Winter 2005

The Interactive Question Protocol: Examining the Relationship Between Feedback, Cognitive Development and Student Achievement

G. Simon Richmond
Old Dominion University

The Interactive Question Protocol: Examining the Relationship between

Feedback, Cognitive Development and Student Achievement

By

G. Simon Richmond
B.A. May 1997, University of British Columbia
M.S. May 1999, Old Dominion University

A Dissertation Submitted to the Faculty of
Old Dominion University in Partial Fulfillment of the
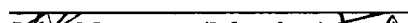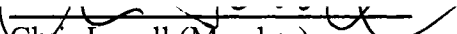Requirement for the Degree of

DOCTOR OF PHILOSOPHY

URBAN SERVICE/URBAN EDUCATION CONCENTRATION

OLD DOMINION UNIVERSITY
December 2005

Approved by:

_____
Dwight W. Allen (Director)

_____
John Nunnery (Member)

_____
Chris Lovell (Member)

ABSTRACT

Feedback is an essential component of effective learning. The advent of the internet as a delivery mode for distance education has expanded the access many people have to higher learning. Despite many advantages that online courses provide for distance learning students, they often lack real time feedback. A software intervention called the Interactive Question Protocol was designed for this study to provide automated, real time feedback. That treatment was then contrasted against changes in student achievement, satisfaction and participation. Learners can be categorized by Perry's scheme of mental maturity according to how they understand and interpret the knowledge they acquire. Learners with low cognitive complexity levels are likely to appreciate basic automated feedback, while those with greater mental maturities are likely to be frustrated by a lack of true interaction. Therefore, Perry grouping was contrasted against changes in student achievement, satisfaction and participation for each subject. This study sought to discover if automated real time feedback had an effect on student achievement, participation and satisfaction. Similarly, it sought to discover if the same three variables were affected by cognitive complexity. Interactive effects between cognitive complexity and feedback treatment were also examined. No significant effects were found. The feedback treatment did not highlight group differences in achievement, satisfaction or participation. Group comparisons between the lower end of the cognitive complexity index scale also confirmed the null hypothesis. Sample sizes proved insufficient to compare subjects in Perry's higher end groups 4 and 5. No interactive effects were found between independent variables. These findings do not refute the obvious value of feedback. Further studies may use a larger sample size to better compare Perry's groups. More feedback complexity, along with the complexity of learning tasks may also be varied to investigate the impact of feedback on achievement, satisfaction and participation.

ACKNOWLEDGEMENTS

I would like to acknowledge the ongoing support and encouragement of my committee. Your suggestions and insight were crucial to the shaping of this study and the amount I learned as I undertook it. Dr. Allen helped design the Interactive Question Protocol and gave me access to his online class and the data it generated. Dr. Lovell suggested the key variable of cognitive complexity, and proved a wealth of information on the work of William Perry. And Dr. Nunnery was of crucial statistical support, both in designing the study and in analyzing the results.

I would also like to thank Dwight Allen, without whose mentoring and friendship this chapter of my life would never have been considered. You have taught me to think differently about just about everything but most of all, myself.

Special appreciation is also due to Barbara Webb, the department secretary who managed the submission bureaucracy while I finished this from Zambia. If you didn't have such a sweet tooth, I wouldn't know how to repay you.

Finally I would like to thank my wife for the understanding and patience it took to grant me the time to finish. As I worked, so you mastered solitaire.

TABLE OF CONTENTS

List of Tables and Figures

CHAPTER ONE: INTRODUCTION

Problem Background

Online education has seen tremendous growth in recent years and is attracting considerable attention from institutions and students alike. Higher education institutions have quickly adopted variations in online education delivery formats. In the vanguard are such institutions as the University of Phoenix Online, which currently enrolls 29,000 students despite being only 11 years old (University of Phoenix Online, 2002). Brand new institutions such as Capella University, which function entirely without brick and mortar campuses, have sprung up to meet the rising demand for online education.

The popularity of the online learning medium underscores the need to refine delivery techniques that exploit the potential of the Internet and maximize learning benefits for the student. One assumes that online instruction has grown quickly because it is popular, and it is popular because it is meeting a large educational need. By understanding how the online learning experience works for those who choose it, educators can refine online instruction to work better for current users, and can redefine it for use by those who have yet to need it. Considerable research is already being done in the field; researchers such as Khan (2001) have carefully documented the dimensions of an asynchronous online course (Appendix A), and others such as Salmon (2000) have proposed new definitions of skill sets for the online teacher (see Appendix B).

Another area that has seen ongoing research and development, and one which is also the focus of this investigation is that of software delivery systems. However, before

examining the software function in question, a closer look at how web based learning performs compared to traditional educational environments is in order. It is only by differentiating between the instructional successes and failures of online learning delivery that the software delivering new strategies can be placed in an appropriate critical context.

Instructional Design Principles

Key to this discussion is a definition of basic terms. While most terms are defined as they are introduced, a glossary is also provided in Appendix C as a courtesy to the reader. Web based learning, abbreviated as WBL, is most commonly delivered through Asynchronous Online Courses, or AOCs. AOCs can be set up in numerous ways, but are only considered asynchronous if they allow students to proceed at their own pace. Often, AOCs are not truly asynchronous in that they have beginning and ending dates that coincide with the traditional semester schedule of higher education institutions. They may also have due dates on assignments. However, they are different from a traditional classroom setting in that they do not physically gather students in one place, and students receive instruction through the at their own pace.

Advantages of Web Based Learning

A great strength of an AOC is that it allows classroom discussions to take place independent of time and place (Phillips and Santoro, 1989). This flexibility has two major advantages: it facilitates greater participation by allowing students time to reflect and contribute at their own pace, and it allows for several discussions to go on

simultaneously; discussion between student and teacher, student and student, and teacher and class can all be conducted at once. This democratization of dialogue leads to a tremendous increase in the efficiency of instructional discourse, and it encourages inter-student exchanges within the context of the learning environment that would be virtually impossible in a traditional classroom setting.

A further advantage is that the online discussion format allows students time to plan their response to each question posed. This writing pause provides for greater thought than a verbal, in-class answer can, and yet does not restrict the creativity and spontaneity of response as a formal written assignment often does. Further, the act of contemplation prior to "conversation" is a remarkable opportunity for the development of critical thinking skills (Kroonenberg, 1994/95).

Because AOCs are structured around the student's convenience, they are easily accessible to non-traditional students who would otherwise struggle to adhere to a traditional higher education schedule. An AOC format therefore greatly increases access to higher education among certain populations that would otherwise be disenfranchised. This is of particular importance to such institutions as Old Dominion University because of its large urban, non-traditional student population.

Another important aspect of AOCs is that the culture of the classroom is drastically changed. Because the student is removed from the external distractions of a public classroom and is able to choose the learning times that are best for his/her daily schedule, the learning experience is much more focused (Berge, 1999). The student develops a more direct relationship with the instructor and the material, as those are the only features of her experience that offer interaction. In addition to the anytime-access

afforded by the online format, the student also has the instructors' email and usually a phone number. These communication tools drastically increase access to the instructor (Phillips and Santoro, 1989), which in turn further transmutes the classroom culture, leading to the democratization of the learning process as student input is more easily directed to the instructor (Phillips and Santoro, 1989).

Disadvantages of Web Based Learning

The AOC format nonetheless contains several weaknesses, however. Ryan reports that despite a higher level of instructor "access" in AOCs, interaction between student and teacher is greater in real time classroom environments, and consequently the content is covered more thoroughly in real time (Ryan, 1999). In online education, faculty technological expertise is a much larger factor in the success of the student because the classes normally rely heavily on complicated technologies (Ryan, 1999), and the instructor often possesses limited technological skills (Cragg, 1994; Berge, 1999). The students also often suffer "distress" from grappling with confusing technologies, disorganization in the course design and unclear communication from the professor.

A dearth of feedback from the instructor is another major problem in AOCs. Feedback is always more difficult to provide in meaningful formats as class size increases. Since one of the advantages for WBL is that higher education institutions can take advantage of economies of scale, class sizes are often large. Add to this high teacher student ratio the fact that there is no face-to-face interaction, and many AOC students end up feeling isolated and unguided. Finding ways to deliver feedback that is both

meaningful for the student and efficient for the instructor is therefore essential for the further development of the field.

Because AOC systems are technologically reliant, and much of the technology is as yet unfamiliar to many students, they face a double learning curve of both the course content and its technological presentation (Phillips and Santoro, 1989; McCollum, 1997). Further, the tools built into AOCs to maximize interaction are often ineffectively used, resulting in a forced and awkward learning environment.

Another limiting factor is the monotony of completing reading online. Alone with their computers and an often overwhelming amount of reading, students can have trouble focusing on what they read. Their ability to attend to the task at hand is sometimes compromised, resulting in an inability to recall the content of the text, even immediately after reading.

In summary, then, there are striking advantages and disadvantages to WBL environments. Through AOCs more people have access to higher education. Students have greater access to class discussions, and discussions take place simultaneously on different levels. Discussions can be at once planned and spontaneous, and therefore result in greater critical thinking skills. Further, learning takes place in a learner-controlled environment that is more focused, and often has more access to the instructor through technological tools.

The disadvantages are also clear. AOCs are technology based, and technology is often unreliable and confusing. Students face twice the learning task in the form of the instructional material as well as the delivery method, and if the instructor does not provide adequate technological support students can be easily overwhelmed. Finally,

there is a large need for increases in the interactivity of the environment, as feedback is essential to learning and is often missing from AOC course designs.

The field of web based learning can be summarized, then, as possessing four notable characteristics. One, it is proving to be a popular new medium for students to pursue higher education. Two, it is particularly useful to non-traditional students whose complex responsibilities often prevent them from attending scheduled, daytime classes (Thompson, 1998). Three, the medium offers strong pedagogical advantages. And four, there are problems caused by unreliable technology and a lack of interaction that need to be addressed to take full advantage of this new instructional medium.

Problem Importance

Each of the above four points lays a separate and crucial part of the groundwork for this investigation. The first point, the popularity of the educational medium, underscores the currency of the problem being discussed. The second point, the particular popularity of the medium among non-traditional students, illustrates the potentially large urban impact of this study. Old Dominion University (ODU) is an urban university, serving the needs of an urban population. By definition, therefore, a large percentage of ODU enrollments are non-traditional students – the same demographic that tends to prefer enrolling in AOCs. Developing new pedagogical tools that maximize the instructional potential of AOCs is a crucial aspect of meeting the educational needs of ODU's student population. The software innovation assessed by this study is just such a tool, designed to extend the capability of higher education to serve an expanding market of non-traditional urban students.

Another factor that makes this study of particular relevance to ODU is the University's Teletechnet distance education program. The Center for Learning Technologies (CLT) is currently expanding the scope of Teletechnet by bringing entire degree programs online. The instructional design of these programs needs to be informed by the latest insights into AOC delivery research. That way, ODU can meet appropriately the educational needs of its distance learning students as well as its non-traditional urban students. This study provides insights into the field of online instructional design, a field that ODU is currently forging into in its endeavor to expand its distance learning program into new mediums.

The third and fourth points, namely the need for new pedagogical delivery designs that take advantage of the medium's strengths while limiting its technological weaknesses, have made up the overarching focus of this dissertation. More detailed attendance to all the advantages and disadvantages of WBL is beyond the scope of this study. However, the discussion above has been offered better to inform this investigation's focus on its two components: the Interactive Question Protocol (the instructional software innovation and treatment instrument of this study), and the differentiation of students along lines of cognitive maturity (as defined by William Perry). The Interactive Question Protocol is introduced in the following section, and Perry's model of cognitive development is discussed in the next chapter.

Interactive Question Protocol

The research vehicle for this investigation is a software innovation called the Interactive Question Protocol (IQP). The IQP is an instructional tool that can be woven

into any AOC, and supplies automated faculty instructional feedback to students. The protocol works by questioning students on their reading, and then providing opportunities for them to evaluate their answers based on an instructor's model answer.

In this protocol, students individually answer questions which were designed to review materials that have been presented as an online "lesson element." A lesson element is a short section of reading that usually contains one or two key concepts. Elements may vary in length, but they are generally a few paragraphs long. The questions asked at their end are divided into two categories: recall (Parrot) questions and comprehension (Ferret) questions.

In this research, for purposes of comparison, the students were divided into two groups, a Model-Response and a No Model-Response group, and up to the point that students submit their answers the groups were treated identically. After they submit their answers, students in the Model-Response group were given feedback in the form of an instructor's "ideal" answer, which is returned to them (instantly) alongside their submitted answer. They then compare the two answers, and were prompted to assess their answer with three secondary evaluative questions. The No Model-Response group does not receive a model answer, although they also answer three evaluative questions. The students in both groups were then required to mark their answers (either as excellent, proficient or needs improvement) according to the criteria of accuracy, completeness and relevance detailed in a provided rubric. An illustration of the protocol can be seen in Appendix E.

There are two differences between the two groups, one major and one minor. The major difference lies in that the Model-Response group was given a form of instructor

feedback, while the No Model-Response group was not. The minor difference lies in the nature of the three evaluative questions both groups answer. The different group's questions were written to be as similar as possible to maximize the similarity of the treatments, yet can not be identical because they reference key differences in the treatments: The Model-Response questions invite the students to directly compare their answers with the instructor's ideal answer, and the No Model-Response questions invite the students to compare their answers with the original text. An example of the different types of questions can be seen in Appendix E.

The Interactive Question Protocol was designed to achieve several goals. First, it gives the Model-Response group immediate feedback about the quality of their answers by simulating, but not requiring faculty interaction or intervention. Second, it breaks up the monotony of the reading for all students, stimulating attending behavior in the reader who is constantly anticipating the next question. Third, the Interactive Question protocol is designed to increase retention by simulating the immediate application of new knowledge through answering Ferret questions. Of course, the Interactive Questioning program does not replace the role of the teacher as the provider of feedback. The program does, however, hugely reduce the amount of time the teacher needs to commit to the process of providing feedback, which is the fourth design goal. Students still contact the teacher, albeit infrequently, for a variety of reasons. The teacher needs to be available for this contact.

Cognitive Development

The second component of this study is the differentiation of students according to their cognitive maturity. Students were categorized according to Perry's scheme for cognitive development (Perry, 1968); a scheme that is discussed in detail in the next chapter but which essentially divides students into four basic groups according to the maturity of their thinking. This scheme provides a compelling framework for the analysis of how students in discrete stages of development respond differently to different feedback treatments.

Purpose of Study

The purpose of this investigation is to determine (in a college AOC) how students respond to the IQP by investigating the students' (a) participation in the feedback process, (b) satisfaction with that process, and (c) achievement scores. Further, the study determines the influence of the level of students' cognitive development on their (a) participation in the feedback process, (b) satisfaction with that process, and (c) achievement scores. Figure 1 below illustrates the dimensions of the study.

The two independent variables in this study were operationalized as follows: a) instructor feedback through model responses provided by the Parrot/Ferret software protocol and b) student cognitive development as measured by the Cognitive Complexity Index (CCI) of the Learning Environment Preferences survey (Moore, 1987). The three dependent variables were operationalized as follows: a) student achievement by unit exam and final exam performance scores, b) student participation by simple treatment event completion tallies and c) student satisfaction by course end survey data collection.

Prior achievement GPA was sought but did not exist in sufficient quantities to construct

an adequate sample. A large number of subjects were either freshmen or transfer students

and as such were new to ODU's records.

C o g n i t i v e C o m p l e x i t y I n d e x R a n g e	Model Response Group	No Model Response Group
	Student Measures 1. Achievement 2. Participation 3. Satisfaction	Student Measures 1. Achievement 2. Participation 3. Satisfaction

Figure 1. Study Dimensions

Research Questions

Given the foregoing statement of purpose, this study investigates the following

questions:

Question One

Do the model vs. no model answer groups vary in terms of their participation in

the Parrot/Ferret exercise, their satisfaction with that exercise and their performance on

unit and final exams?

Question Two

Is there a difference between the Parrot/Ferret participation rates, exercise

satisfaction reports and student exam achievement levels for different CCI groupings?

Question Three

Is there an interactive effect between the CCI groupings and the treatment group?

Conclusion

The implications for this study are quite simple: it provides insight into how AOC

pedagogy can accommodate more interactive models that are designed to appeal to the

learner based on her cognitive development. Assuming results are significant,

instructional multimedia, informed by this study, will be able to move a crucial step

forward to emulating a richer classroom experience: customizing feedback to the needs of

the learner. If findings are insignificant, however, they suggest staying the trend in AOC

instructional design to favor increased interaction. A null hypothesis would serve to explain the increased popularity of WBL; despite the impersonal nature of the medium, students ascribe more value to other aspects of AOCs than they do to its restrictions on interactive feedback.

CHAPTER TWO: LITERATURE REVIEW

Introduction

Feedback is a fundamental phenomenon of life – every moment of the day, whether waking or sleeping, human bodies and minds incessantly provide and process feedback. Feedback is the means by which organisms monitor all conscious and unconscious body processes, and the way people engage in, control and accommodate all social interaction.

Human beings are capable of effortlessly and simultaneously processing massive amounts of feedback from their surrounding social and physical environments. Recent brain research reveals that the human brain has amazing multiprocessing powers to monitor multifarious sensory inputs (Jensen, 2000). Indeed, humans are surrounded by so much feedback at all times that for survival we have developed the ability to allocate cognitive attention on both conscious and unconscious levels in order hierarchically to assess feedback and focus better on only that which is essential for survival. Those who are unable to discriminate between feedback of different levels of importance, i.e., those with conditions such as autism, are hugely disadvantaged by the bustle of daily living.

Feedback is crucial to education. At the heart of every educational exchange lies the act of giving and receiving feedback. In a learning environment without feedback from an instructor or peers, the student is learning in a void, unable to question new material, cross check changing levels of understanding, or confirm fresh insights. Comprehension is the key to learning, and feedback is an essential component of the process of constructing comprehension (Bransford, 2000).

It is understandable, therefore, that extensive research has been done on the acts of giving and receiving feedback. When setting out to complete their 1996 meta-analysis of the field of feedback research, Kluger and DeNisi reported finding over 3,000 individual feedback studies. That said, this body of research has not discovered a set of definitive feedback principles. Research findings have been surprisingly contradictory and inconclusive. While the key findings and influential studies are detailed below, it might help the reader first to summarize the literature in a few broad strokes before delving into its finer points.

For the purpose of this study, the vast body of feedback research is distilled to focus on only the essential factors. These factors can be roughly divided into two categories: those entailing the "external" characteristics of the learning environment and those comprising the student's "internal" processes. Key external factors measure the frequency with which feedback is provided, the complexity of the learning task, and the setting in which it is given. A key internal factor is the level of the student capacity, or cognitive maturity.

Further breaking down the external factors, increasing feedback frequency has shown a positive relationship to effect size. This is especially true in the early stage of a complex learning task. However, increase the amount of feedback too much and that relationship breaks down, even to the point where feedback begins to hinder learning.

The external factor of setting can also be partitioned into contributing elements. Contrived learning environments appear to produce markedly different research results than real life study settings, perhaps because of the artificial manipulation of such key factors as feedback timing, student incentive and feedback credibility.

The internal factor of student capacity can be similarly broken down. Students with higher cognitive maturity levels appear to respond to feedback in different ways from their less mature counterparts. Although the research in this area is not conclusive, providing different levels of feedback elaboration to students with different levels of cognitive development can, in theory, further benefit their learning.

This literature review seeks to answer several questions which arise after these factors have been considered – questions which must be answered to fully inform the design of this study. What is the ideal rate of feedback provision? How does the level of learning task complexity dictate how feedback ought to be provided to students? How does the learning setting for the study affect how feedback is processed? And finally, how can students be effectively differentiated according to their cognitive maturity?

