time than those in the immediate feedback group. The *t*-test results indicate that the difference in the total means between the immediate feedback and delayed feedback groups were statistically significant as were the differences in means between the two feedback groups for the English 055, History 043, and Health 041 courses. The difference in means between the two feedback groups was not statistically significant for the

Table 4

Mean Course Completion Time by Course of Study and Type of Feedback

Course	<i>n</i>	Immediate Feedback		Delayed Feedback		<i>t</i>	<i>df</i>	<i>p</i>	Effect Size
		<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>				
English 055	29	87.03	68.53	39.24	46.47	3.11	56	.003*	.816
History 043	28	118.39	79.82	50.71	53.25	3.73	54	.001*	.998
Health 041	29	128.41	106.01	67.45	83.56	2.43	56	.018*	.639
Exploring Values 041	90	49.14	37.23	36.51	51.43	1.89	178	.061	.281
Total	176	79.47	73.21	44.32	58.10	4.99	350	.0001*	.532

Exploring Values 041 course. The effect of delayed feedback on course completion times was .816 for the English 055 course and .998 for the History 043 course. Both of these, according to Cohen's (1988) guidelines, should be considered to be large effects. The effect of delayed feedback on course completion times for the Health 041 course was .639 and for the Exploring Values 041 course it was .281. The effect size for the Health 041 course would be considered medium and the effect size for the Exploring Values 041 course should be considered small. The effect of delayed feedback on the course totals was .532 which would be considered a medium effect size.

Chapter 5

Conclusions

This chapter includes a summary of the conclusions drawn from the results of this study reported in Chapter 4, observations, limitations of the study, and recommendations for future research.

Hypothesis 1

The final grade, commonly understood to be an indicator of a student's success in a course, was the dependent variable used to determine whether the use of immediate feedback was more successful in helping a student achieve in an independent study course. Do students receiving immediate feedback in a course earn higher scores on a final exam than those receiving more traditional delayed feedback? The results of the study indicate that this is the case.

The results of the comparisons between both groups of students enrolled in the English 055 and Exploring Values 041 courses reflected a statistically significant difference in mean final examination scores. Students enrolled in these courses who received immediate feedback scored significantly higher than those students who received delayed feedback. Immediate feedback students enrolled in English 055 scored over an entire grade higher than their delayed feedback counterparts. Students enrolled in Exploring Values 041 who received immediate feedback scored over one half of a grade higher than those who received delayed feedback.

Similar findings were found in comparing the mean final scores of both groups of students enrolled in History 043 and Health 041. Although the differences in mean final exam scores between the immediate and delayed feedback groups enrolled in these

courses were not found to be statistically significant, students who received immediate feedback still scored higher than those who received delayed feedback—an important consideration for most students. Immediate feedback students enrolled in History 043 scored almost one half of a grade higher than students who received delayed feedback. Immediate feedback students enrolled in Health 041 scored one fourth of a grade higher than their delayed feedback counterparts. In addition, a review of the effect sizes of all four courses indicated that the use of immediate feedback had a greater impact on course final exam grades than the use of delayed feedback.

Hypothesis 2

A continual item of concern for independent study administrators is the need to keep students involved in a course and progressing toward completion. Hypothesis 2 addresses this concern by comparing the impact of immediate and delayed feedback on the amount of time needed by a student to complete a high school level independent study course.

Does the use of computer-delivered immediate feedback encourage a student to complete a course in less time than use of more traditional delayed feedback delivered by return mail? Results of the study would indicate that this is not the case as students in the immediate feedback group took a significantly greater amount of time to complete their coursework than students enrolled in the delayed feedback group. The average amount of time for students receiving immediate feedback was 35 days longer than those students receiving delayed feedback.

An individual examination of the courses included in the study showed that, in each case, students receiving delayed feedback completed the course in less time than

those students receiving immediate feedback. Results of the analyses of 3 of the 4 courses (English 055, History 043, and Health 041) indicated a significant difference in the average number of days required for completion between the immediate and delayed feedback groups. Immediate feedback students enrolled in English 055 took 48 days longer on average to complete their courses than students who received delayed feedback. Students enrolled in History 043 who received immediate feedback required 68 more days on average to complete their courses than those students who received delayed feedback. Immediate feedback students enrolled in Health 041 used 61 more days on average to complete their courses than students who received delayed feedback. Although the difference in the completion times between the two groups was not significant for the course Exploring Values 041, students receiving immediate feedback still took 13 days longer to complete their courses than those students who received delayed feedback. Again, a review of the effect sizes indicated that the use of delayed feedback had a greater impact on average course completion time than did the use of immediate feedback for all courses.