After examining the influential studies that elaborate upon the synopsis of themes provided above, this chapter concludes with a specific look at the design of this study's research treatment and the particular questions that are driving this research.

Feedback Factors

External Factors

Feedback frequency is defined as how often a student is given feedback, and is normally calculated as a percentage of possible feedback interventions; 100% feedback frequency is feedback that is given every time the subject ventures a learning trial, 50% is feedback given at every second trial, etc. Another way to calculate feedback frequency is as a function of time, rather than of learning trials. This method is helpful when a

collection of subjects is given group feedback on communal performance. Such feedback may be given every three days, or every two weeks, for example.

The first question examined in this review is at which level of frequency is feedback most effective? Generally speaking, more feedback is better than less, but too much feedback can be detrimental. The feedback effect is not always a function of frequency. This finding is well documented in a variety of studies and settings, as demonstrated by the research discussed below. That said, in certain conditions more feedback is helpful. For example, early in the learning process, particularly when the learning task is complicated, the student tends to appreciate more feedback.

High Frequency Feedback is Redundant

In the real world setting of a heat exchanger plant, Chhokar and Wallin (1984) conducted safety training for employees and set a factory goal of 95% safe worker practice. After establishing a baseline of safe practice performance, they began monitoring workplace behavior and posting public feedback of achievement. They found that the workforce quickly improved safety performance to meet the 95% goal, and maintained that goal when given weekly feedback updates on performance. When feedback was reduced to every two weeks, the workforce maintained the 95% safe practices behavior standard. That rate dropped quickly when feedback was totally withdrawn, and recovered when it was reintroduced. The researchers concluded that although some feedback was necessary, reduced feedback rates were sufficient to maintain target outputs and therefore had greater cost benefit.

Chhokar and Wallin (1984) did not investigate what the optimal rate of feedback frequency was. Neither did they elaborate on their suggestion that some feedback is too much. Further, there is some question about generalizing the results of the study and applying them to an educational setting, since the workers were not dealing with learning new material; they were simply maintaining a standard that they had already mastered. Finally, Chhokar and Wallin do not make clear which control was in place to prevent experimenter bias when observations were being made. Presumably those conducting the safety observations knew when feedback was being provided and withheld, and this knowledge may have affected how they evaluated the relatively subjective variable of "safe behavior."

Wulf, McConnel, Gartner and Schwarz (2002) investigated how feedback frequency affects the learning of complex motor skills, in this case learning how to loft a soccer ball at a target. Using a sample of 52, they ran a 2x2 factorial design, analyzing the effects of external and internal feedback at 100% and 33% frequency rates. External feedback was defined as feedback focusing subject attention on the results of the trial (e.g., 'your kick sent the ball high and to the right'), while internal feedback focused on the subject's physical movement during the trial (e.g., 'you leaned too far back as you wound up for the kick'). Feedback was given in person by an observer-coach. While the 100% and 33% external feedback groups achieved similar results, the 33% internal feedback group performed significantly better than the 100% internal feedback group.

While these results suggest that less feedback is better, there are several problems with this study. There is a treatment crossover between the two groups, because although the observing coaches focused their feedback either externally or internally, the external

feedback (i.e., whether the ball struck the target or not) was there for both groups to see. Easily reading environmental feedback (or task feedback) decreases the power of the feedback intervention (Leivo, 2001). Further, providing the feedback in person is the most likely delivery format to trigger a distracting "meta-task process" (Kluger and DeNisi, 1996). This phenomenon is particularly true when the feedback focuses on a person's direct action, as was the case with the internal feedback group. Such a distracting personal analysis could explain why the 100% feedback group fared less well than its 33% counterpart, given that they were receiving three times the amount of critical attention.

In a real world rest stop maintenance study, Leivo (2001) worked with a group of 90 janitors in three rest stops to establish a rubric for a clean bathroom. Janitorial achievement was then measured against that rubric when random inspections were made, and the evaluation results were handed over to the rest stop supervisors. Over time the researcher slowly reduced the amount of feedback given by increasing the intervals between inspections. The infrequent feedback was found to be as equally effective as frequent feedback.

Similar to the Chhokar and Wallin (1984) study, this investigation did not reinforce any learning with its feedback; it simply enforced a predetermined standard. Obviously, frequent feedback is not as necessary in this situation as it would be in an educational setting as the variables of work are not constantly changing as instructional material does in a classroom setting. This point does not invalidate the study, but it does question the study's applicability to an educational environment.

And, as Levio himself points out, the state of cleanliness of the environment itself provides all the feedback the participants need. This task feedback undermines the treatment by making feedback commonplace when it is theoretically infrequent. Finally, the treatment did not provide personalized feedback to the individual janitors; it provided generalized feedback to the janitor supervisors. Perhaps more individualized feedback would have affected performance differently.

Alavosius and Sulzer-Azaroff (1990) conducted a real world study on the skill acquisition of health care givers. Nurses were provided with shadow trainers, who accompanied them on their rounds and offered feedback on how they completed various routine tasks. The researchers found that, when first learning, the nurses with the most continuous and frequent feedback learned fastest, but once a correct procedure was learned, it could be executed sustainably with intermittent feedback.

Surprisingly, this study only utilized four subjects, presumably because of the intense one-on-one nature of the researcher-subject relationship; the researcher shadowed the nurse for hours at a time, over a period of months. Further, given the small number of subjects, different frequency treatments were administered by the same trainer to the same nurse simultaneously. Therefore, a subject may have been given 100% feedback on a bed-making task, and 33% feedback on a blood sample-taking task. Not surprisingly, with such a large proportion of the researcher's attention directed at one particular aspect of the job, the 100% feedback task was more quickly learned.

Despite the range in activities these various studies investigated, and their respective flaws, they all concluded that more frequent feedback is often redundant. None of them was able to provide insight into what the ideal frequency of feedback is, though

many of them expressed interest in further research that discovered it. Most likely the ideal frequency rate would vary depending on participants, activities, and feedback formats.

Without conclusive evidence of the superiority of a particular feedback provision rate, it is difficult to set an appropriate rate for this study. While it may be interesting to vary the rate among different students, such a manipulation would not be true to the purpose of the study: to examine how students of different cognitive maturity levels utilize feedback. Therefore, as suggested by the literature, a feedback frequency rate has been selected that is relatively high, but hopefully not overbearing.

A further point is raised in the studies above particularly by Alavosius and Sulzer-Azaroff (1990), that higher feedback frequencies are beneficial in the early portion of a learning process when the task is most complicated. This relationship between feedback frequency and learning task complexity is examined below.

Feedback Frequency and Learning Task Complexity

In a 1986 study, Rudd investigated how workplace productivity could be affected by electronic surveillance and the feedback it can provide. Dividing secretarial workers into groups that completed tasks of different complexity and which received different amounts of feedback, the researcher surveyed them all on their level of job satisfaction. Contrary to his predictions, he found that the most satisfied workers were those who were given the most complex tasks and the highest frequency of feedback.

Wulf, Shea and Matschine (1998) investigated the acquisition of another complex motor skill: the movement involved in the giant slalom. Using a sample of 27, Wulf et al.

divided the subjects into two groups, one that received 100%, and the other 50% feedback frequency rates. After the training and feedback trials were over, tests indicated that the 100% feedback group had better mastered the ski simulator. The researchers concluded that more complex tasks, such as the one under experiment; can require higher levels of feedback when being learned.

The definition of an ideal slalom movement was provided as one that utilized a late force onset, a motor skill the researchers designated as complex, and a condition best met by the 100% frequency group. While Wulf et al. no doubt had good reason to pick this criterion; it seems a meager indicator of the mastery of slalom movement.

In conclusion, two strong principles emerge from the present literature on feedback frequency. First the feedback effect is not a direct function of feedback frequency, as it can often be sustained with intermittent feedback. Second, more complicated skills are best taught with a high degree of feedback frequency, at least in the early stages of learning.

As discussed in the overview of asynchronous online courses (AOCs) in the previous chapter, online learning can be a complicated process. Not only are students struggling with the material in the course, they are also struggling with the technology of the medium of delivery. Therefore, the combination of educational content medium in the course ECI 301 presents subjects of this study with a complex learning task. There is little doubt, then, that although feedback frequency is not the topic of this investigation and hence not a variable, the high rate of feedback provided is an important aspect of the study design because it is in line with the best practices recommended by the research on feedback frequency.

If high frequency feedback does not always benefit the learner unless the learning environment is complex, then at what point does feedback cease being helpful? This question is discussed in the next section.

Feedback that Inhibits Learning

Too much feedback, or feedback of the wrong kind, can inhibit learning because "increasing the amount of extrinsic feedback is thought to promote dependence on that feedback, and thereby prevent the development of intrinsic response capabilities" (Winstein and Schmidt, 1989, p. 47). There are several explanations offered for this observation, including the idea that offering too much feedback can be perceived as being too controlling (Ilgen, Fisher and Taylor, 1979), the suggestion that feedback can induce an interfering meta-task process (Kulger and DeNisi, 1996), the theory that feedback can obfuscate task coherence (Carroll and Kay, 1988), and the observation that feedback can inhibit a student's task transfer abilities (Schroth, 1997). These ideas, and their originating studies, are discussed in greater detail below.

In a meta-analysis of feedback studies, Kluger and DeNisi (1996) investigated the not uncommon finding that feedback can inhibit learning. There are numerous variables to feedback (i.e., timing, source, credibility, format, frequency, complexity, etc.) that are difficult to isolate and control, and therefore it is difficult to explain why a certain type of feedback in a certain situation (with certain types of student, material and instruction) has failed to reinforce learning. Kluger and DeNisi (1996) posit a model, however, that offers a theoretical explanation for many such failures. They break down the learning process into three discrete steps. The first is task incentive, during which the student applies her

proven learning strategies to master a given task. Upon a feedback intervention when the student perhaps learns of her failure to master a task, she enters a second, and somewhat deeper, process called the task details. In this process she buckles down to apply her cognitive strategies more rigorously, moving into an increasingly focused learning mode. If more feedback still reveals that she is not making progress, the student may enter the third condition, a meta-task process. In this process she begins to cast about for alternative and untried learning strategies, perhaps even seeking excuses for her failure, in an ever more desperate attempt to grasp the material.

Kluger and DeNisi (1996) suggest that although the meta-task process may help the student by landing on a useful alternative approach, it is certainly going to cause a short term cognitive distraction, and can also reduce long term attention to the task. The researchers postulate that feedback that is likely to trigger a meta-task process is feedback that is provided in person by a superior, as it is often perceived as threatening. Given that internal psychological phenomenon are difficult to study, this theory is difficult to test, but remains intriguing as it suggests a plausible explanation for the failure of some feedback interventions.

In 1988, Carroll and Kay designed a study that used computers to teacher word processing functions in one of four particular manners. Sixty subjects with no prior experience then learned the word processing program, in one of four groups, with each group being manipulated to learn in a different way. A control group learned entirely without guidance, through simple trial and error. The other groups learned with variations of feedback in the forms of computer prompting, automatic error correction and direct computer instruction. The researchers found that the guided groups learned the fastest,

with the prompting and auto correction groups learning the best. When confronted with transfer tasks, however, Carroll and Kay report that the prompting and direct instruction groups struggled the most, while the control group did the best. They conclude that too much information provided during learning, as was the case with the direct instruction group, can obscure the coherence of the task, thus providing less support than intended.

This study was weakened by the fact that the word processing skills taught were not comprehension skills, but rather the memorization of a linear sequence of steps used to save and print files. Hence, subjects did poorly on transfer tasks, which by definition measure deeper levels of comprehension, possibly because there was not a lot of comprehension to begin with. Further, Carroll and Kay (1988) mislabel their direct instruction group as a feedback group when the treatment it was exposed to consisted primarily of computer interjections of direct instruction, followed by structured programming that prevented the user from taking wrong steps. This cannot accurately be considered feedback.

In a different study that found opposite results, McCarthy (1995) examined the near-transfer abilities of sixth graders studying verb usage. With fifty-six subjects divided into three groups receiving immediate, delayed and no feedback, McCarthy found the feedback did help near-transfer tasks. Unfortunately, he did not investigate far-transfer tasks. He also failed to account for the fact that the two-day wait for feedback by the delayed feedback group amounted to double instruction (Kulik and Kulik, 1988), a serious confounding variable. As such his results, while interesting, cannot be given too much weight.

Using a sample size of eighty eight, Schroth (1997) designed his research around four groups, each of which received feedback at a frequency rate of 100%, 75%, 50%, and 25%. He found two interesting things. Reducing the number of feedback interventions early in the learning process reduced the subjects' speed of acquisition of the concepts. However, the reduction also led to the subjects' greater success at transferring tasks, both of a simple related nature and a removed complex nature.

In conclusion, feedback can actually be harmful in certain circumstances. If it is delivered so as to trigger a meta-task process in the student, it can detract cognitive attention from the learning task at hand (Kluger and DeNisi, 1996). If too much feedback is given, it can disrupt the cohesion of the learning task, confusing the learner (Carroll and Kay, 1988). Feedback may also inhibit transfer tasks (Carroll and Kay, 1988; Schroth, 1997).

It is important to keep these findings in mind because a balance must be struck between the dual dangers of providing too little feedback and leaving AOC students isolated or unguided, and providing too much feedback and leaving them distracted or dependent. Exactly when feedback is too frequent or too infrequent appears to be too complicated to predict. Nevertheless, within the context of this study, given the disenfranchised characteristics of the AOC learning environment and the non-traditional student, it is wiser to err on the side of too much feedback rather than not enough. The findings on feedback frequency therefore, although not clear in demarking simple principles of best practice, would suggest that an AOC environment is best suited to a high level of feedback intervention.

Feedback Setting

An important factor that can often determine the result of a feedback study seems to be the setting in which that study is conducted. A differentiation must be made between laboratory studies and real world studies. Laboratory studies, understandably seeking to control the complicated variables comprising feedback process, manipulate their treatments in contrived environments. Real world settings, while being more natural environments for the subjects concerned, often fail to control all the potential variables. Choosing a research design from those two categories is essentially a dichotomy between favoring internal or external validity.

Kulik and Kulik (1988) were the first to point out that the two study settings yield consistent, yet contradictory results. The variable of timing in particular, though not of specific interest to this study, evokes dual conclusions from the two settings. In laboratory settings delayed feedback consistently produces higher learning gains, while in real world settings, immediate feedback is demonstrably superior. Kulik and Kulik explain these conflicting results by observing that in controlled settings, where subjects are being instructed in what is necessarily new (and likely obscure) material, delaying feedback often means that the feedback functions more as a second instructional trial than as true feedback.

This explanation is augmented by the further observation that student incentive plays a key role in feedback processing and achievement. Morrison (1995) demonstrates this observation in a study that compared two student groups; one that completed his study for a blanket participation grade in a college course (the task incentive group), and another that completed it as a marked assignment that could dynamically affect final

course standing (the performance incentive group). Using two hundred and forty six college students, he randomly assigned his two incentive groups to one of three feedback treatments or two controls, in order to be able to analyze how students with different incentive used different types of feedback. Students were asked questions on course material and were given different feedback formats: delayed feedback, knowledge of correct results, answer until correct feedback, no feedback and no questions.

Morrison discovered that the performance incentive group did significantly better than the task incentive group. He found that both groups responded to their various feedback treatments in the same way, but that the task incentive groups' effects were much more muted. This discovery lead him to question the results of any study conducted outside a real world setting, as it would likely utilize subjects that lacked sufficient incentive. As an explanation for his finding, he invoked the concept of "mindfulness" that has been defined as the "volitional, metacognitively guided use of non-automatic, usually effortful processes" (Salomon and Globerson, 1987). Students with proper incentive, regardless of the feedback format they are provided with, are more mindful of that feedback and therefore more responsive to it.

The results of studies on feedback setting cast an interesting light on this study. Because it is conducted in a real world environment, the research indicates that immediate feedback is likely most beneficial to students (Alessi, 2001, p. 256). Hence the feedback provided in the current study is as immediate as possible. Further, because the feedback processing activities are linked to final course standing, it is students have high task incentives, hopefully leading to more observable feedback effects.

External Factor Conclusions

The external features of feedback can be summarized in four points. High frequency feedback can be redundant – often feedback effects can be reasonably sustained by intermittent feedback, particularly once the necessary skills have been learned. However, teaching complex tasks often benefits from the use of high frequency feedback, particularly early in the learning process. Sometimes feedback can interfere with learning, either by inducing a meta-task process, by distorting the learner's task comprehension with too much information, or by failing to teach higher-level understanding that can be utilized during transfer tasks. Study setting can also influence findings, particularly when contrived environments limit the achievement incentive of students.

With these findings in mind, the feedback in this study was provided at a high frequency rate because of the complex learning environment of an AOC, and the disenfranchised nature of the average urban student. Each feedback intervention was immediate in order to take advantage of the real world setting of the study, which in turn was expected to stimulate high levels of incentive among most students.

Internal Factors

An important internal factor that affects feedback is mental processing. While the effects of feedback have been studied in detail for the larger part of this century, its relationship to the internal processes of the learner has only recently been investigated. Perhaps this burgeoning research is triggered by the relatively recent advances in psychology and education that offer testable schema for the analysis of different human

abilities. The result is that there is surprisingly little research investigating the relationship between different psychological characteristics and feedback processing.

Cognitive Development

The study of student development has become increasingly important to higher education in the later half of this century. Although delivering educational content has always been and remains still the major focus of institutions of higher learning, more and more attention is being paid to the ontogenesis of cognitive development. The student is no longer seen as the simple master of knowledge. She is at the center of a larger context of evaluation and judgment that she is continually conducting in order to make meaning out of her life and world. Higher education in general is recognizing the importance of that developmental process, not only in how it profoundly impacts the personal lives of students, but also how it cannot be separated from their ability to consume and produce knowledge.

Several major models of social development have been proposed over the last few decades; the model of moral development by Kohlberg (1984), and the studies on ego development by Loevinger (1966) stand out prominently. Each model builds on the assumptions and insights of the previous theory. Of specific relevance to this study is the theory of cognitive development proposed by William Perry, as his has been called "the single most powerful framework for both listening to and understanding student perspectives on knowledge and learning" (Moore, 1994, p. 46). After examining Perry's model, this study will look at a test instrument developed to categorize students according to its discrete stages of development.

Perry's Model

While teaching at Harvard in the early 60's William Perry and a group of other counselors and teachers became intrigued by how differently they were each perceived by different students (Perry, 1981). Each semester students turned in course evaluations that directly contradicted each other, ranging from either complaining about, or praising to no end, the professor. At first, Perry remembers attributing the different reactions to be nothing more than manifestations of the diverse personalities of his students.

But, intrigued by the work of Piaget (1965) and Kohlberg (1984), Perry (1981) began to wonder if the task of mapping cognitive stages could not be carried into adulthood. It struck him that differences in evaluation could be attributed to different stages of adult development. He began his research by inviting freshmen students to share their perceptions of college. Each year he would invite the same students back for an interview and ask the very simple question "What stood out for you about college in this last year?" Over time, as he collected and transcribed these interviews, he began to notice patterns in the students' responses, and he organized these patterns into a scheme for analyzing their cognitive development.

So began the research that eventually resulted in the definition of nine distinct stages of cognitive development, four that are the focus of the present study. Each of the stages, called by Perry "positions," is based on a different set of assumptions regarding how knowledge and values work and how they shape the perception and behavior of the individual. As an individual moves between the positions, those fundamental assumptions change, becoming increasingly mature. Subsequent work (Moore, 1987) has refined the nine stages, resulting in the 4 groups under examination in this study.

Dualism: Position two.

The first position, dualism, involves the use of sweeping generalities by the young adult (Perry, 1968, p. 66). The individual observes everyone as falling into one of two groups: us or them, good or bad, right or wrong. Authorities are seen as absolute figures, unchallengeable and infallible. The purpose of learning is to master the information they dispense, as they are always correct. Even learning to be independent, which said authorities often promote, is understood to mean learning to be self-controlled and obedient to the expectations of others in the group. Dualism is an innocent and child-like position, one that is quickly abandoned by most students once they find themselves in the more demanding pluralistic environment of college.

Multiplicity Pre-legitimate: Position three.

The complexities and diverse experiences of college can force the young adult to move into the next position, which is called multiplicity pre-legitimate, or early multiplicity. In this position the young adult begins to realize that people other than authorities may have legitimate opinions. They also realize that authorities themselves often disagree.

This is not to say that the student has abandoned the idea that absolute truth is attainable. The diversity of opinion she is suddenly encountering is easily explained by the individual's conviction that some of those people are wrong, while others are right. Even the complex reasoning of academic instructors, who often present multiple and conflicting perspectives on issues, is seen simply as an elaboration to test the student's ability to discern absolute truth. Perry notes that the entry into this position is often

tumultuous, and he compares it to the departure from Eden. There is a lost innocence in suddenly realizing that one needs to take responsibility for constructing meaning -- a responsibility that some people try to shirk by stepping into a sub-stage that Perry terms retreat (Perry, 1968) where "otherness, differentness and complexity can be righteously hated" (Perry, 1981, p. 76).

In this early stage of multiplicity, however, young adults often accept multiple presentations of opinion as a good exercise for them to wrestle through to discover the truth. Nonetheless, as an exercise it is still considered ultimately unreal. In effect, they have not left Dualism because they still hold to the idea of absolute truth: multiple conflicting opinions are simply a helpful encounter that better teaches one what truth really is.

Multiplicity Legitimate: Position four.

Slowly the young adult comes to realize that uncertainty is unavoidable. Those authorities who have been frustrating them with qualifiers like "it depends" are no longer seen as either illegitimate experts who are simply wrong, or clever instructors whose duplicitous ways trick students into thinking more deeply. Instead, in multiplicity legitimate the individual realizes that nothing is certain, and therefore all opinions must be carefully evaluated.

This has difficult consequences for the student's relationships with authority figures. Before, students perceived their answers to be marked according to their amount of correctness. Now they question the right of the instructor to judge their work (Perry, 1981) – who is to say anyone's opinion is more valid than anyone else's? Their reaction

in this position seems to Perry to depend largely on their attitude towards authority.
Those who are resentful may step into alienation (a sub stage called Escape) or Retreat
(Perry, 1968). Those who are more trusting progress with their development.

Often times a new type of dualistic perspective emerges within those in the later
multiplicity position. They divide the world not into right and wrong, but into those who
feel they are right, and those who realize that all opinions are equally valid. Instructional
authorities suddenly have the tables turned on them and find themselves categorized as a
person who considers himself always right, and therefore against the multiple opinions of
the "free" world.

Contextual Relativism: Position five.

In this fourth stage of relativism students begin to understand that although there
are diverse opinions, some are more valid than others depending on context. Simply
holding an opinion does not make one right. Instead, logical thought and empirical
investigation are recognized as tools that can be used to authenticate one's thinking. Perry
(1981, p. 87) describes this transition as being from one that sees the person as a "holder"
of meaning to a "maker" of meaning. The responsibility that used to be considered the
territory of the authorities is now the responsibility of all.

It can be an anxious transition for many students. Diversity of opinion in the world
does not cease, but the freedom of believing that that diversity prohibits people from
rightfully judging you dissolves away. Now people can be right or wrong, in a relative
way. Now personal opinions have to be legitimated or abandoned. Relativism is the most

mature state of thinking in that it puts the most responsibility on the individual, and debunks any conceptual shelters that had previously protected more naive thinking.

Young adults of all ages struggle through these different stages. Perry (1968) worked extensively to document each position and developed means of assessing which position a given person fell into, but could never develop a means of systematically assisting a person to traverse a position. Life appears to be too intricate, and the human mind too complex to be routinely stimulated and manipulated through to higher levels of understanding by a systematic outside force. Instead, diverse social and academic experiences come together for most people and cause the growth to happen organically. That said, for some people the growth never really happens, and they remain lodged in a particular cognitive position for much of their lives.

The purpose of this study is to analyze how students in different stages of cognitive development respond to feedback. It is therefore essential to have a reliable instrument to assign membership to Perry's positions. Before continuing further, a brief discussion of such an instrument is in order.

The Learning Environment Preferences Survey

William Moore recognized the value of Perry's framework, and how its further testing was hindered by the lack of an instrument that was empirically sound, grounded in the ongoing research of the model, and heuristic in its ability to provide quality research. For these reasons he designed the Learning Environment Preferences survey (Moore, 1989).

Several instruments had been previously designed, such as the Measure of Intellectual Development (MID) (Knefelkamp, 1984), Scale of Intellectual development (Erwin, 1983), Parker Cognitive Developmental Inventory (Parker, 1984), Learning Context Questionnaire (Griffith and Chapman, 1982) and Measure of Epistemological Reflection (MER) (Baxter Magolda and Porterfield, 1987). However, such instruments are not sensitive to ongoing refinements of Perry's model, and the MID and MER tests are expensive and require extensive training to mark at an acceptable level of inter-rater reliability. Beside the fore mentioned instruments the only other way to evaluate Perry's model, or assess a student's placement in his scheme, is to conduct interviews. This method is also expensive and inhibits any serious, large-scale research. This last point is important, because although Perry's model has held up well during confirmation studies, the lack of an easy-to-use assessment instrument prevents large scale testing in different populations, which is a vital part of the validation of the theory.

Moore therefore developed the Learning Environment Preferences survey, or LEP (1989). The LEP was in large part based on a pre-existent test called the Defining Issues Test, a moral judgment test designed by J. Rest in 1979. Designed to assess the salient four positions of cognitive development, the LEP focuses on five domains that are related to student attitudes in higher learning:

1. The view of knowledge.

2. The role of the instructor.

3. The role of student/peers in classroom.

4. The classroom atmosphere.

5. The role of evaluation.

Each domain is tested with a total of twelve items, and the respondents are asked to rate each item (on a four level scale) according to their ideal learning environment. They then rank the three most significant statements for each domain. Each domain also has what Moore calls an "M" item, which is essentially a distracter that has little meaning, but which is important-sounding. High M scores therefore indicate students who are not taking the LEP seriously. Sample questions drawn from the LEP can be seen in Appendix D.

When scoring the LEP, the evaluator generates a Cognitive Complexity Index (CCI). The CCI is a single coefficient based on a weighing algorithm that uses a respondent's relative preferences for coding the four positions.. The CCI scale ranges from 200 to 500.

Construct Validity of the LEP

In assessing the construct validity of the LEP, Moore (1989) refers to three criteria articulated by Nunnally (1967): the instrument must articulate clearly defined and observable behaviors that relate to the construct, it must determine how these behaviors co-relate with each other, and it must correlate those behaviors with established measures of the construct.

As a starting point in the design of the LEP, and as a means of satisfying Nunnally's first criterion, Moore drew the item structure for the LEP from the Measures of Intellectual Development test (MID), the most common approach to measuring Perry's scheme. Using expert MID raters, the original item pool was edited down 40% to create an 80-item instrument.

Running internal consistency checks on the instrument items, and completing an item factor analysis tested Nunnally's second criterion. A strong alpha reliability coefficient (above 0.8) was found on three of the four positions, with position three items scoring 0.72. The internal consistency checks also showed strong inter-correlations for items measuring positions two, four and five, but weak inter-correlations (on two items out of 15) on position three.

Moore (1989) points out that the weaker reliability of position three items suggests a lack of conceptual clarity in the set of items. This lack of clarity he attributes to the relative similarity of position three (multiplicity pre-legitimate) to position five (contextual relativism) and to the cultural "popularity" (in America) of a number of the position three items that lead participants to score the position as more significant than it perhaps is.

Examining criterion group differences satisfied the third criterion, correlating measured behaviors with the construct. An examination of CCI scores for a randomized sample (n=470) showed a steady increase in means from freshman to senior, as would be predicted by Perry's theory. An analysis of variance of those results found them significant (F=3.8, p<.01).

Pointing out that some further attention needs to be paid to validation studies done with minority populations and other cultures, Moore concludes that the test is both reliable and valid.

Internal Factors Conclusion

Given the complexities of the human mind, feedback is processed by different students in different ways. Controlling how feedback is processed is not possible, so studies in the past have ignored the possible effects of internal factors. However, by adopting Perry's schema to differentiate between students of different cognitive maturity levels, this study investigated if students in the dualist, multiplicity pre-legitimate, multiplicity legitimate or contextual relativism positions varied in terms of how they used the feedback provided for them by the Interactive Question Protocol. Because the different positions represent markedly different ways of relating to and processing both information and those who present it, the schema is likely to show variations of interaction with the feedback presentation utilized in this study.

Metacognition

Metacognition is a term that refers to the "cognitive ability to monitor and self-regulate one's thinking" (Langrehr and Palmer, para. 1), and is commonly referred to as "cognition about cognition" (Wellman, 1985) or "thinking about thinking" (Babbs and Moe, 1983). If "cognition refers to having skills," then "metacognition refers to awareness of and conscious control over those skills" (Stewart and Tei, 1983). Metacognitive skills are vital to higher level learning because they enable an individual to take stock of her understanding, identify areas of misunderstanding, and actively "develop and expand on new knowledge" (Langrehr and Palmer, para. 2).

The topic of metacognition is not a primary focus of this study, but it is an inescapable part of efficient learning and must therefore be given adequate attention in

this literature review. Metacognitive practices come to bear on this investigation in that the No-Model Response group in this study, in order to make their workload as analogous to the treatment group as possible, were be given a series of metacognitive question prompts. The nature of these questions, though not a major thrust of the investigation, is an indispensable part of the research design. The research that cast the shape and direction of the prompting questions is therefore reviewed below.

Metacognitive Instruction

Some basic metacognitive skills are self-assessment, self-exploration, and monitoring the acquisition of new levels of understanding (Lin, 2001). Any time these skills are used, learning is enhanced. A lack of metacognitive skills shows up easily among poor readers who are unable to track what they are learning from a text. Garner and Kraus (1981-82) concluded that direct instruction of metacognitive strategies could help poor readers move beyond their struggles to decode word sounds and actually follow the meaning of the words. Students who are given direct instruction in metacognitive skills such as summarizing, questioning, predicting and clarifying are able to better interact with their learning material in both formal and non-formal educational settings. (Palincsar and Baker, 1984). Students using the Interactive Questioning Protocol are not given specific metacognitive training. However, the No Model Response Treatment of the Parrot/Ferret activity is carefully designed to incorporate metacognitive practices, as inspired by the studies reviewed below.

Structuring Metacognitive Activities

The National Reading Panel (2000) commissioned a study to examine strategies readers use to construct meaning. After narrowing down the extensive research available by using strict research criteria, they settled on a core group of 205 studies. From those studies they gleaned several metacognitive principles and dozens of instructional strategies that had shown significant results.

Key among the metacognitive principles is the idea that readers create meaning when they deliberately engage in problem solving behaviors as they read. Although this phenomenon of creating meaning while reading can be enhanced by teaching readers comprehension strategies, most students develop them informally. One of the most common and useful strategies is to enhance meaning by relating text content to prior knowledge. Therefore, one of the metacognitive prompts used in this study is designed to stimulate a schema-reflective process in the student.

Among the numerous instructional strategies, the report highlighted seven that comprise the most common comprehension instruction strategies. Although each of the seven can be successfully used individually, they are most effective when used in cohort.

The first strategy is that of comprehension monitoring, where students are taught to be aware of their own understanding. The second strategy is to use graphic organizers to represent a text's major ideas in pictures. Question answering, when students answer teacher questions and are given immediate feedback, and question asking, when students ask themselves questions about what they do not understand in the reading, are the third and fourth strategies. Story structure is another strategy, when students are taught to remember the content of the reading by relating it to the structure of the text. The sixth

strategy involves summarization, where students integrate the ideas from the text and synthesize generalizations for the reading. The final strategy is co-operative learning, where students read together and help each other utilize the different strategies.

Pressley (2002) has generated a similar list in his commentary on the conclusions of metacognitive research over the past 30 years. This overlap is striking because while the Reading Panel's research focuses on comprehension skills among beginning readers (i.e., children), Pressley gives particular attention to metacognition among adults. The two skill sets are remarkably similar, implying that the only difference between monitoring comprehension as a child and as an adult is the level of sophistication with which one utilizes the strategies.

This sophistication, Pressley (2002) explains, is difficult to develop. In general, high school students and college readers rarely show much metacognitive maturity (Pressley and Afflerbach, 1995), as it is usually an ability found in older adults. Little is understood about how mature readers reach their metacognitive sophistication, and consequently researchers are unclear how to teach such sophistication to an average reader. Metacognitive maturity appears to be a naturally occurring process, although some metacognitive instruction certainly helps. In addition, a high level of reading fluency and an extensive array of background knowledge augment the process.

That said, Pressley's list is surprisingly simple. It comprises six major abilities: the ability to relate reading material to prior knowledge, to predict upcoming ideas, to ask questions, to construct images of ideas, to summarize reading and to recognize and re-read confusing parts.

In particular, Pressley's list echoes the research of Cooper (1997) who discovered that older readers need to use five strategies to improve reading comprehension: inferencing (making predictions, judgments and conclusions when reading), identifying major ideas, monitoring comprehension, summarizing content and asking questions.

Metacognitive Research: Implications for this study

The design of the Interactive Question Protocol utilizes several of the metacognitive strategies that have been outlined above. The three questions that the No Model Response group is asked to answer after each lesson element (see Appendix E) are specifically drawn from the research covered above. The questions require that students summarize the major points of their reading, relate those points to any pre existing knowledge, and ask questions about the material covered. These three strategies were chosen from the list generated by the literature simply because other activities (i.e., graphically represent the material, re-read confusing sections) did not produce an easily measurable outcome in an AOC environment.

Research Findings Conclusion

Before examining the implications of the above research for the treatment instrument in this study, a review of the research findings detailed above is in order. Feedback effects can be divided into two categories: external and internal processes. Of all the variables associated with feedback, four external variables are particularly relevant to this study.

The first external variable is that of feedback frequency. Large amounts of feedback are not necessary to sustain a feedback effect, especially after the early stages of the learning process are mastered. The second point is that students engaged in learning tasks with high complexity actually do benefit from high initial feedback frequency, at least until learner experience increases to the point that the task becomes less complex. Third is the observation that sometimes feedback can inhibit learning by triggering a meta-task process, by obfuscating task cohesion, and by interfering with a student's transfer task ability. Fourth is that research setting affects feedback findings, particularly when it influences the subject's incentive to learn.

One internal variable that is particularly relevant is the student's cognitive maturity. This factor supposes that students of different maturity levels process information in fundamentally different ways, therefore taking entirely different tacks towards receiving and processing feedback.

The purpose of this study is to investigate possible interactive effects between feedback and positions of cognitive maturity. Cognitive maturity is defined by Perry's framework of developmental positions, where an individual commonly moves from dualism to pre-legitimate multiplicity, to true multiplicity and finally to contextual relativism. An individual's position in this schema can be calculated by Moore's Learning Environment Preferences survey.

Implications for this study

Feedback Implications

The research findings discussed above raise interesting questions for the current study's research design. At what rate is feedback frequency too high? The answer to this question is not clear, but the high rate of feedback provided in this study, because of the complexity of the learning environment, is consistent with recommendations in the feedback literature.

How different students respond to the feedback is a key question in this study. Delivering the feedback impersonally through the computer hopefully decreases the possibility of inducing meta-task process distractions. Requiring the student to evaluate and reflect upon the feedback that is provided, a design feature that is unique among the studies encountered in the review of literature, is designed to encourage mindfulness among the students. Although this study is not intended to investigate feedback effects on transfer tasks, it is possible that the extra evaluative step in the treatment induces a higher level of understanding.

Student incentive, another key factor that has affected study outcome in the past, is not expected to be a problem. Given the real world setting of the study, and the direct impact that learning the material and evaluating the feedback has on the student's final grade, all participants are likely be sufficiently motivated.

Cognitive Development Implications

Perry's model of cognitive development has implications for this study. At an urban campus like Old Dominion University (ODU), with a large enrollment of non-

traditional students, one can expect a diversity of cognitive positions among the students in any given class.

This range of developmental positions has complex implications for any teacher, but especially for those involved in distance learning and web based learning (WBL), where the impersonal nature of the medium makes it all the more difficult to provide feedback to students. Having an accurate gauge of the average cognitive development of a class, especially one that does not meet in person, is therefore an important part of teaching successfully.

Though researchers such as Clariana (2000) acknowledge some students use different forms of feedback more effectively than others, no conclusive research seems to have been done on how different cognitive states respond differently to feedback types. Hopefully, the Interactive Question Protocol provides some insight in this regard.

By running basic projections from Perry's theory, one can informally hypothesize how different students might respond to the Parrot/Ferret program. There are two treatment groups: a Model Response group that receives the instructor's ideal answer, and a No-Model Response group that is guided through a metacognitive review of the material they just covered.

The Dualist student can be expected to be happy about the feedback treatment; immediately receiving the "correct" answer would presumably be helpful to such a student. She may also be the most likely to use the feedback as a crutch, avoiding mindful engagement with each question as she grows accustomed to the immediate answer that follows it.

The Multiplicity Pre-legitimate student may be pleased with the feedback treatment as well, perhaps taking more time to compare her answer with that of the instructor, but still hesitant to mark herself correct if the two disagree. Such students may enjoy the processing of comparing answers and therefore give greater thought to the material. They may prove to be the largest beneficiaries of the feedback.

A student in position four, or Multiplicity Legitimate, is presumably frustrated by the exercise. Being required to evaluate her answer against that of an authority figure is an annoying exercise to someone who believes that all opinions are valid and there is no wrong answer. She may even be inclined to ignore the feedback altogether, reacting in an almost opposite manner to the dualist student. Not having a voice to confront the opinions of the instructor could also frustrate a student who believes strongly in her own conclusions.

The Relativist student may also benefit greatly from the feedback, being the best able to process the more elaborate answers and the most appreciative of the exercise of evaluating both answers at once. She can be expected to be the most objective in marking her own answers, neither bowing to the instructor nor insisting stubbornly on her views. However, like fourth position students, she may also become frustrated with the process if she finds herself continually disagreeing with the professor, yet not able to voice that disagreement.

With these thoughts in mind, it is appropriate to now turn to the methodological details of the study, and review the exact questions that are being investigated.

CHAPTER THREE: METHODOLOGY

The purpose of this dissertation is to investigate how students of different cognitive maturities respond to the IQP. The following questions are examined.

Research Questions

Question One

The first question investigates the independent variable of model response. Do the model vs. no model answer groups vary in terms of their participation in the Parrot/Ferret exercise, their satisfaction with that exercise and their performance on unit and final exams?

Question Two

The focus of the second question is the independent variable of Perry group. Is there a difference between the student's Parrot/Ferret participation rates, exercise satisfaction reports and exam achievement levels for different CCI groupings?

Question Three

Is there an interactive effect between the CCI groupings and the treatment group?

The Course

The *Social and Cultural Foundations of American Education*, (or ECI 301) is Old Dominion University's (ODU) introductory education course. A sophomore or junior

level course, almost all education majors at ODU take the class, as well as current teachers who are seeking licensure.