Observations

A question that immediately comes to mind is concern about the possible impact that the use of the computer in providing course materials might make in the immediate feedback group when compared to the use of the paper-version of course materials in the delayed feedback group. The instructional material presented to both groups is identical and both groups essentially read black text on a white background. Course delivery via the internet, however, allows for the inclusion of some extras such as the use of animation, color, and additional reference material accessed by means of hyperlinks

embedded in the course material. In order to explore this possibility a comparison was made between a group of students enrolled in the paper-versions of each of the courses included in this study who opted to return their lesson assignments via computer with both the immediate and delayed feedback groups already discussed. The students in this new group were also selected randomly from a larger population and the total number selected was equal to the number in the original groups ($n = 176$). The mean final exam scores and their standard deviations received by students in all three independent study course settings are compared in Table 5.

The average mean score for students enrolled in English 055 using computer-generated course materials, submitting lesson assignments by computer, and receiving immediate feedback via computer was highest at 82.14 ($SD = 11.94$). The average mean score for students using paper-versions of the course materials, submitting lesson assignments by computer, and receiving immediate feedback by computer was 78.69 ($SD = 12.93$). The average mean score for students enrolled in courses using the paper-version of course materials, submitting lesson assignments by mail, and receiving delayed feedback by return mail was 70.62 ($SD = 15.83$). The global F -test indicated significant differences between the means, $F(2,84) = 5.42, p = .006$. Tukey's HSD test was then used to ascertain which specific pairs of group means, if any, were significantly different. The results indicated that the difference between the mean scores of the original immediate and delayed feedback groups was statistically significant with the immediate feedback group scoring an average of 11.5 percentage points higher than the delayed feedback group. This finding is consistent with the findings previously reported in Chapter 4. However, the difference between the means of the computer-immediate feedback and the

Table 5

Mean Score on Final Examination by Course of Study and Type of Course and Feedback

Course	Computer Course with Immediate Feedback			Paper Course with Delayed Feedback			Paper Course with Immediate Feedback		
	<i>n</i>	<i>M</i>	<i>SD</i>	<i>n</i>	<i>M</i>	<i>SD</i>	<i>n</i>	<i>M</i>	<i>SD</i>
English 055	29	82.14	11.94	29	70.62	15.83	29	78.69	12.93
History 043	28	74.96	9.09	28	70.32	12.58	28	78.57	13.11
Health 041	29	86.48	10.80	29	83.76	10.15	29	88.93	7.72
Exploring Values 041	90	83.50	9.97	90	76.78	12.05	90	80.08	15.84

paper-immediate feedback groups was not statistically significant although the computer course mean was higher by 3.5 percentage points. Finally the difference in means between the paper-immediate feedback and the paper-delayed feedback groups was not significant although the immediate feedback group means was higher by 8 percentage points.

The average mean score for students enrolled in History 043 using computer-generated course materials, submitting lesson assignments by computer, and receiving immediate feedback via computer was 74.96 ($SD = 9.09$). The average mean score for students using paper-versions of the course materials, submitting lesson assignments by computer, and receiving immediate feedback by computer was 78.57 ($SD = 13.11$). The average mean score for students enrolled in courses using the paper-version of course materials, submitting lesson assignments by mail, and receiving delayed feedback by return mail was 70.32 ($SD = 12.58$). The global F -test indicated there were no significant differences in any of the mean comparisons, $F(2,84) = 2.09, p = .131$.

The average mean score for students enrolled in Health 041 using computer-generated course materials, submitting lesson assignments by computer, and receiving immediate feedback via computer was 86.48 ($SD = 10.80$). The average mean score for students using paper-versions of the course materials, submitting lesson assignments by computer, and receiving immediate feedback by computer was 88.93 ($SD = 7.72$). The average mean score for students enrolled in courses using the paper-version of course materials, submitting lesson assignments by mail, and receiving delayed feedback by return mail was 83.76 ($SD = 10.15$). The global F -test indicated significant differences in one or more of the mean comparisons, $F(2,81) = 3.48, p = .035$. The results of Tukey's

HSD test indicated that the difference between the means of the paper-immediate feedback and paper-delayed feedback groups was statistically significant with students in the paper-immediate feedback group scoring an average of 5.2 percentage points higher on the course final exam than those students in the paper-delayed course. The difference between the means of the computer-immediate feedback and paper-immediate feedback was not statistically significant although the paper course mean was higher by 2.5 percentage points. Finally, as reported in Chapter 4, the difference between the original computer-immediate feedback and the paper-delayed feedback groups was not significant although the mean score of the immediate feedback group was higher by 2.7 percentage points.