As an introductory course the syllabus covers fundamental concepts relating to American education. Students are introduced to a basic history and philosophy of education, as well as an overview of current standard practices and major reform movements. A central theme of the course is that teachers must play a vital role in preparing their students for a fast changing world.

Although a real-time section is available for traditional students, it enrolls fewer students than the online version. Since its first uncapped offering in the Spring of 1998, the online sections of ECI 301 have consistently grown and now enroll approximately one and a half times more students than the traditional section.

The participants in this study were drawn from the ECI 301 online class. The class' content was delivered entirely online, with the exception of three meetings that were televised through Teletechnet, ODU's satellite television distance learning network. The first of these three meetings was an orientation session in which the course medium and assignments were introduced. The second was an optional midterm tech support meeting (that was offered in support of students with persistent technical difficulties or other support questions) and the third was a proctored final exam.

The main course delivery was done asynchronously online, and consisted of more than 20 lectures that are divided into basic "lesson elements." A lesson element is the fundamental building block of the course, each one containing a key concept for the student to master. At the end of each lesson element, the student was required to answer a

review question (or a Parrot) and an application question (or a Ferret). For an illustration of what this process involves, turn to Appendix E.

Students in the course take a unit exam every two weeks, with each exam covering approximately four "lectures" of material, where each lecture asks about seven Parrot/Ferret questions. Exams are taken online, and consist of approximately 20 multiple-choice questions and two short answer questions. For course security purposes, all unit exams are randomized so no two students are likely to get the same exam. This procedure was only followed for the multiple-choice questions -- all students receive the same short answer questions.

Participants

Participants in the study were the approximately 100 students that complete ECI 301 each semester. These students involve a mixture of traditional and non-traditional on-campus students, and traditional and non-traditional distance learning students. They vary greatly in their personal circumstances and even in their reasons for taking the class. Both the ODU teaching degree and Virginia's State Teacher Certification require the class, so students enroll both as traditional undergraduate students and as working professionals trying to upgrade their credentials.

As mentioned previously, the students are best characterized by their self-selection to enroll in an online version of this class, though their reasons for doing so may vary. The two most common explanations offered by students is that they are unable to attend regular class hours due to their schedule, or they are unable to attend class on ODU's main campus due to its distance from their place of residence.

Treatment

Students were administered the LEP to ascertain their Perry position. Once a cognitive complexity index (CCI) score was calculated for each student, they were randomly assigned to one of two treatment groups: the Model Response group or the No-Model Response group.

All students completed the course ECI 301 and all associated assignments. This task included the interactive Parrot and Ferret questions at the end of each lesson element. The only difference between the two groups was the feedback they received after they answer each interactive Parrot and Ferret question.

Participants from the Model Response group were, upon submitting their answers to each question, given the instructor's ideal answer. The two answers, the student's and the instructor's, plus the original question were posted alongside each other for easy comparison (see Appendix E for an illustration). The student was then required to answer the following three evaluation questions:

Question One: If you included any inaccurate information in your answer, please state why it is inaccurate.

Question Two: Please retype your answer to make it more complete and accurate.

Question Three: What aspects of Dr. Allen's answer would you like to see clarified?

They were then asked to score their level of understanding using a provided rubric (Appendix E). Levels of scoring include "advanced," "proficient" and "in need of improvement." Finally, they completed the following statement using a four-part Likert scale of strongly agree, agree, disagree and strongly disagree: "Now that I have completed this process, my understanding of this material has improved..."

The No- Model Response group participated in a similar process that differs on two counts. They were not provided with an answer from the instructor (i.e., they get no feedback) and they were asked the three different questions below:

Question One: Summarize the major points of what you just read.

Question Two: Have you had any personal experience with the material you just read? Describe the experience and how it relates to the reading.

Question Three: What questions do you now have about what you just read?

The metacognitive prompt questions were intended to focus attention back on the reading that has just been completed. The questions given to the model response group were designed to be similar to those given the no model response group so as to ensure the two treatments were as analogous as possible in process and in workload. The only difference, therefore, was that one set of questions focuses on the reading content, and the other focused on the instructor's feedback.

Measures

The data collected came from five major sources, four providing a different perspective on the students' Parrot / Ferret experience and one calculating their Cognitive Complexity Index (CCI) score. The first source was a catalogue of the total number of each students' original answers to each Parrot / Ferret – in essence a participation score for completing the exercise. The second was the students' achievement scores from each unit exam. Third was their final exam score. The fourth source was an end of semester survey on student attitudes towards the Parrot/Ferret program (Appendix F). Finally, a CCI score was calculated from each student's completed LEP.

Census data was collected in the form of student GPA (calculated from the semester previous to enrollment in the class). This data could not be used as a measure of prior achievement, as the ODU records could provide an adequate sample size.

Analysis

Question One

Do the model vs. no model groups vary in terms of their participation in the Parrot/Ferret exercise, their satisfaction with that exercise and their performance on unit and final exams?

Question Two

Is there a difference between the student's Parrot/Ferret participation rates, exercise satisfaction reports and exam achievement levels for different CCI groupings?

Question Three

Is there an interactive effect between the CCI groupings and the treatment group?

Limitations

All three research questions were answered with one statistical test: a 4 (Perry Positions) X 2 (model / no model response groups) X 3 (dependent measures) MANOVA. The dependent variables are student exam scores, Parrot/Ferret participation score and Parrot/Ferret satisfaction score.

The two way MANOVA disclosed both the main effect of the treatment, and any interactive effects that existed between the treatment and the Perry positions. Wilk's

lambda was then used as a criterion of multivariate significance to see if the set of

dependent variable means vary as a function of an interaction with the main effect.

CHAPTER FOUR: DATA ANALYSIS

In short, the three questions for statistical analysis can be summarized as follows: do the subjects differ in their experience/usage of the protocol according to the feedback treatment or according to their Perry grouping, and is there any interactive effect between these two variables?

Data Preparation

The data needed to answer these questions was acquired through various means outlined below, and most of it can be processed in its current form. An exception must be made, however, for the satisfaction survey data. Student satisfaction was measured by a satisfaction survey, consisting of seven items, as shown in Appendix F. The survey data must therefore be refined through factor analysis to distill a representative satisfaction score for each student.

Student Satisfaction Factor Analysis

The student survey was completed after students had finished their final exam. Completion of the survey earned subjects participation marks. A total sample size of 92 surveys was gathered. Questions about different aspects of satisfaction were posed against a four point scale with choice options spanning 'quite a lot,' 'a considerable amount,' 'a small amount' and 'not at all.' The survey comprised seven questions, with each question designed to discern a unique measure of satisfaction. The analysis correlation matrix revealed the following: the survey includes appropriate questions and

none of the items need to be dropped, questions correlate well with each other but do not cause a problem of multicolinearity; and only one variable (question seven) has a majority of significant correlations at >0.05. No variables have correlation coefficients greater than 0.9. The KMO value of 0.843 further confirms that a factorial analysis is appropriate. The anti image correlation matrix revealed large cross diagonal elements (the smallest was 0.625) and Barlettes test of sphericity was significant ($p<0.001$).

The analysis extracted only one factor, as only one eigenvalue exceeded the extraction level of one (3.456). Although, a second variable could perhaps have been justified by the score of 0.984, an examination of the point of inflection in the scree plot (see figure below) demonstrates that a one factor solution best fits the data. Further the extraction level of one is conventional for datasets of less than 30 variables, and the amount of variance explained by the one factor solution, given its eigenvalue of 3.456, is quite high. The disparate values between factors would indicate that a second factor solution would be tenuous.
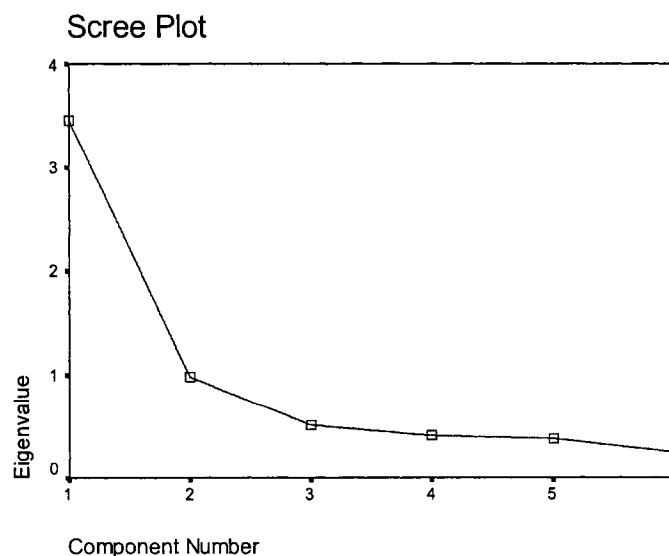
Figure 2. Satisfaction Factor Analysis Scree plot

Using the one factor solution recommended by the statistical procedure above, a factor score representing subject satisfaction was produced. This satisfaction index was included in the dataset, and used in subsequent calculations.

Question One Analyzed

The first research question is: do the model vs. no model groups vary in terms of their participation in the Parrot/Ferret exercise, their satisfaction with that exercise and their performance on unit and final exams? A review of the data sources for scores on student participation, satisfaction and achievement are in order.

Types of Data

This study gathered data on four dependent variables: participation, satisfaction, unit exam achievement and final exam achievement.

Participation Data

The Parrot / Ferret Protocol was designed as a web-accessible embedded database integrated with the online course readings. Students logged into the database upon answering their first question in a session (in the asynchronous environment, a session is defined by the student's schedule and the cookie retention settings of her browser), and moved seamlessly between servers as they toggled between Parrot questions, Ferret questions and course readings for the duration of their session. All Parrot and Ferret interactions, therefore, were logged and recorded in the database participation index. Each question answered was granted a mark. Maximum participation scores were

determined by the finite number of Parrot and Ferret questions available, which totaled

394. In the dataset, participation scores ranged from 150 to 394. See Figure 3 for group

average index scores.

Satisfaction Data

Student satisfaction was measured using a post assessment survey that queried

subject's experience with different aspects of the Parrot Ferret exercise (see Appendix F).

A factor analysis was run on the data, transforming survey scores into a representative

satisfaction index. See the previous section for details on these data.
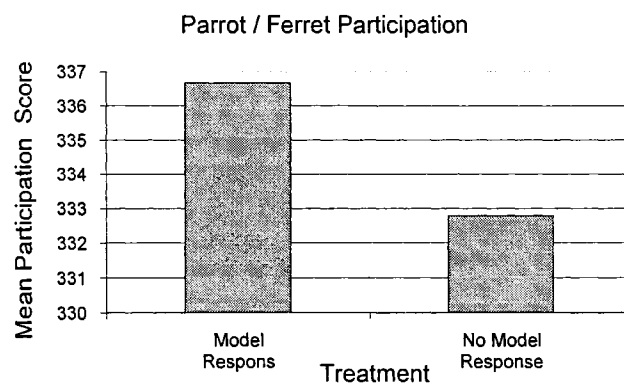
Figure 3. Subject participation.
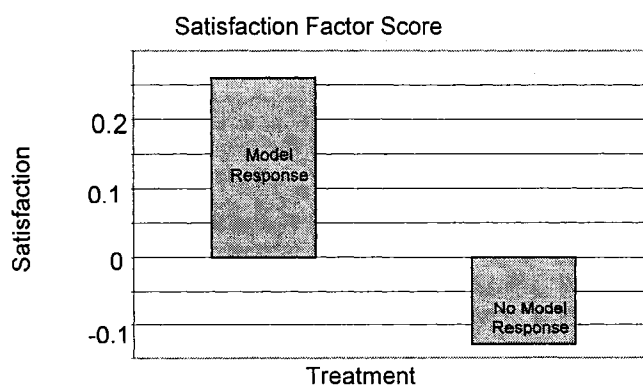
Figure 4. Subject satisfaction.

Achievement

     Students completed both unit and final exams. Testing formats varied greatly between the two exams.

Unit exams.

     Subjects were required to complete six unit exams over the duration of the course, one of which was designed for practice, five of which were counted towards their course grade. Exams were available online and taken on the honor system. They were timed, with subjects required to complete the exam within 30 minutes. In keeping with the restrictions of an asynchronous environment the assessment design required, to minimize dishonest practice, that each exam be randomly generated from a database of questions. This ensured that each exam would be unique, and thus helped minimize cheating.

     All questions were multiple choice, and exam scores were returned in immediate real-time, along with the correct solutions to problems answered incorrectly. Table 1 below demonstrates the trend of unit exam achievement between the two groups, while the graphs below highlight the exact group achievement gaps on each unit exam.

Final exam.

     Subjects completed a traditional multiple choice paper-based test at the end of the course. All subjects completed the same instrument. The test covered the same material quizzed on the unit exams, but was administered in a proctored environment. Subjects were informed that large deviations (greater than a letter grade) between final exam scores and unit exam averages would be considered suspect, and those who did

suspiciously better on the unit exams would be required to retake them under proctored conditions. Subjects gathered in teletechnet centers for the final exam administration. Final exams were graded by Hughes Hall computer services, and grades were later posted on a secure access website.

Data Analysis

The four dependent variables listed above (subject participation, subject satisfaction, unit exam achievement and final exam achievement) were contrasted with two independent variables (feedback treatment and a cognitive complexity measure). Both of these independent measures were explained in chapter three.

Table 1

Average Achievement By Treatment Group Disaggregated By Exam

Exam	Group [a]	n	Mean	Std. Deviation
Unit 2	1	43	74.81	11.042
	2	45	71.18	12.055
Unit 3	1	43	76.49	11.620
	2	45	75.27	13.436
Unit 4	1	43	81.23	10.589
	2	45	82.87	10.159
Unit 5	1	43	84.05	11.195
	2	45	78.09	12.053
Unit 6	1	43	73.72	11.232
	2	45	73.62	12.333
Final Exam	1	43	401.05	38.166
	2	45	403.78	47.842

[a] Group 1=model response, Group 2=no model response

Final Exam score
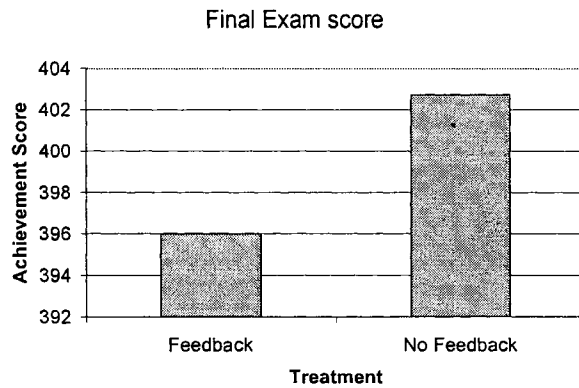
Figure 5. Average final exam achievement by treatment group.

The first research question can best be answered by conducting a MANOVA. This approach is preferable to conducting several ANOVAs because it does not risk inflating the familywise error rate, and it allows for the investigation of correlations between the dependent variables.

The MANOVA sample size equals 88, with groups divided somewhat unequally between Treatment A (n=43), the feedback intervention group, and Treatment B (n=45) the no model response group. Box's test (p=0.063) indicated that the assumption of equality of covariance holds between the two groups, and that the null hypothesis of homogeneity is tenable.

Of the six unit exam scores, the first was dropped due to low participation. Subjects were not required to complete the exam, as it was only a practice test that exposed them to the novel exam format. Assumedly, this caused lower participation rates to the extent that no useful sample could be drawn. Participation was much higher, however, on the remaining five Unit Exam dependent variable measures.

All dependent variables were tested with Levene's test for equality of variance as it is an assumption of a MANOVA. Differences were insignificant, allowing the

assumption to stand. In short, there was no difference in participation or satisfaction measures.

There does appear to be a difference between the two groups, with the treatment group reporting significant on several different multivariate tests. Oddly, all four tests (Pillai's trace, Wilk's Lambda, Hotellings Trace and Roy's Largest Root) reported the same significance level ($p=0.045$). Given the inequality of groups, it is inadvisable to attach importance to Pillai's and Hotelling's tests, but it is worth noting that they confirmed the findings of the other tests.

To investigate which dependent variables were causing the difference between the treatment groups, ANOVAs were run on all variables. They all reported non significant, with the exception of Unit Exam five ($p=0.019$).

The significance of unit exam five is odd, as it is essentially a single assessment in a time series achievement measure that goes uncorroborated by preceding or subsequent inquiries. Presumably, if the groups did indeed differ in their achievement, group differences should be discernable in other achievement trials such as other unit exam scores or the final exam score. The fact that no such differences exist implies that the statistically significant difference between the groups in unit exam five is simply a chance variation.

It is possible that the subject matter taught in unit five, namely school administration, lends itself more easily to comprehension through feedback. The review of the literature on feedback research indicates that feedback is most frequently manipulated according to its mode and frequency. Its effectiveness is generally studied according to these variations, not according to the type of information that is being

taught. If it is plausible that some types of subject matter are learned better with feedback than others, then future studies need to be contrived to vary the information type as well as the feedback mode and frequency. It is more likely, however, that the significant difference reported between the groups in unit exam five is a statistical fluke.

In short, there is no difference between the two feedback treatment groups in terms of their participation in the Parrot/Ferret exercise, their satisfaction with that exercise and their performance on unit and final exams. Receiving feedback did not significantly increase students' participation in the Parrot / Ferret exercise, nor did it increase their satisfaction with that exercise or their achievement in the class.

Question Two Analyzed

The second research question asks "Is there a difference between the Parrot/Ferret participation rates, exercise satisfaction reports and student exam achievement levels for different Perry groupings?"

Perry Groupings

Cognitive Complexity Index (CCI) scores measure the mental maturity of subjects according to Perry's model. They were derived from the LEP instrument administered to students at the beginning of the semester. They span a range from 200 to 500, and can be segregated into four major positions of mental maturity. It should be stressed that these positions are not correlated, as the model dictates, to intelligence. Instead they are an attempt to measure the way subjects process the learning they glean from the world around them.

A subject's CCI score is a composite comprised of residual position scores, each of which in turn represents a percentage of position inclination. One subject in the study has a total CCI score of 310, and position scores of 40, 27, 17 and 17 in positions two through four respectively. Since this subject scores highest in position two, she is clearly in the Dualism stage.

However, assessing a subject's position is not simply a matter of deferring to her highest position score. People grow organically through their own maturing perception frameworks, meaning that they are often in transition between positions. And their transitions may not be linear – it is common that students leap over positions as they mature (C. Lovell, personal communication, February 14, 2005 and B. Moore, personal communication, February 18, 2005).

Another subject in the study with a CCI score of 357 has the residual scores of 20, 33, 17 and 30 in positions two through four respectively (Figure 6). This subject may at first appear to be in position three (Early Multiplicity) with a score of 33. But closer examination reveals a comparable position five score (Contextual Relativism) at 30. The small spread of three points suggests that the subject is in a state of transition, and can perhaps best be described as position three moving five.

Accounting for subjects in transition is challenging because there are so many possible transitional score combinations that a remarkably large sample size is necessary to ensure the adequate representation of each possible grouping. This study therefore only focuses on clear cut cases where subjects are firmly lodged in a particular position. As the general significance standard for social science research is set at 5%, this same standards

applied to this study. High position scores that stood at or beyond 5% of their fellow

constituents were designated as distinct positions. Subjects in transition, though

interesting cases, were discarded as their sample sizes were insufficiently large to be

representative.

	CCI	Position 2	Position 3	Position 4	Position 5
Subject	357	20	33	17	30
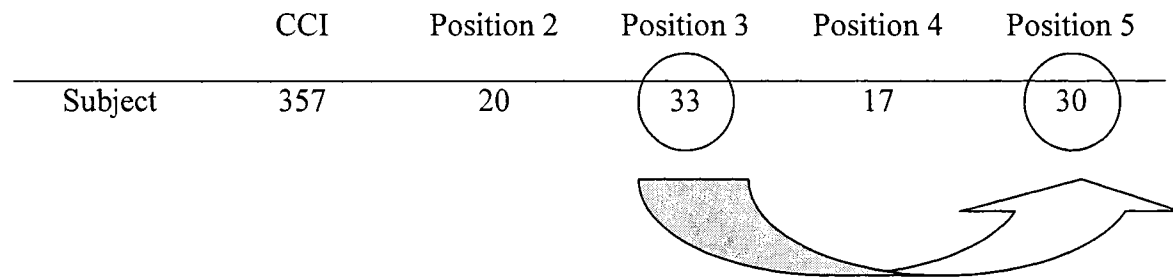
Figure 6. Perry Position Scores of a Subject in Transition

Participation, Satisfaction and Achievement

The variables investigated in this question are largely the same as those delved in

question one.

Results

The MANOVA reported the following findings. The sample size was 52, divided

into unequal groups as seen in Table 4. This produced an unbalanced design.

Table 2

Perry Position Group Membership

Position	n
2	18
3	15
4	8
5	11

It should be noted that the sample size of positions four and five were too small to be useful. A large number of transitional cases diluted the sample, leaving only enough cases to compare positions two and three.

Box's Test of the Equality of Covariance was insignificant (p=0.783). This means that the null hypothesis is tenable, that there is equality of covariance, and that there are no concerns with the data.

The Multivariate Tests was insignificant. Given the unbalanced nature of the design, tests such as Pillai's Trace are inappropriate to consider, but even the most powerful in Roy's Largest Root reported non significant at p=0.056. The guiding multivariate in this study is Wilk's Lambda, which reports a non significant p=0.207.

The implication of this finding is a confirmation of the null hypothesis in that there is no difference between the groups. Subjects that were categorized according to the LEP into Perry Positions denoting different levels of mental maturity did not perform, in a statistically significant way, any differently from each other on the variables of unit exam achievement, final exam achievement, interactive question participation or satisfaction.

Question Three Analyzed

The third research question is "Is there an interactive effect between the Perry groupings and the treatment group?" To answer this question, a between groups related factorial ANOVA was conducted for each dependent variable, looking specifically at interactions between the independent variables. The findings for each dependent variable pairing are reported below.

Final Exam Score Interactions

Possible interactions between Perry Position and treatment groups around final exam achievement were investigated with an ANOVA that ran with an unbalanced design of N=52. The assumption of homogeneity of variance holds as Levene's Test is insignificant at p=0.448. There is no significant interaction as the ANOVA reports (F_3, $_{44}$=0.532, p=0.663).

Final Exam Achievement
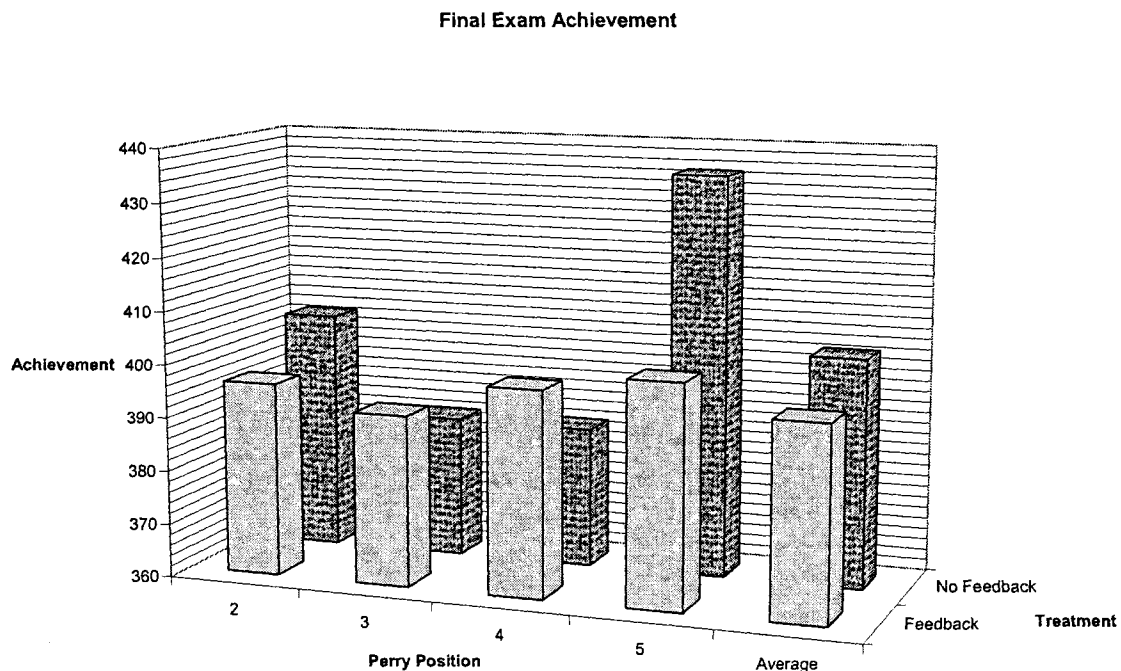
Figure 7. Achievement scores differentiated according to independent variable.

As can be noted from the Figure 7 the model response group did not consistently score higher on the final exam than the no model response group. Those who were in positions three and four generally did better than their non feedback counterparts, but those in positions two and five did worse. Details can be seen in Figures 8 and 9.

Final Exam score
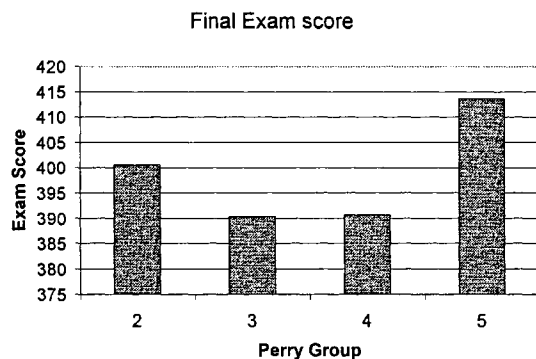
Figure 8. Achievement scores of Perry Groups.

Final Exam score
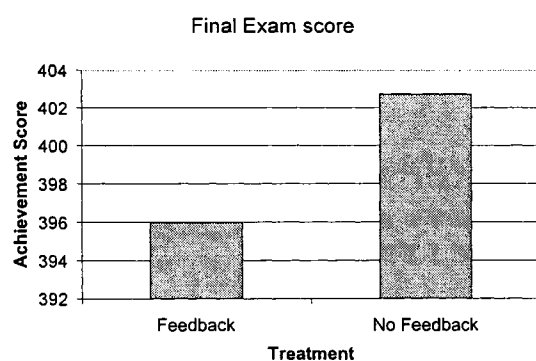
Figure 9. Achievement scores of Treatment Groups

Participation Interactions

Possible interactions between Perry Position and treatment groups around the interactive question protocol (IQP) participation were investigated with an ANOVA that ran with an unbalanced design of N=52. The assumption of homogeneity of variance holds as Levene's Test reports insignificant at p=0.938. Despite the higher participation rates among the model response group, the ANOVA differences are not significant ($F_{3, 45}$=0.006, p=0.999).
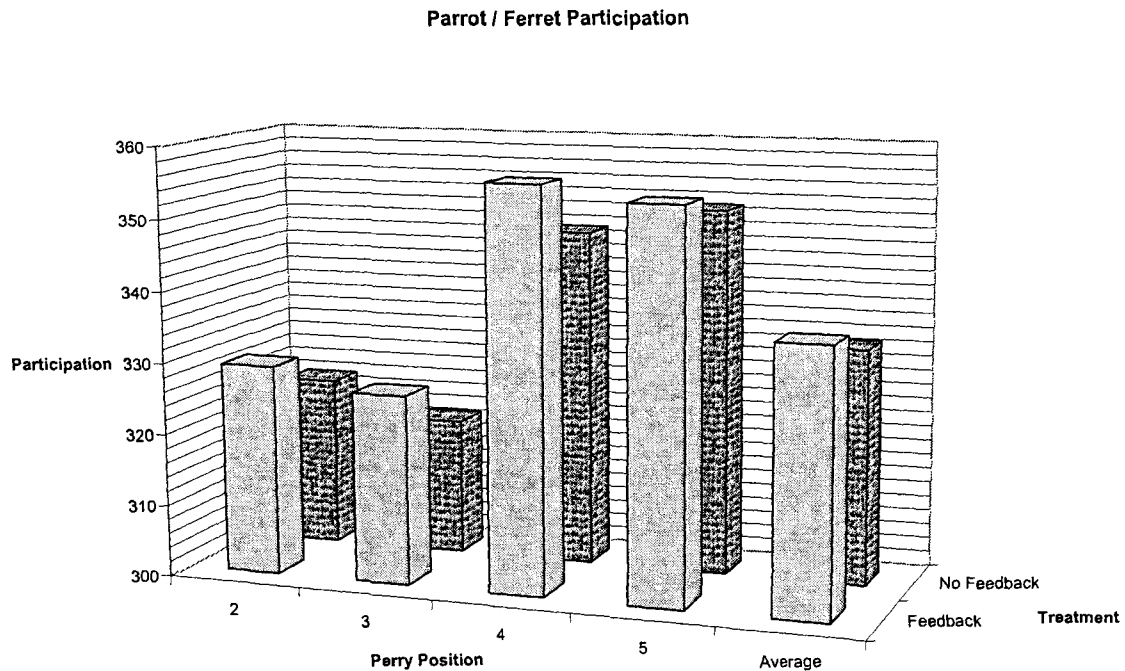
Figure 10. Participation scores differentiated according to independent variable.

As can be noted from Figure 10 subjects in the model response group participated more than their non feedback counterparts in all four Perry groupings. However, this difference was insignificant.

Satisfaction Index Interactions

Possible interactions between Perry Position and treatment groups around IQP satisfaction were investigated with an ANOVA that ran with an unbalanced design of N=52. The assumption of homogeneity of variance holds as Levene's Test reports insignificant at p=0.308. Despite the cursory trend that the model response group was

more satisfied, there is no significant interaction as the ANOVA reports ($F_{3, 44}$=2.156,

p=0.107).
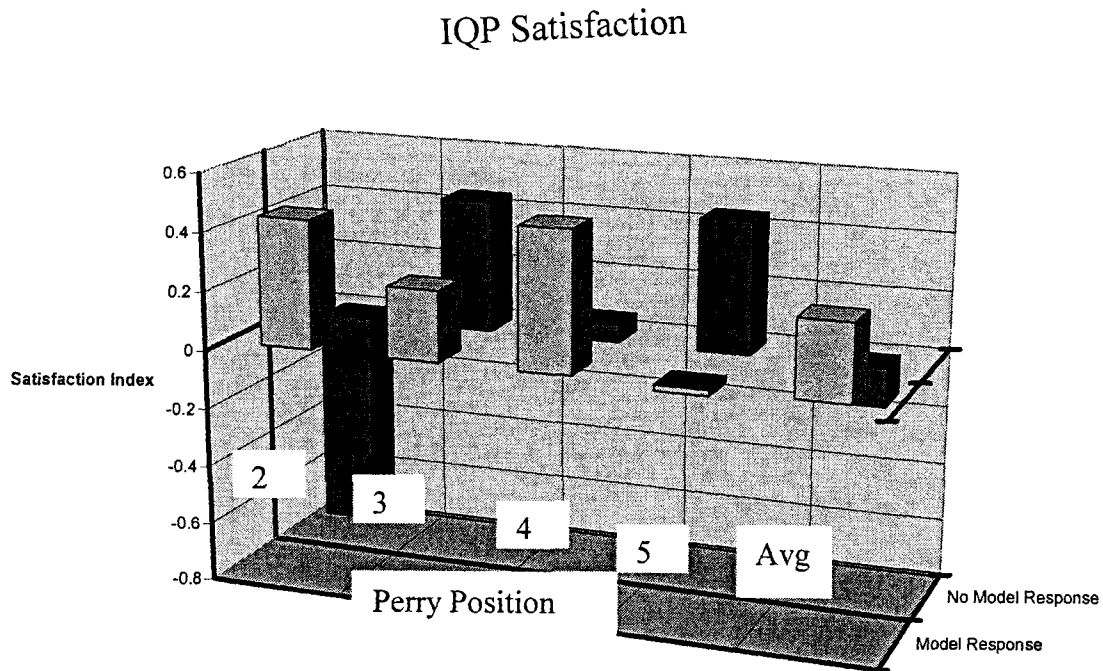
IQP Satisfaction

Figure 11. Satisfaction scores differentiated according to the independent variables.

Figure 11 indicates that those who got feedback were generally more satisfied with the Parrot Ferret exercise than those who did not. However, this difference was not significant. It is also interesting to note that as the model predicts, the Position two subjects who did not get feedback were strongly dissatisfied with the exercise.

Achievement Interactions

Unit Exam Two Interactions

Possible interactions between Perry Position and treatment groups around

unit exam two achievement were investigated with an ANOVA that ran with an

unbalanced design of N=55. The assumption of homogeneity of variance holds as

Levene's Test reports insignificant at p=0.745. However, there is no significant

interaction as the ANOVA reports ($F_{3, 47}$=0.725, p=0.542). With the exception of those

in Position five, the model response group did better on Unit Exam Two.

Unit 2 Exam Achievement
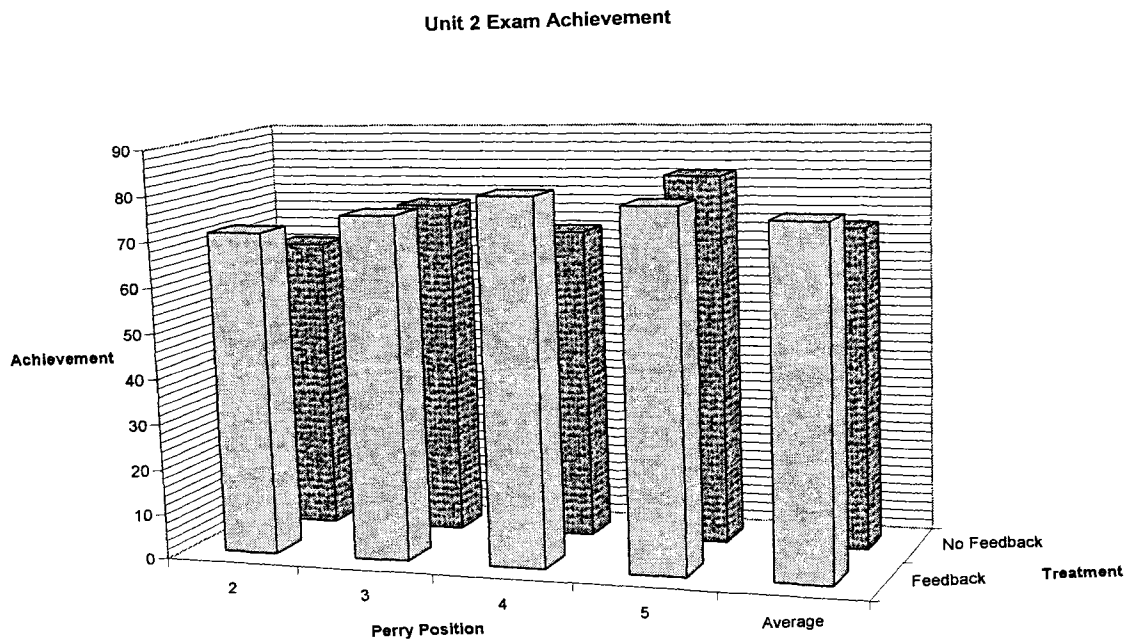
Figure 12. UE2 achievement scores differentiated according to the independent variables.

Unit Exam 3 Interactions

        Possible interactions between Perry Position and treatment groups around

unit exam three achievement were investigated with an ANOVA that ran with an

unbalanced design of N=53. The assumption of homogeneity of variance holds as

Levene's Test reports insignificant at p=0.464. There is no significant interaction as the

ANOVA reports ($F_{3, 45}$ =0.893, p=0.452). Figure 13 indicates that the two groups

achieve comparable results on Unit Exam 3.

Unit 3 Exam Achievement
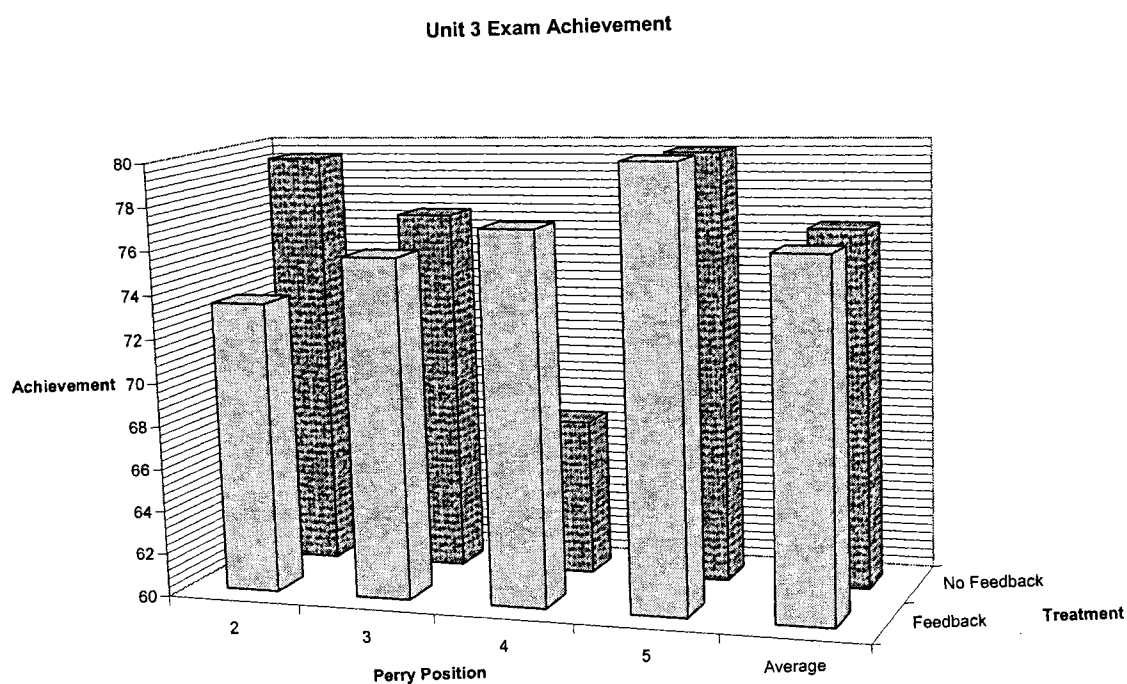
Figure 13. UE3 achievement scores differentiated according to the independent variables

Unit Exam Four Interactions

        Possible interactions between Perry Position and treatment groups around unit

exam four achievement were investigated with an ANOVA that ran with an unbalanced

design of N=52. The assumption of homogeneity of variance holds as Levene's Test

reports insignificant at p=0.885. There is no significant interaction as the ANOVA reports

($F_{3, 44}$=1.721, p=0.177). In Unit Exam four, the no model response group out performed

the model response group with the exception of the subjects in Perry Position four (see

Figure 14). Differences were not significant.