The average mean score for students enrolled in Exploring Values 041 using computer-generated course materials, submitting lesson assignments by computer, and receiving immediate feedback via computer was highest at 83.50 ($SD = 9.97$). The average mean score for students using paper-versions of the course materials, submitting lesson assignments by computer, and receiving immediate feedback by computer was 80.08 ($SD = 15.84$). The average mean score for students enrolled in courses using the paper-version of course materials, submitting lesson assignments by mail, and receiving delayed feedback by return mail was 76.78 ($SD = 12.05$). The global F -test indicated significant differences in one or more of the mean comparisons, $F(2,267) = 6.16, p = .002$. Tukey's HSD test indicated that the difference between the mean scores of the computer-immediate feedback and paper-immediate feedback was not statistically significant although the computer course mean score was higher by 3.4 percentage points. The difference between the mean scores of the paper-immediate feedback and the paper-

delayed feedback groups was also not significant although the immediate feedback mean score was higher by 3.3 percentage points. The difference between the mean scores of the original immediate and delayed feedback groups, however, was found to be statistically significant with the immediate feedback group scoring an average of 6.7 percentage points higher than the delayed feedback group as previously reported in Chapter 4.

The mean number of days required for course completion and the standard deviations for all independent study course settings are summarized in Table 6. Again, the completion time was defined as being the number of days between the submission of the first course assignment and final exam. The average completion time for students enrolled in courses using computer-generated course materials, submitting lesson assignments by computer, and receiving immediate feedback via computer was 79.47 days ($SD = 73.21$). The average completion time for students using paper-versions of the course materials, submitting lesson assignments by computer, and receiving immediate feedback by computer was 82.42 days ($SD = 85.32$). The average completion time for students enrolled in courses using the paper-version of course materials, submitting lesson assignments by mail, and receiving delayed feedback by return mail was 44.32 days ($SD = 58.10$). The global F -test indicated significant differences in one or more of the mean comparisons, $F(2,525) = 14.81, p < .0001$. Tukey's HSD test indicated that the difference between the average completion time of the paper-immediate feedback and the paper-delayed feedback groups was statistically significant with students in the paper-delayed feedback group completing their course work in an average of 38 fewer days than those students in the paper-immediate group. The difference between the average completion time of the computer-immediate feedback and the paper-delayed groups were

Table 6

Mean Completion Time by Course of Study and Type of Course and Feedback

Course	Computer Course with Immediate Feedback			Paper Course with Delayed Feedback			Paper Course with Immediate Feedback		
	<i>n</i>	M	<i>SD</i>	<i>n</i>	M	<i>SD</i>	<i>n</i>	M	<i>SD</i>
English 055	29	87.03	68.53	29	39.24	46.47	29	92.66	75.70
History 043	28	118.39	79.82	28	50.71	53.25	28	87.71	89.22
Health 041	29	128.41	106.01	29	67.45	83.56	29	143.14	123.20
Exploring Values 041	90	49.14	37.23	90	36.51	51.43	90	57.91	58.89
Total	176	79.47	73.21	176	44.32	58.10	176	82.42	85.32

also statistically significant with students in the delayed feedback group completing their course work in an average of 35 fewer days than those students in the immediate feedback group. However, the difference in average completion time between the computer-immediate feedback and the paper-immediate feedback groups was not significant although the computer-immediate feedback group completed their course work in an average of 3 fewer days than those students in the paper-immediate feedback group.

It would appear then that the use of course materials provided via computer does not make a significant difference in either the course final exam score or in the amount of time a student requires to complete an independent study course. These findings focus our attention on a second concern regarding how or if feedback is used.

An item of interest that came to light in the course of this study was the fact that nine of the students enrolled in the delayed feedback section of the Exploring Values 041 course submitted all of the course assignments on the same day and arranged to take the final exam on that day or on the next. These students most likely lived in close proximity to BYU and had the opportunity to hand-deliver their assignments as well as complete the final exam at the Independent Study Testing Center on campus. Although the amount of time the students spent completing coursework could not be determined, it is apparent that these students did not wait to receive feedback responses for individual end of lesson assignments before proceeding on to the next lesson or before taking their final exam. It would seem to be a safe assumption that these students also did not make use of the end of lesson feedback responses in preparation for their final exam. It should also be pointed out that this scenario would not be possible for a student in the immediate feedback

group. While a student receiving immediate feedback could choose to ignore the feedback responses he or she receives, the feedback would automatically be provided for each lesson before the next one could be initiated.