Unit 4 Exam Achievement
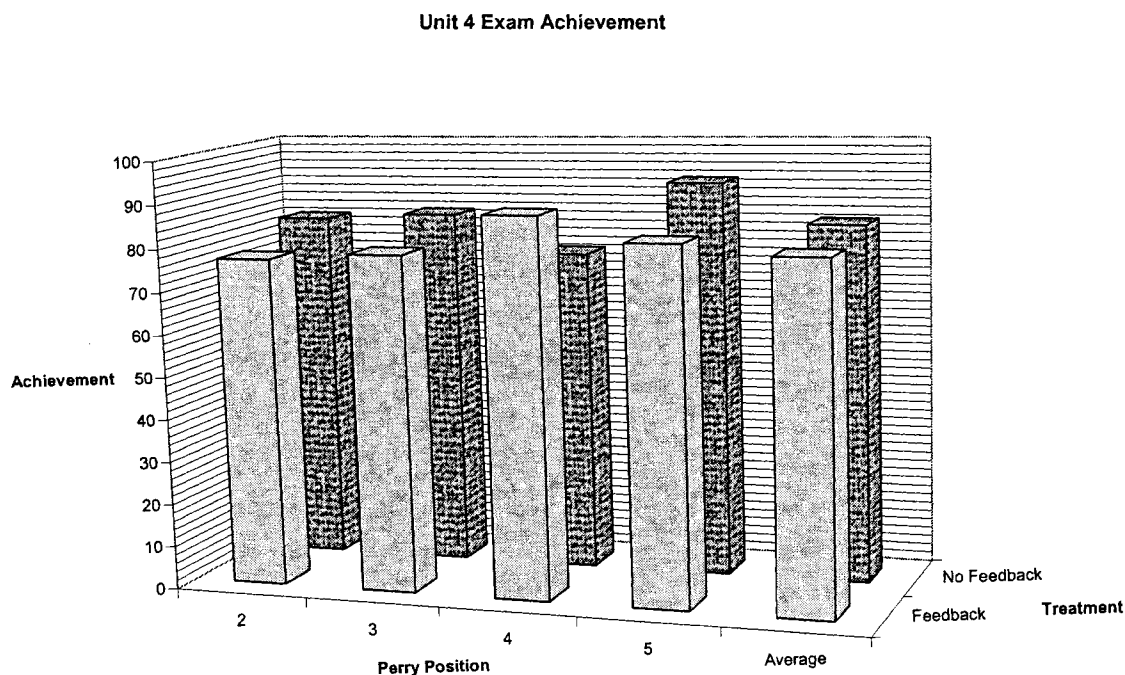
Figure 14. UE4 achievement scores differentiated according to the independent variables.

Unit Exam Five Interactions

Possible interactions between Perry Position and treatment groups around

unit exam five achievement were investigated with an ANOVA that ran with an

unbalanced design of N=52. The assumption of homogeneity of variance holds as

Levene's Test reports insignificant at p=0.128. There is significant interaction as the

ANOVA reports ($F_{3, 44}$=2.993, p=0.041). However, as discussed earlier, this finding is

most likely explained as an anomaly. In Unit Exam five, the model response group only

slightly out performed the no model response group as seen in Figure 15.

Unit 5 Exam Achievement
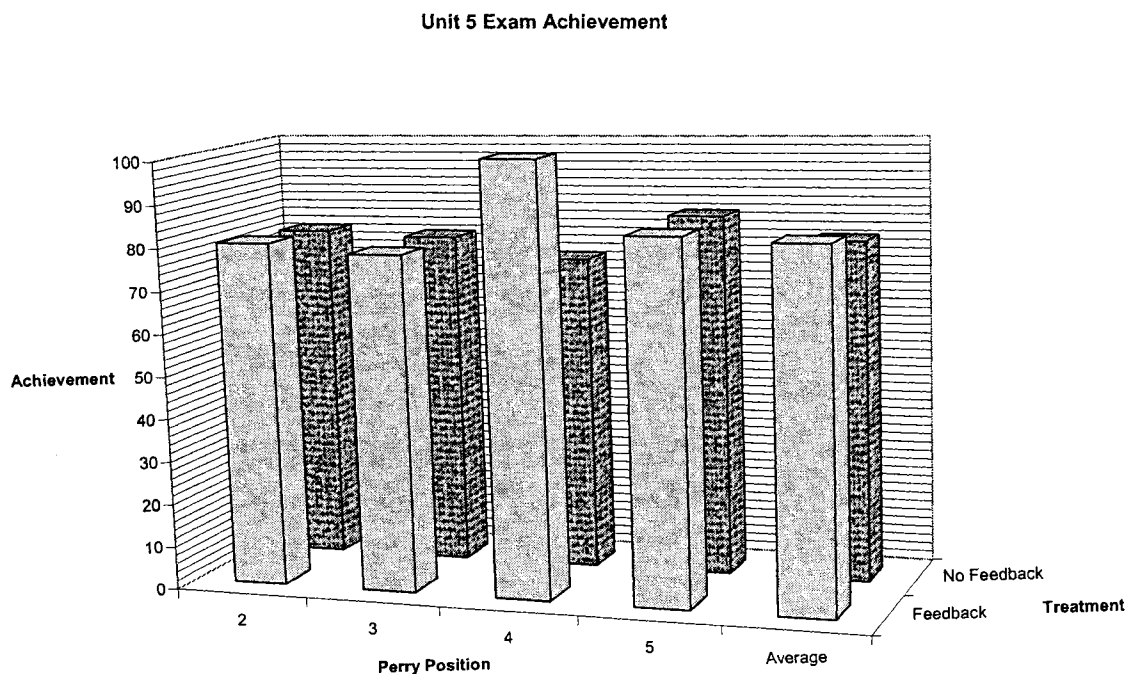
Figure 15. UE5 achievement scores differentiated according to the independent variables.

It is also difficult to assign importance to this finding because of the small sample

size of the Position four sample (n=8). However, given its implications it may be worth

further research. As mentioned above, this finding may suggest that feedback is more

effective in certain subject areas than others – hence the more effective feedback in unit

exam five than in other exams. But this ANOVA indicates that the achievement gains of

the model response group are limited to those in position four. Perhaps position four

students in particular benefit from feedback-conducive subjects.

Unit Exam Six Interactions

Possible interactions between Perry Position and treatment groups around unit

exam six achievement were investigated with an ANOVA that ran with an unbalanced

design of N=52. The assumption of homogeneity of variance holds as Levene's Test

reports insignificant at p=0.236. There is no significant interaction as the ANOVA reports

$(F_{3,\ 44}$=0.429, p=0.733).

Unit 6 Exam Achievement
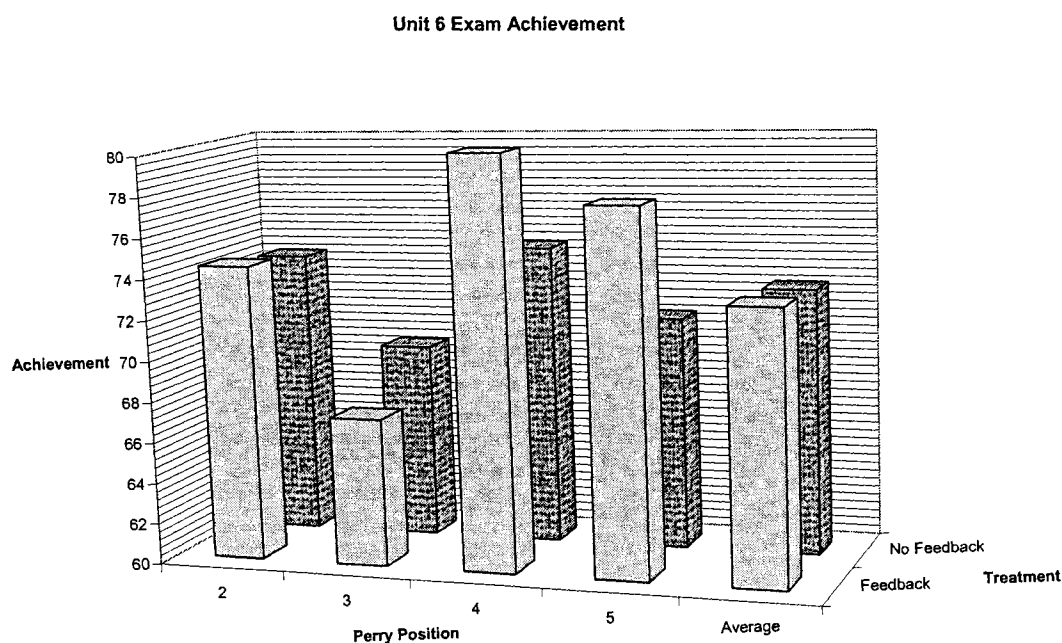
Figure 16. UE6 achievement scores differentiated according to the independent variables.

Figure 16 indicates that in Unit Exam six both the feedback and the no model

response group performed at approximately equal levels. Figure 17 further illustrate this

finding.

Final Exam score   Final Exam score
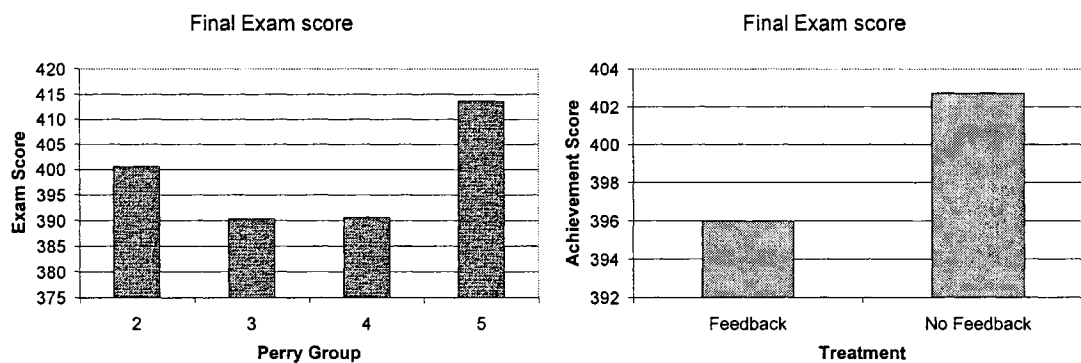
Figure 17. UE6 achievement scores contrasted within IVs.

Conclusion

When seeking to answer question one, an anomalous level of significance was discovered between the feedback treatment achievement scores of unit exam five. Although students who received feedback did indeed outperform their counterparts, the fact that they did so only once out of five unit measures, and were unable to repeat their success during the final exam, indicates that any treatment effect detected is at best inconsistent and most likely spurious.

Therefore, it is safe to report that no significant difference was found between the treatment groups with regards to achievement, satisfaction or participation. The treatment intervention had no effect.

On the same dependent measures there was no significant difference found between the students when categorized into Perry groups. Mental maturity did not contribute to higher or lower rates of achievement, satisfaction or participation.

Finally, only one interaction effect was detected. This effect was suspect as it revolved around the same unit exam five that showed unusual significance in question one. Compounding this unlikely finding is the fact that the greatest achievement gap

came from Perry Group four which is under represented with only eight members. It appears wisest to disregard this finding. However, it can be investigated in further research.

Question 3 is concluded with the answer that there was no interactive effect between the independent variables of feedback treatment and mental maturity, and the dependent variable combinations of achievement, participation and satisfaction.

CHAPTER FIVE: CONCLUSIONS

Topic Relevance

Importance of Distance Learning in Education

Distance learners comprise a large percentage of many university's enrollment, a percentage that has only increased since the development of web tools and the wide adoption of the as a delivery platform. Not only does web based learning (WBL) increase a university's income stream by broadening its access to a wider base of learners, it also meets the learning needs of many of today's disenfranchised and non-traditional students.

Importance of Feedback in Education

The human brain has an incredible ability to perceive and process feedback, and this feedback is the key to our ability to learn (Jensen, 2000). Feedback is such a key component of education that extensive research has been done in the field (Kluger and DeNisi, 1996). This research is inconclusive, however, and often discovers contradictory things. For example, large amounts of feedback have been discovered to improve comprehension (Chhokar and Wallin, 1984), but it has also been shown to have no impact on comprehension (Leivo, 2001 and Alavosius and Sulzer-Azaroff, 1990) and even to actually hinder comprehension by complicating the learning exercise (Ilgen, Fisher and Taylor, 1979; Carroll and Kay, 1988; Winstein and Schmidt, 1989; Kulger and DeNisi, 1996; Schroth, 1997 and Wulf, McConnel, Gartner and Schwarz, 2002).

An important factor in the contradictory findings of studies seems to be the study setting. Contrived studies necessarily manipulate such vital factors as student motivation

and feedback timing in ways that are different from real world investigations. This may explain why the two research settings consistently deliver different results (Kulik and Kulik, 1988). On two principles there is agreement, however: frequent feedback improves learning (Bransford, 2000, p. 78) particularly during complex tasks (Rudd, 1986; Wulf, Shea and Matschine, 1998), and student motivation in real world settings is crucial to the effective interpretation of feedback (Morrison, 1995; Salomon and Globerson, 1987).

The Importance of Cognitive Complexity in Learning

Motivated by the similar works of Piaget (1965) and Loevinger (1966) before him, Perry (1981) set out to map the transitional phases of cognitive development in adulthood. Although his full theory involved nine discrete states, only four are commonly found in the population at large. These four, in increasing order of cognitive complexity, are dualism, multiplicity pre-legitimate, multiplicity legitimate and contextual relativism. People progress through them at different paces, and during different times of their lives. They are of particular interest to institutions of higher education, however, because in theory it is the task of universities to direct their learners through these positions until they (hopefully) reach the most mature mental state.

Moore (1989) developed an instrument to assess a subject's Perry position, called the Learning Environment Preferences survey. This survey was used in this study to locate each subject's mental maturity position, which provided an independent variable to contrast with the feedback treatment intervention.

Urban Relevance

Old Dominion University is an urban school that serves a population with a large contingent of non traditional students. The mixture of various student characteristics such as ethnicity, socio economic backgrounds, age and professional experience define a heterogeneous population of urban, non traditional students that benefit from the flexibility of WBL and asynchronous online courses (AOCs). By examining attempts at improving the distance educational services offered by advances in the field of instructional technology, this dissertation offers insight into meeting the ongoing needs of the broader urban population: access to education with minimal complications added to the constraints of a busy metropolitan life. This dissertation addresses an urban problem because it seeks to improve the educational services offered to today's metropolitan students in all their diverse forms.

Purpose of Dissertation

The purpose of this dissertation is to investigate the relationship between simulated feedback, cognitive maturity, participation, achievement and satisfaction. The study was conducted in a real world AOC of non-traditional and urban distance learners provided by those enrolled in Old Dominion University's (ODU) course ECI 301. It seeks to find if learning criteria such as achievement, participation and satisfaction can be improved through providing feedback, and if so, if students benefit from it more or less according to their level of cognitive maturity.

Review of Questions

This dissertation investigates three research questions. While the first examined the relationship between the dependent variables (achievement, satisfaction and participation) and the feedback treatment intervention, the second investigated the relationship between the dependent variables and student's cognitive maturity level. The third question investigated possible interactive effects between the two independent variables. They are repeated below.

Question number one.

Do the model vs. no model groups vary in terms of their participation in the Parrot/Ferret exercise, their satisfaction with that exercise and their performance on unit and final exams?

Question number two.

Is there a difference between the Parrot/Ferret participation rates, exercise satisfaction reports and student exam achievement levels for different Cognitive Complexity Index (CCI) positions?

Question number three.

Is there an interactive effect between the CCI positions and the treatment group?

Question Number One Reviewed

The first question investigates the performance of the feedback-receiving

treatment group on the measures of achievement, participation and satisfaction and

contrasts them with the same measures taken from the control group, which did not

receive feedback. The findings are outlined below.

Findings in Brief

The model response group (*n*=43) achieved an average unit exam score of 78.87

and an average final exam score of 401.05. The control group's (*n*=45) achievement

scores on the same measures were similar at 77.46 and 403.78. In purely numerical terms,

the model response group outperformed the control group in unit exam achievement,

exercise participation and exercise satisfaction, but not in final exam participation.

However, none of these differences are significant, so it can not be said that the model

response group achieved more than the no model response group.

On the participation measure, the model response group completed an interactive

question protocol (IQP) average of 334.37, while the non-feedback group completed an

average of 331.33. These numbers are similar enough to be non-significant, so it can be

reported that the treatment group did not participate to a greater extent that the control

group.

As measured by the satisfaction survey, the model response group scored a

slightly satisfied index of -0.07, which is statistically similar to the slight dissatisfied

control score of 0.11. It can be concluded therefore, given the non-significant difference

between the numbers, that the group were equally satisfied.

Analysis

Literature Comparisons

The feedback provided in the IQP did not affect student achievement. Although this may be surprising at an intuitive level, given the important role of feedback in learning, it is not contradicted by some of the research (Leivo, 2001 and Alavosius and Sulzer-Azaroff, 1990).

Feedback is most effective during complex learning tasks (Rudd, 1986; Wulf, Shea and Matschine, 1998). It can be argued that the course material studied in ECI 301 is not complicated material and may therefore not require continuous feedback. The course focuses on the assumptions that lie behind the American educational system, and repeatedly invites students to question those assumptions and envision a more commonsensical future system. The process of analyzing, demystifying, simplifying and re-visualizing, repeated systematically throughout the course and across all aspects of education, is less about mastering complex topics than it is simply about learning to think and ask why. Feedback may therefore be extraneous when the material being taught is largely grounded in common sense as it eschews complexity.

Neither was feedback a negative factor. It did not decrease student performance, as predicted by studies of too much feedback (Wulf, McConnell, Gartner and Schwarz, 2002). This means that although it was immediate and regular, it did not clutter the learning activities and induce any meta-task processes (Kulik and Kulik, 1988). This finding is confirmed by the approximately neutral satisfaction index averages. The feedback was not intrusive enough to be consistently annoying.

Finally, the non-significant difference in participation and satisfaction rates indicate a similar level of motivation between the two groups. This is key considering the important role that student motivation plays in interpreting feedback (Morrison, 1995 and Salomon and Globerson, 1987). If the two groups were not equally motivated it would raise concerns that they were not representative of the same population, and would jeopardize the entire study. Motivation is a difficult phenomenon to measure, but two strong indicators of motivation are participation and satisfaction. Because both groups were randomly assigned, because they chose to participate equally, and because did so with the same level of satisfaction, it can be noted that they were motivated at an approximately equal level. Finding similar participation and satisfaction rates, therefore, confirm the internal validity of the study.

Implications for Practice

Creating a successful online course is a considerable amount of work (Khan, 2001; Salmon, 2000). Designing a pedagogical approach for an AOC, adjusted to the delivery content and the target student, is a complicated instructional process that is difficult to perfect. Few courses, therefore, manage the content delivery sufficiently to overcome two of the largest complaints about AOCs: technical difficulties and lack of feedback. (Ryan, 1999; Cragg, 1994; Berge, 1999). This raises the question: why then are AOCs so consistently popular?

This dissertation provides a possible answer to that question. The lack of feedback was not a hindrance to learning; the imputed "great weakness" was not a fatal flaw. This was indicated by the fact that differences in achievement, participation and satisfaction

were not significant, despite huge differences in the amount of feedback. While the dearth of feedback in AOCs may frustrate students, it does not necessarily detract from their learning. The equality between treatment intervention groups in the educational bottom line (learning gains), combined with the advantages they enjoy with regards to issues of access, may explain why AOCs continue to be popular. Even those that are poorly designed are effective instructional experiences.

This would indicate a serious implication for future AOC instructional designers: if the learning material is not complex, there is little need to build feedback systems into the delivery structures. If achievement levels are stable between both the treatment and control group, it follows that the value of the extra effort of programming and administering the IQPs must be questioned.

It is conceivable that while the feedback may not provide instructional advantages, it does serve an emotional purpose in that it connects the learner with the instructor and creates some sort of social dynamic, not matter how simple. However, this argument is put to rest by the non significant differences in student satisfaction. A bold assertion this dissertation might make, therefore, is that in courses of more basic instruction, such as ECI 301, providing feedback does not further contribute to learning.

A further point to make, however, is that neither did the feedback detract from the achievement levels. Not only that, but neither group reported strong dissatisfied feelings. These two findings combine to indicate that providing the feedback opportunities had no ill effect on the learning process for students, either emotionally or on comprehension. While it may not have provided significant benefit to the population at large, it was certainly well received by many individuals, as indicated by specific satisfaction scores in

the dataset. This indicates that there is benefit to some individuals, at least at the emotional level of satisfaction if not at the more cognitive level of achievement, in using the IQP.

The case can therefore be made that tools such as the IQP should be made available for students on a voluntary basis. Those who enjoy the task and feel that they benefit from the process can engage in the exercise, receive feedback and continue with their learning. While those that wish to can streamline the class reading and avoid the activity.

Suggestions for Future Research

This study questions the extent to which material complexity bears on the role of feedback in learning environments. What exactly is meant by complexity? How does a teacher assess the complexity of the material she is teaching? At which complexity level does feedback become effective, and therefore appropriate? How does that complexity level vary between students of different Perry positions? Any study that sought to answer these questions, perhaps by varying the amount of detail provided in a learning task with the feedback about that learning, would contribute greatly to the field of feedback research.

A second area of interest is that which relates to the type of feedback. In this study subjects were provided with generic simulated feedback that represented the materials as it was initially learned: in text form. Varying feedback modes could possibly make the feedback more effective, and therefore become an affective factor. Students could perhaps review the instructional material as presented in another medium – in the

form of an audio presentation or a diagram to see if the feedback could not be more effective in reinforcing the original instruction.

Continuing with this idea, the feedback could also be better tailored to the subject's needs if it was made specific to the comprehension deficiencies the student was displaying, or the questions she was asking. Allowing for a proper dialogue between subject and instructor would enable the feedback to be more adequately tailored to the subject's learning needs, and presumably more effective in affecting achievement. Designing an interface for a large AOC that provided this level of interaction would certainly be a challenge, and would also place (impossibly?) high demands on the instructor to provide in-person, tailored feedback to the students. In a real world setting, this would therefore not likely be done. However, if studies were to indicate that it had a large affect on learning it would focus more creative attention on overcoming obstacles to practical applications.

<div align="center">Question Number Two Reviewed</div>

The second question also asked if there was difference between the Parrot/Ferret participation rates, exercise satisfaction reports and student exam achievement levels, but with regards to different CCI positions.

Findings in Brief

In short, no significant differences were found. In the two Perry positions examined, they completed statistically similar levels of participation of 336.22 for position two and 324.40 for position three. The satisfaction index from position two was 0.146, while that for position three was -0.293. The difference between the two was non

significant (p=0.056). Lastly, their achievement rates of 75.68 and 400.56 (unit and final exam scores for position two) and 75.42 and 390.33 (unit and final exam scores for position three) were also statistically similar. There were no differences in participation, satisfaction or achievement between the two Perry positions studied.

<div align="center">Analysis</div>

Literature Comparisons

The literature review revealed that no serious study has previously been done on how subjects of different cognitive maturity levels benefit from feedback. There are, however, several logical projections that can be made from the characteristics of each position that could be used to predict how they would benefit from feedback of the nature provided by the IQP. It should be noted that this amounts to merely informed speculation, but it nonetheless bears on the study at hand as it is examining a un-researched topic.

Possible dualism response to feedback.

The dualism subject sees the world in black and white. They are likely to regard the professor as an absolute authority figure, whose knowledge is nearly infallible. As students they seek to master the wisdom bequeathed by the instructor without doubt or challenge. Learning is to be stored and recited on the final exam.

The subjects in the dualism position who receive feedback are likely to be very happy with it. They would regard feedback provided by the IQP as a source of distilled key concepts, neatly packaged for memorization. Like a chapter summary, the student

likely seizes upon it as the fundamental casting of what needs to be learned. As such, the feedback is likely to be sought and embraced.

The subject who does not receive feedback, however, is likely to be frustrated. Although all the information they are required to learn is presented in the course material, it is not simplified and recapitulated for easy consumption. It should be pointed out that the subjects do not realize what they are missing as they are not briefed on the nature of the treatment group's intervention. Instead, their own task requires them to reflect on their answer and encourages them to think more deeply about the material. But such an activity is likely to go unappreciated, as a subject in the dualism position does not value the process of self-reflection. They view education as the task of consuming the knowledge dispensed by the teacher. As such, the IQP is most likely to be viewed as a distraction from the learning task.

Possible multiplicity pre-legitimate response to feedback

The subjects who have moved on to the position of multiplicity pre-legitimate are only slightly more advanced than their dualism peers, but have undergone a massive conceptual shift. Perry likens the transition from dualism to multiplicity pre-legitimate to the departure from the Garden of Eden. Students retain the same faith that knowledge is absolute and the professor wields ultimate mastery of her subject area. However, multiplicity pre-legitimate students are beginning to realize that people have legitimate differences of opinions, and that it is sometimes difficult to find the correct answer. This does not replace Truth, it simply obfuscates it. An ultimate understanding is still

attainable, and likely held by the authorities; it just needs to be sought out. Those who

disagree with the knowledgeable ones are seen as uninformed, simple minded or wrong.

The student in multiplicity pre-legitimate is likely to respond to the direct

feedback answers provided by the IQP in a similar way to dualism subjects. An important

difference, however, is that they may not feel they are being as challenged as they could

be. Sorting through differing opinions is an interesting exercise enroute to the discovery

of ultimate understanding. The learning byte answers provided by the IQP may be too

much like cheat sheets for the subject in multiplicity legitimate. Although they are

grateful for them, they may find that they over simplify the learning task.

That is not likely the case for those subjects in the control group. Without

prefabricated answers, they only have the metacognitive prompt questions to reflect upon

their reading. This is exactly the type of puzzling that they regard as an important step

towards mastering material. The lack of feedback, while is stops short of offering

differing opinions to debunk, is likely to satisfy them and their spirit of investigation.

Possible multiplicity legitimate response to feedback

Subjects who transition into the multiplicity legitimate position are going to begin

looking at the professor's opinions in a very different light. They strip the learned of

absolute status because they have come to believe that uncertainty exists everywhere, and

therefore truth is unavoidable. Instead of right and wrong, the world is comprised of a

swirl of opinions, each as valid as the other because nobody knows for sure.

In such a state students who are being given feedback are likely to be frustrated

by the exercise. Because the professor is no longer regarded as all knowing, his or her

opinion matters for much less. The student's own opinion becomes the most important one, because no one has the privilege of being surely right. Being told the correct answer, according to the professor, is useful only in so far as it reviews what the lecture thinks he or she knows. It serves little more than to inundate the learner with information that they may consider wrong. If the subject and instructor happily agree, the exercise becomes repetitive and boring. It they disagree, it may cause the subject to react in hostility and frustration.

On the other hand, those subjects who are not being given feedback are likely to revel in the chance to reflect on their own experiences and opinions, and weight them carefully against the so called learning of the authority. Without suffering the imposition of having to review the opinions of others, they can construct their own understanding un-hampered. The lack of feedback is unlikely to be missed at all.

Possible contextual relativism response to feedback

The subjects who have grown into the final position of contextual relativism are the ones who see the world in shades of grey. Like their multiplicity counterparts they recognize that the world is awash with opinions that are often false, but like their more naïve peers in dualism they do believe that the truth is out there. By carefully considering alternate and conflicting views, a more robust version of the truth can be constructed – perhaps not an absolute truth, but definitely a most correct answer. The key to improving one's understanding is to actively investigate the world around oneself, and seek dialogue with contrary perspectives.

The implications of this for those that receive feedback is likely muted frustration. The professor's viewpoint is certainly valued and respected as a viable, and even informed opinion. But it is by no means the final word. The static feedback that rehashes his or her viewpoint is a frustrating narrative to encounter, because no engagement is possible. Students with relevant experience and key insights have their voices neutered, unable to present viable perspectives, or request further information. The feedback is likely a frustrating carrot that fails to satisfy a deeper hunger.

Similarly the control group, without a feedback intervention, is unlikely to be satisfied. Although the reflective exercise they engage in is more compatible with their mature approach to constructing meaning, it does not allow for more than two opinions: their's and the instructor's. And like their treatment counterparts, they are likely to be frustrated by the elaboration restraints the WBL medium erects. Surely they would prefer a face-to-face discussion with multiple parties. In short, for the contextual relativism learners, neither of the two treatment groups is likely to be satisfying experiences.

These predictions, it bears repeating, are nothing more than a logical anticipatory response of a set of Perry positions to the interventions affected by this study. There is little to no research that examines how students of varying levels of cognitive maturity would respond to feedback. The set of anticipations outlined above, therefore, stand as nothing more than a hypothesis postulated by a close reading of the Perry model and some common sense. It is disappointing, therefore, that the hypothesis appears to be incorrect.

The model posited above was not borne out by the findings of this study. It appears there was no significant difference between the two Perry positions postured on

any of the dependent variable scores examined. They achieved the same level on unit and final exams, they participated equally in the program and they scored similar levels of satisfaction. While there might have been subtle trends that indicated a tendency to confirm the model, data findings were insignificant, and as such the model is unconfirmed.

Implications for Practice

General practice among higher education degree programs already caters to the spectrum of Perry positions. Although there is not necessarily a correlation between age and cognitive maturity, it is commonly found that the lower Perry positions are mounted and transgressed with age. At any rate, institutions of higher learning aspire to develop in their learners the type of mature processing skills that are associated with contextual relativism. As this is certainly one of their core functions, the assumption is almost universally made that as students progress to higher degree programs a university's instructional strategy needs to be adjusted to cater to their abilities. Consequently there is a general shift away from the large lecture formats of undergraduate freshman courses towards the small seminar formats of doctoral classes. This naturally accommodates more direct, personal, bidirectional, complex and dynamic feedback. It would appear that the best practices for delivering content to learners according to the assumed level of cognitive maturity is naturally being followed in the higher education system in general.

However, there are ways of improving this. Differences in maturity within a single university course are not only possible, but likely. ODU's ECI 301, for example, caters to a wide range of maturity levels, possibly because it is commonly taken by

freshman, returning students, non traditional students and graduate students alike. The AOC format allows for customized instruction, as the IQP has shown. It is possible, therefore, to construct a delivery platform that caters to each student's learning preferences. Whether externally assessed and mandated, or left for the student to self evaluate and elect, the course can be offered in various online formats, each tailored to the considerations of a different maturity position. Students can then complete the same class assignments and be graded against the same criteria, but be instructed in specialized formats that predict their preferred learning modes.

This concept is premature to present here, as it assumes a significant finding of the study. In fact, there was not correlation between feedback type and maturity level and as such the practical implications of this study are rather uninteresting. It would indicate that feedback, as provided in this model, was ineffective at stimulating an effect in any particular group. As such, the learning would likely have occurred at an equal rate without the IQP intervention, and without specialized attention to cognitive maturity levels.

While confirmation of the null hypothesis is the plain indication of the numbers of this study, the persuasion that 'feedback matters' persists at an intuitive level. Perhaps doctoral students expect to be treated differently from undergraduate because they have been socialized by tradition, but the current structuring of higher education indicates a natural confirmation of Perry's model. There seems to be an increased aptitude for dynamic feedback among more mature learners. To conclude from this study that feedback is irrelevant in AOCs and to subjects of varying mental maturity is to ignore the larger need for further research that approaches the question from different angles.

Suggestions for Future Research

A fundamental beginning point for further research is a more complete comparison between Perry positions. The class size of ECI 301 proved insufficient to adequately seed all the Perry positions. A large number of subjects was lost when they tested into stages of transition, and thus did not allow for clean comparisons between discrete groups. While two positions were compared, two more remain to be investigated. To confirm the findings of this study, to transect all of Perry's positions and extrapolate results for the whole model, a primary consideration is to reconstruct the study with a larger sample size.

A second consideration is that the design of the study could be altered to vary the mode of feedback. The Perry feedback model predicts that more mature learners respond better to dynamic feedback, from their instructor and their peers. Delivering feedback in formats that cater to the projected needs of different students would accommodate more subtle learning preferences and allow for a closer reading of possible the effect sizes.

A further consideration would be to alter the study design to accommodate a control group that remained inactive. The current control group for the study was given reflective questions to answer, a type of metacognitive exercise that did not qualify as feedback, but did stand to potentially consolidate learning. This activity was introduced largely to equate the work levels between the two groups. It was important that any effect size be attributed only to differences in feedback type, not to disproportional cognitive tasking. And although it is fair to say that metacognitive engagement is not feedback, it is conceivable that the assignment eroded effect size.

The study's design, therefore, is not ideal, though it accommodated a contentious issue and removed it from clouding the study's validity. Reproducing the study with a larger population would allow for three treatment groups: the model response group, a metacognitive stimulant group and a control group. This, or a different design altogether, could allow for more insight into feedback as an affective factor on AOC learning.

A further derivative study could offer students the opportunity to answer the professor's feedback, either voluntarily or as a course requirement. A voluntary response, contrasted with cognitive maturity, could provide interesting qualitative insight into how the feedback was used by different students. A study such as this could begin to get at how the course material was constructing students' understanding of the field of education in a way that reached further than traditional classroom assessment tools.

Finally, there are elements of learning that are not measured by the standard achievement measures on exams. While students may have memorized concepts at uniform levels, they may not have internalized their learning in the same way. While the achievement measures were adequate for university assessment practices, they could be expanded over time to provide more perspective to the research. Long-term memory could be tested with another assessment in a few months time. Task transfer skills could be assessed by visiting subjects in their future classrooms. Qualitative research methods could seek to discern deeper levels of understanding between students. In short, this study is a first blush foray into a new area that seeks to highlight areas of interest for future research.

Question Number Three Reviewed

The third research question sought to discover if there is an interactive effect between the CCI positions and the treatment group.

Findings in Brief

No such interaction was found. Interactions were sought with each dependent variable pair, and there were none to report between final exam achievement, exercise participation or exercise satisfaction. With regards to the five unit exams that were compared, the achievement levels on unit exam five did register as significant. As mentioned earlier, this finding is baffling. There is no reasonable explanation that the treatment group should outperform the non treatment group on this particular unit exam when it failed to register significance on any other measure.

Limitations

Although the Interactive Question exercise was mandatory, previous experience indicates that a percentage of students fail fully to participate. One must assume that this failure was because of unidentified variables specific to each student's circumstance.

The study does not provide definitive evidence of a direct relationship between Parrot/Ferret participation and quiz scores. The research may suggest but cannot conclusively indicate whether or not the Parrot/Ferret protocol improves student learning.

A possible confounding variable in this study is prior achievement. Students may do well on quizzes and conscientiously participate in the Parrots/Ferrets simply because they are better students, while poorer students achieve lower quiz scores and fail to

answer the parrots and ferrets. In other words, the poor students' low quiz score is not necessarily a function of their failure to complete all Parrots and Ferrets, but rather both are a function of their poor scholastic ability. For this reason, GPA scores were sought to be factored in wherever they could possibly be used to explain variance. Unfortunately the data was inadequate to draw a sufficient sample size.

A further limitation is that the real word setting of the class, a prerequisite for external validity, did not provide enough of a population for adequate group comparisons. Perry's model categorizes subjects into 4 positions, but an individual's status is not cut and dry within a position. Given the organic nature of personal growth, and the formative experience that higher education is supposed to be, many subjects were in a state of flux during this study as they transitioned between positions. Because mental maturity is not a linear acquisition, subjects may transcend position boundaries, bridging position or fall within two positions simultaneously. These cases are difficult to categorize in the data, and amount to transitional discounts. When the number of such cases is sizable, they detract from the expected group membership of the standard 4 positions. In order to protect against transitional discounts, a sample size must be very large indeed to guarantee a sufficient number of cases in each conceivable position bridge configuration. Such a sample size was not possible in the ODU course ECI 301. In this situation, comparisons between available position representations were made.

Conclusion

In conclusion, then, here is a revision of the findings of this study. Of the two groups that were given different levels of feedback, there were no significant differences

between them on the measures of IQP participation, exercise satisfaction, and unit exam

or final exam achievement. On the same three dependent measures there were no

significant differences found between the different groups of subjects as defined by

Perry's scheme of cognitive maturity. Finally, there were no significant interactive effects

between the two independent variables of cognitive maturity and feedback intervention.

REFERENCES

Alavosius, M. P., & Sulzer-Azaroff, B. (1990). Acquisition and maintenance of health-care routines as a function of feedback density. *Journal of Applied Behavior Analysis, 23,* 151-162.

Baxter Magolda, M., & Porterfield, W. (1988). *Intellectual development: Linking theory and practice.* Washington, DC: American College Personnel Association.

Berge, Zane L. (1999). Interaction in post-secondary web-based learning. *Educational Technology, 39(1),* 5-11.

Bransford, J. D., Brown A. L., & Cocking, R. R.,(2000). *How people learn.* Washington, DC: National Academy Press

Carrol, J.M., & Kay, D.S. (1988). Prompting, feedback and error correction in the design of a scenario machine. *International Journal of Man-Machine Studies, 28,* 11-17.

Chhokar, J.S., & Wallin, J. A. (1984). A field study of the effect of feedback frequency on performance. *Journal of Applied Psychology, 69(3),* 524-530.

Clariana, R. B. (1999). *Differential memory effects for immediate and delayed feedback: A delta rule explanation of feedback timing effects* (Annual Convention of the Association for Educational Communications and Technology in Houston TX) [Presentation]. Retrieved April 22, 2002, from ERIC database.

Clariana, R.B., Wagner, D., & Roher Murphy L.C. (2000). Applying a connectionist description of feedback timing. *Educational Technology, Research and Development, 48(3),* 5-21.

Cooper, J. D. (1997). *Literacy: Helping children construct meaning.* 3rd ed. Boston:

Houghton Mifflin.

Cragg, Catherine E. (1994). Nurses' experiences of a post-RN course by computer

mediated conferencing: Friendly users. *Computers in Nursing, 12(5),* 221-226.

Erwin, T.D. (1983). The scale of intellectual development: Measuring Perry's scheme.

Journal of College Student Personnel, 24, 6-12.

Garner, R., & Kraus, C. (1981-1982). Good and poor comprehender differences in

knowing and regulating reading behaviors. *Educational Research Quarterly, 6(4),*

5-12.

Griffith, J., & Chapman, D.W. (1982). *Learning context questionnaire.* Davidson

College, Davidson, NC.

Ilgen, D.R., Fisher, C.D., & Taylor, M.S. (1979). Consequences of individual feedback

on behavior in organizations. *Journal of Applied Psychology, 64,* 349-371.

Jensen, E. (2000). *Brain based learning* (Revised Edition). San Diego: Brain Store Inc.

Khan, B. H. (2001). *Web based training.* NJ: Educational Technology Publications.

Khan, B. H. (2001). *A framework for web-based learning* (Instructional Technology

Department, Utah State University) [Presentation].

Kluger, A.N., DeNisi, A., (1996). The effects of feedback interventions on performance:

A historical review, a meta-analysis, and a preliminary feedback intervention

theory. *Psychological Bulletin, 119(2),* 254-286.

Knefelkamp, L.L., Fitch, M., Taylor, K., & Moore, W.S. (1984, March). *The measure of

intellectual development: a review and update.* Paper presented at the annual

meeting of the American College Personnel Association, Baltimore, MD.

Kohlberg, L. (1984). *Essays on Moral Development: The Psychology of Moral Development*. New York, NY: Harper & Row.

Kroonenberg, N. (1994-1995). Developing communicative and thinking skills via electronic mail. *TESOL Journal, 4,* 24-27.

Kulik, J.A., & Kulik, C.-L.C. (1988). Timing of feedback and verbal learning. *Review of Edicational Research 58(1),* 79-97.