Limitations

During the course of this study it became apparent that there were several factors that could not be controlled and proved to items of concern. First was the fact that the students self-selected their course option and whether they consequently would be part of the delayed feedback or immediate feedback groups. Because random assignment was therefore not practical, a posttest only control group quasi-experimental design was used in the study. Cook and Campbell (1979) point out that obvious flaw to this type of experimental design is the absence of pretest data. This leads to the possibility that any differences discovered between the study groups could be attributed to the influence of selection differences rather than the treatment effect being tested. In this case the possibility of selection differences or the differences between the kinds of people in one experimental group as opposed to the other could be a real concern because these were preexisting groups with no explanation as to why students selected the course option they did. As was indicated previously a number of students in the delayed feedback group were contacted and they explained that they had chosen that option because they did not have access to a computer or the internet. Was their course selection motivated then by simply not having a computer available to them or do they not have a computer because they belong to a lower socio-economic class and consequently are poorer students academically than those students who opted for the immediate feedback option?

The second factor was the lack of naturalistic and evaluative data about the student population. This study assumed that students both received and used end-of-unit feedback. However, without direct input from the students, there is no certain knowledge as to whether the feedback was used or how it was used. Nor do we know what the students' satisfaction level was regarding the feedback.

Another question that is raised here might be the student's motivation for taking an independent study course. The fact that a student takes a course only because they need a few more units and only need to pass a course as opposed to those students who are (a) trying to accelerate their progress, (b) nontraditional students, (c) making up a failure, or (d) taking a course not offered by their school can make a potential difference in how a student might approach the use of feedback responses or a course in general.

A third concern was the restrictions found in the course of gathering grade and registration data on the students in the experimental groups. Due to limited data availability, it was only possible to identify those students in the delayed feedback group that were currently enrolled in or finishing courses during the time utilized for this study.

A final concern was the time limit imposed by the researcher. Independent Study students at BYU are given up to one year to complete a course however because of a desire to conclude the study in a timely manner, only those students who completed coursework in a seven-month period were included.

Recommendations for Future Research

While this study attempted to take a first-time look at an area that has not previously been examined, the researcher felt as though it broached more questions than it answered. Some of these include:

1. What factors were present that influenced a student's course option selection?
2. Is there a real difference in student achievement levels between the two groups?
3. Do students of either or both groups use the feedback responses at all? Why or why not?
4. Are students of either or both groups careful to review each assignment completely or do they only review those questions that were missed?
5. Are the feedback responses an integral part of the students' preparation for the final exam?
6. Do students in either or both groups feel as though the feedback provided is advantageous?

Additional research is needed to answer what would seem to be important considerations in how feedback responses are used by students in independent study settings. Answers to these questions could also potentially provide insights for instructors and course designers as to how they might be able to design and present instructional feedback responses in ways that would encourage students to make better use of them.

Another area of interest for administrators of independent study programs is the rate of student completion. Does the inclusion of immediate feedback encourage a higher completion rate than more traditional delayed feedback? Due to the nature of the data maintenance program encountered by the researcher, this question was unable to be answered in the course of this study. Additional research would be warranted to examine this important statistic.

Conclusion

The purpose of this study was to compare the impact of different feedback delivery time frames on student performance in high school independent study course settings. The results of Hypothesis 1 agree with current research which indicates that students who receive immediate feedback on lesson assignments tend to perform better on a delayed final exam instrument than students who receive delayed feedback or no feedback (Kulik & Kulik, 1988). It would appear that independent study students, like their in-classroom counterparts, benefit from a rapid review of their initial responses on lesson assignments. This rapid review, as Dihoff, Brosvic, and Epstein (2003) claimed, allows for an immediate confirmation of correct responses and, in turn, enhances a student's ability to recognize those same responses more confidently in future settings such as a course final exam. It also serves to identify those concepts that have not been clearly understood by the student and encourages further efforts in learning the material in question.

The results of Hypothesis 2 were surprising. It seemed to be a safe assumption that students receiving delayed feedback would take longer on average to complete an independent study course if only because of the turn-around time required in submitting assignments and receiving responses through the mail. Just the opposite proved to be true, however, and it is apparent that receiving immediate feedback was not a factor in reducing the time requirement needed to complete an independent study course.

While it is tempting to attribute these findings to the type of feedback alone, that would not seem fair or feasible in light of the limitations and recommendations outlined above. Although it is evident that changes occurred between the two experimental

groups, other factors must surely come into play. One of the most important of these is the independent nature of both the learning package and the learner as discussed in Chapter 1.

It is important to remember that students in a traditional classroom move together even when reviewing feedback on a past assignment. An independent learner moves at his or her own pace. In order to review feedback on a past assignment he or she must make a conscious decision to stop forward progress and return to review a past lesson or exam. An advantage then of immediate feedback delivered by computer is the fact that it arrives promptly upon submission of a lesson assignments for grading and before a student begins to move forward to the next lesson. Even though it is received in a timely manner, students in this group, as well as those in the delayed feedback group, can choose to review or ignore the feedback responses and this emphasizes the role of motivation in how or if a student uses feedback.

Current research demonstrates that student motivation is an important factor in the use of feedback. Dempsey and Driscoll (1996) and Stock, Kulhavey, Pridewater, and Krug (1992) found, for example, that students are more inclined to use feedback when they learned that answers they felt confident were correct were actually incorrect. It would seem then that the independent learners included in this study would use feedback in the role of a teacher's aid helping to clarify concepts that were initially misunderstood. Feedback responses would conceivably be used even less or not at all in those situations where students felt confident of their knowledge and understanding of the material in question.

Attempting to prove the two hypotheses included in this study has helped to create a clearer picture of how different types of feedback might impact student success and progress in high school independent study courses. The study also generated questions and concerns about how students use feedback responses. Answers to these questions through additional research would hopefully help develop administrative and pedagogical strategies that will foster enhanced student learning.

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Appendix A

Sample of Speedback™ Assignment Questions



LESSON 1

SPEEDBACK ASSIGNMENT

Mark all answers here, then transfer them to your Speedback answer form. You may either submit your completed answer form to Independent Study for processing, or you may use WebGrade for immediate grading. See your *Read Me First* pamphlet for instructions.

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Multiple Choice

from *The Republic*

1. Society must teach youth by example the values it wants grown citizens to have.
 - a. true
 - b. false
2. What did Plato say about what young minds learn?
 - a. Young minds quickly forget casual tales.
 - b. Young minds develop best when they are exposed to many different ideas and tales.
 - c. Ideas that young minds learn early become unchangeable and permanent, so they had better be virtuous.
 - d. It is usually not very important at all.
3. What kinds of stories did Plato specifically mention that youth should hear first?
 - a. Stories that are full of wit and wisdom.
 - b. Stories that are easy for youth to understand.
 - c. Stories that are devised by casual people.
 - d. Stories that are models of virtuous thought.

from "Rules of Civility"

4. According to rule 37, what must we work hard to do?
 - a. obey our parents
 - b. keep our conscience alive
 - c. keep a little spark in our heart
 - d. build a heavenly fire
5. What value is taught in rule 32?
 - a. work
 - b. courage
 - c. faith
 - d. honesty

Appendix B

Example of Feedback Provided to Immediate and Delayed Feedback Groups

(Corresponds to Sample in Appendix A)

Course: XPLR 041

Question 1

("a" is correct answer response)

All answer responses:

He made the point that the minds of young people are very impressionable.

Question 2

("a" is correct answer response)

All answer responses:

Plato felt that society must teach young people good stories and good examples for their later lives.

Question 3

("c" is correct answer response)

Answer response "a":

Youth hear more than casual tales. He insists that what they hear should be purposeful because it stays forever (see paragraph 2).

Answer response "b":

It may sometimes be the opposite, but is not necessarily so. Plato states that it becomes indelible and unalterable (see paragraph 2).

Answer response "d":

Not necessarily. Youth may hear many unimportant things. Plato's point is that what youth hear becomes indelible and unalterable (see paragraph 2).

Question 4

("d" is correct answer response)

Answer response "a":

This is not mentioned. He talks of giving youth virtuous thoughts (see paragraph 2).

Answer response "b":

This is mentioned, but the emphasis is on teaching virtuous thoughts (see paragraph 2).

Answer response "c":

He spoke against such stories. Plato emphasized teaching youth virtuous thoughts.

Question 5

("b" is correct answer response)

Answer response "a":

He was more concerned with the stories the youth would hear even before they could read; his concern was with how they lived.

Answer response "c":

This helps, but only if the examples are living virtuous lives.

Answer response "d":

This helps, but Plato emphasized that it is essential for all people to live virtuous lives. Some parents do this, but others do not.