Langrehr, & Palmer (n.d.). A historical perspective of metacognition: From abstraction to paradigm. Retrieved October 16, 2001, from http://garnet.acns.fsu.edu/~dbl2291/metacog.html

Leivo, A. K. (2001). A field study of the effects of gradually terminated public feedback on housekeeping performance. *Journal of Applied Social Psychology, 31(6)* 1184-1203.

Lin, X. (2001). Designing metacognitive activities. *Educational Technology Research and Development, 49(2),* 23-40.

Lin. X., & Lehman, J. (1999). Supporting learning of variables control in a computer-based biology environment: Effects of prompting college students to reflect on their own thinking. *Journal of Research In Science Teaching, 36(7),* 1-22.

Loevinger, J. (1966). The meaning and measurement of ego development. *American Pshychologist, 21,* 195-206.

McCarthy, M. T. (1995). Form of feedback effects on verb learning and near-transfer tasks by sixth graders. *Contemporary Educational Psychology, 20(2),* 140-50.

McCollum, K. (1997). A professor divides his class in two to test the value of online learning. *Chronicle of Higher Education, 43(24),* 23.

Moore, W. S. (1987). The Learning Environment Preferences: Establishing preliminary reliability and validity for an objective measure of the Perry scheme of intellectual development. *Dissertation Abstracts International,* 49 (06) 1386A.

Moore, W. (1989, November). The Learning Environment Preferences: Exploring the construct validity of an objective measure of the Perry scheme of intellectual development. *Journal of College Student Development,* 504-514.

Moore, W. (1994). *Handbook of college teaching.* Westport, Connecticut: Greenwood Press.

Morrison, G.R., Ross, S., Gopalakrishnan, M., & Casey, J. (1995). The effects of feedback and incentives on achievement in computer-based instruction. *Contemporary Educational Psychology, 20(1),* 32-50.

National Reading Panel. (2000). *Teaching children to read: An evidence-based assessment of the scientific research literature on reading and its implications for reading instruction.* National Reading Excellence Initiative.

Nunnally, J. (1967). *Psychometric theory.* New York: McGraw-Hill

Palmer, B.C., Hafner, M.L., & Sharp, M.F. (1994). *Developing cultural literacy through the writing process: Empowering all learners.* Needham Heights, MA: Paramount.

Palincsar, A.S., & Brown, A. L. (1984). Reciprocal teaching of comprehension fostering and monitoring activities. *Cognition and Instruction, 1,* 117-175.

Parker, J. (1984). *The preliminary investigation of the validity and reliability of the Parker Cognitive Development Inventory.* Unpublished doctoral dissertation, University of Iowa, Iowa City.

Perry, W. (1968). *Forms of ethical and intellectual development in the college years: A scheme.* New York: Holt, Rinehart, and Winston.

Perry, W. (1981). Cognitive and ethical growth: The making of meaning. In A.W. Chickering & Associates, (Eds), *The modern American college* (pp. 76-116). San Francisco: Jossey-Bass.

Philips, Gerald M., & Santoro, Gerald M. (1989). Teaching group discussion via computer-mediated communication. *Communication Education, 38(2),* 151-161.

Piaget, J. (1965). *The Moral Judgment of the Child.* New York, NY: Free Press.

Pressley, M. (2002). Metacognition and self-regulated comphrension. In A.E. Farstrup & S.J. Samuels (Eds), *What research has to say about reading instruction* (3rd ed.). Newark, Delware: International Reading Association.

Rudd, J. R. (1987). The effects of feedback frequency and goal setting on data processing performance. (Doctoral dissertation, Virginia Polytechnic Institute, 1987). Dissertation Abstracts International, 48(2-B), 589.

Ryan, Marilyn, Hodson, Carlton, & Aki, Nagia S. (1999). Evaluation of traditional classroom teaching methods versus course delivery on the world wide web. *Journal of Nursing Education, 36(1),* 18-23.

Salmon, G. (2000). *E-Moderating: The key to teaching and learning online.* London: Kogan Page.

Salomon, G., & Globerson, T. (1987). Skill may not be enough: The role of mindfulness in learning and transfer. *International Journal of Educational Research, 11*, 623-637.

Schroth, M. L. (1997). Effects of frequency of feedback on transfer in concept identification. *American Journal of Psychology, 110(1),* 71-79.

Stewart, O., & Tei, O. (1983). Some implications of metacognition for reading instruction. *Journal of Reading, 26,* 36-43.

Thompson, Melody. (1998). Distance learners in higher education. Retrieved September 21, 2001 from http://wbwe4.worldbank.org/disted/Teaching/Design/kn-02.html

University of Phoenix Online. (2002). Retrieved July 17, 2002 from http://www.online-learning-info.com/default.asp

Wellman, H.M. (1985). The origins of metacognition. In Forrest-Pressley, D.L., MacKinnon, G.E., Waller, T.G. (Eds.), *Metacognition, cognition, and human performance* (vol. 1, pp.1-31), Orlando, FL: Academic Press.

Winstein, C.J., & Schmidt, R. A. (1989). Sensorimotor feedback. In D.H. Holding (Eds.), *Human Skills* (2nd ed., pp. 18-47). Chichester, UK: John Wiley & Sons.

Wulf, G., McConnell, N., Gartner, M., & Schwarz, A. (2002). Enhancing the learning of sport skills through external-focus feedback. *Journal of Motor Behavior, 34(2), 171-182.*

Wulf, G., Shea C. H., & Matschine, S. (1998). Frequent feedback enhances complex motor skill learning. *Journal of Motor Behavior. 30(2), 180-192.*

Appendix A

The Sub-dimensions of Khan's WBL Model

Table A1.

1. INSTITUTIONAL	2. PEDAGOGICAL

1.1 Administrative Affairs
1.1.1 Needs Assessment
1.1.2 Readiness Assessment (Financial,
 	
Infrastructure, Cultural and Content
 	
readiness)
 	
1.1.3 Organization and Change
    (Diffusion, Adoption and
    Implementation of Innovation)
1.1.4 Budgeting and Return on
    Investment
1.1.5 Partnerships with Other
    Institutions
1.1.6 Program and Course
    information Catalog (Academic
Calendar, Course Schedule,
    Tuition, Fees, & Graduation)
1.1.7 Marketing, Recruitment and
    Alumni Affairs
1.1.8 Admissions
1.1.9 Financial Aid
1.1.10 Registration and Payment
1.1.11 Information Technology
    Services
1.1.13 Instructional Design and
    Media Services
1.1.14 Graduation Transcripts
1.2 Academic Affairs
1.2.1 Accreditation
1.2.2 Policy
1.2.3 Instructional Quality
1.2.4 Faculty and Staff Support
1.2.5 Class Size, Workload and
    Compensation and Intellectual
Property Rights
1.3 Student Services
1.3.1 Pre-enrollment Services
1.3.2 Orientation
1.3.3 Advising
1.3.4 Counseling
1.3.5 Learning Skills Development
1.3.6 Services for Students with
    Disabilities
	2.1 Content Analysis
	2.2 Audience Analysis
	2.3 Goal Analysis
	2.4 Medium Analysis
	2.5 Design approach
	2.6 Organization
	2.7 Methods and Strategies
	2.7.01 Presentation
	2.7.02 Exhibits
	2.7.03 Demonstration
	2.7.04 Drill and Practice
	2.7.05 Tutorials
	2.7.06 Games
	2.7.07 Story Telling
	2.7.08 Simulations
	2.7.09 Role-playing
	2.7.10 Discussion
	2.7.11 Interaction
	2.7.12 Modeling
	2.7.13 Facilitation
	2.7.14 Collaboration
	2.7.15 Debate
	2.7.16 Field Trips
	2.7.17 Apprenticeship
	2.7.18 Case Studies
	2.7.19 Generative Development
	2.7.20 Motivation

1.3.7 Library Support 1.3.8 Bookstore 1.3.9 Tutorial Services 1.3.10 Mediation and Conflict Resolution 1.3.11 Social Support Network 1.3.12 Students Newsletter 1.3.13 Internship and Employment Services 1.3.14 Alumni Affairs 1.3.15 Other Services	

Appendix B

Salmon's Lexicon of E-Moderator Competencies

Table B1.

Ability/ Characteristic	1. Confident	2. Constructive
Understanding Online Access	Confident in providing a focus for conferences, intervening, judging participant's interest, experimenting with different approaches, and being a role model	Able to build online trust & purpose; to know who should be online and what they should be doing
Technical Skills	Confident in operational understanding of software in use as a user; reasonable keyboard skills; good access	Able to appreciate the basic structures of CMC, and the WWW and Internet's potential for learning
Online Communication Skills	Confident in being courteous and polite	Able to write concise, energizing, personalb eonoline messages
Content Expertise	Confident in having knowledge and experience to share, and willing and able to add own contributions	Able to encourage sound contributions for others
Personal Characteristics	Confident in being determined and motivated as an e-moderator	Able to establish an online identity as e-moderator

Ability/ Characteristic	3. Developmental	4. Facilitating	5. Knowledge Sharing
Understanding Online Access	Ability to develop and enable other, act as catalyst, foster discussion, summarize, restate, challenge, monitor understanding an misunderstanding, take feedback	Know when to control groups, when to let go, how to bring in non-participants, know how to pace discussion and use time online.	Able to explore ideas, develop arguments, promote valuable threads, close off unproductive threads, choose when to archive, build a learning community
Technical Skills	Know how to use special features of software for e-moderators, e.g. controlling, archiving	Able to use special features of software to explore learners' use eg message e history	Able to create links between CMC and other features of learning programs
Online Communication Skills	Able to engage with people online (not the machine of the software)	Able tin interact through e-mail and conferencing and achieve interaction between others	Able to value diversity with cultural sensitivity
Content Expertise	Able to trigger debates by posing intriguing questions	Carry authority by awarding marks fairly to students for their CMC participation and contributions	Know about valuable resources (e.g. on the WWW) and refer participants to them
Personal Characteristics	Able to adapt to new teaching contexts, methods, audiences & roles	Show sensitivity to online relationships and communication	Show a positive attitude, commitments and enthusiasm for online learning

Ability / Characteristic	6. Creative
Understanding Online Access	Able to use a range of CMC conferencing approaches from structured activities to free wheeling discussion, and to evaluate and nudge success of conferences
Technical Skills	Able to use software facilities to create and manipulate conferences and to generate an online learning environment
Online Communication Skills	Able to communicate comfortably without visual cues
Content Expertise	Able to enliven conferences through use of multimedia and electronic resources
Personal Characteristics	Know how to create a useful, relevant online learning community

Appendix C

Glossary

AOC: see Asynchronous Online Course

Asynchronous Online Course (AOC): A specific type of WBL course that allows

students to cover material at their own pace because no synchronous presence,

virtual or otherwise, is required of the instructor or students.

CAI: see Computer Assisted Instruction

CCI: see Cognitive Complexity Index

Computer Assisted Instruction: (CAI) educational courses that rely on the computer for

the delivery of some, if not all off their content.

Cognitive Complexity Index (CCI): Measure of student's cognitive development, as

defined by Perry's stages, which is calculated using Moore's Learning

Environment Preferences (LEP) instrument

Feedback Complexity: **The feedback format where different formats include different types of information / options for students. Different formats are Knowledge of Results, Knowledge of Correct Response, Single Try Feedback and Multiple Try Feedback.**

Feedback credibility: a reflection of the level of trust the student has with the source of the feedback.

Feedback Elaboration: feedback that includes extra information to the student, beyond whether they were correct, or what the right answer is. Elaborated feedback may include explanations to debunk wrong answers, to better explain right answers, or even extra instructional material to re-teach the lesson.

Feedback Frequency: A measure of how often the student receives feedback during the learning process. There is no clear understanding of how much is enough, and when it becomes too much. However, too much or too little feedback appears detrimental.

Feedback Intervention: The act of providing feedback to a student, be it from a peer, instructor, computer, etc.

Feedback Timing: A measure of how soon after a test even the feedback is provided. It can be instantaneous, immediate or delayed. Generally speaking, the soon the feedback is provided, the better.

KCR: see Knowledge of Correct Response

Knowledge of Correct Response (KCR): a feedback format that informs the student what the correct answer is

Knowledge of Results (KR): a feedback format that simply informs the student if they were correct or not

KR: see Knowledge of Results

Learning Environment Preferences (LEP): a test instrument designed by Moore used to calculate cognitive development by generating a CCI score.

LEP: see Learning Environment Preferences

Lesson element: short section of online reading in an AOC that contains one or two key concepts.

Meta-Task Process: A cognitive search for alternative solutions / explanations when one is struggling with a concept or a task. Suggested by Kluger & DeNisi (1996) as an explanation for why some feedback, particularly personalized feedback, can reduce achievement, presumably by distracting from the task at hand and engaging the subject in the contemplation of alternative activities or explanations for the task at hand.

Mindfulness: the act of carefully considering a concept before accepting it.

Multiple Try Feedback (MTF): A feedback complexity level where students who choose incorrectly are told they are wrong and invited to try again multiple times.

Non-traditional students: students between the ages of 24 and 65 (Justice & Dornan, 2001), who have more serious financial and familiar responsibilities than traditional students (age 18-23). Consequently, they need to hold jobs throughout their schooling (Stern 1997).

Presearch Availability: The availability of an answer to a student in an easy location, so that the student's cognitive engagement is reduced when answering.

Single Try Feedback (STF): A feedback complexity level where students who choose incorrectly are not given a second chance to choose again.

Threaded discussion: An instructional tool used in online courses that allows students to post opinions for each other to read, so as to answer specific questions or carry on a discussion. The overall format can be sorted for easy access to student submissions by author, date, subject etc, and manipulated to expose continuing themes, or threads, in the discussions.

WBL: see Web Based Learning

Web Based Learning (WBL): The general name for the field of education that delivers content through the Internet

APPENDIX D

THE LEARNING ENVIRONMENT PREFERENCE SURVEY
SAMPLE QUESITONS

The selection of questions below were taken from the 5 different sections of the LEP.

Rating Scale:

1	2	3	4
Not at all significant.	Somewhat significant.	Moderately significant.	Very significant.

SECTION 1: COURSE CONTENT/ VIEW OF LEARNING

MY IDEAL LEARNING ENVIRONMENT WOULD:
___1. Emphasize basic facts and definitions.

SECTION 2: ROLE OF INSTRUCTOR

IN MY IDEAL LEARNING ENVIRONMENT, THE TEACHER WOULD:
___1. Teach me all the facts and information I need to learn.

SECTION 3: ROLE OF STUDENTS/ PEERS

IN MY IDEAL LEARNING ENVIRONMENT, AS A STUDENT I WOULD:
___1. Study and memorize the subject matter.

SECTION 4: CLASSROOM ATMOSPHERE/ ACTIVITIES

IN MY IDEAL LEARNING ENVIRONMENT, THE CLASSROOM
ATMOSPHERE AND ACTIVITIES WOULD:
___1. Be organized and well-structured; there should be completely clear expectations set
(like a structured syllabus that's followed).

SECTION 5: EVALUATION PROCEDURES

EVALUATION PROCEDURES IN MY IDEAL LEARNING ENVIRONMENT
WOULD:
___1. Include straightforward, not "tricky," tests, covering only what has been taught and
nothing else.

APPENDIX E

The Interactive Question Protocol Sample
Illustration 1 of 4

Why do we need affirmative action in education?

Mr. Clark is the assistant principal at an inner-city school that is predominately black. Mr. Clark is also black, so most of the few white students in the school feel that all of the policies that the school makes are intended mainly for the majority of the school's population rather than all of the school's population. How can Mr. Clark make sure that there is no institutionalized racism in the school against the minorities in the building?

Answer Here

What questions do you now have about what you just read?

APPENDIX E

The Interactive Question Protocol Sample
Illustration 2 of 4

Parrot Question

Why do we need affirmative action in education?

SSN:

Answer:

Submit

APPENDIX E

The Interactive Question Protocol Sample
Illustration 3 of 4

Question: Why do we need affirmative action in education?

Your Answer: Affirmative action is an important tool to overcome institutionalized racism.

Professor's Answer: We need affirmative action to help solve the problems of institutionalized racism as well as other societal problems.

Guided Marking Questions:
Please use the questions below to discuss your answer

Question 1: Summarize the major points of what you just read.

Question 2: Have you had any personal experience with the material you just read? Describe the experience and how it relates to the reading.

Question 3: What questions do you now have about what you just read?

APPENDIX E

The Interactive Question Protocol Sample
Illustration 4 of 4

Question: Why do we need affirmative action in education?

Your Answer: Affirmative action is an important tool to overcome institutionalized racism.

Guided Marking Questions:

Please use the questions below to discuss your answer

Question 1: Summarize the major points of what you just read.

Question 2: Have you had any personal experience with the material you just read?
Describe the experience and how it relates to the reading.

Question 3: What questions do you now have about what you just read?

Appendix F

Excerpt from last page of final exam in ECI 301

The following questions are marked by participation. There are no correct/incorrect answers.

(sat)94 To what extent did answering the Parrots/Ferrets help you attend, or pay attention to, the reading
- Quite a lot
- A considerable amount
- A small amount
- Not at all

To what extend did answering the Parrots/Ferrets help you: (answer 95 - 97)

(v19)95 identify and recall the key concepts of the class?
- Quite a lot
- A considerable amount
- A small amount
- Not at all

96 see how to apply and use the key concepts of the class?
- Quite a lot
- A considerable amount
- A small amount
- Not at all

(v21)97 see relationships / connectedness between ideas presented in the class?
- Quite a lot
- A considerable amount
- A small amount
- Not at all

(v22)98 To what extend did the Parrots/Ferrets increase your confidence in what you knew (or did not know)?
- Quite a lot
- A considerable amount
- A small amount
- Not at all

(v23)99 To what extent did your Parrots/Ferrets answer match the Profs answer?

- almost always
- frequently
- Sometimes
- Seldom if ever

100 Consider the four survey questions at the end of each Parrots/Ferrets and select any number of the below options that best describes your response to them
- I appreciated being asked for my opinion.
- I found them a bit of a distraction
- I found them to be a hassle
- To be honest, I didn't take them seriously

VITA

G. Simon Richmond

Background

At the age of ten I moved from Canada to Zimbabwe with my family. Attending a rural government school I completed my high school in Africa before returning to North America for college. Between high school and college I took a year off to travel extensively though the Papua New Guinean highlands as an itinerant story teller. This experience consolidated my interest in formal, informal and life long education.

Education

Ph.D. Urban Services (Dec 2005)
Concentration: Education - Cognate: Technology
Old Dominion University, Norfolk, VA, USA

MSc. Secondary Education (May 1999)
English teacher certification
Old Dominion University, Norfolk, VA, USA

BA. English Literature (May 1997)
University of British Columbia, Vancouver, Canada

Experience

Technical Advisor, Interactive Radio, Zambia   (2002-Sept, 2004)

As a USAID contractor for the Education Development Center I currently work in Zambia adapting the school curriculum to radio to reach out of school children. As an advisor I work with Zambian Ministry of Education staff, managing a staff of 18 script writers and 4 studio technicians. My responsibilities include studio management and production, curriculum planning and script editing. I also specialize in Life skills education and HIV / AIDS awareness, having developed a Life Skills curriculum for Zambian children.

Online Instructional Designer   (1997-2002)

I produced Old Dominion University's first fully online course as a graduate assistant in 1997. During the 5 years I supported the class I recreated it for several different learning platforms, eventually writing my own for maximum flexibility. A total of approximately 3000 students passed through the course during my tenure. For my efforts I was awarded the department 2001 award for GA of the Year.

Digital Portfolio Project Manager   (2001 – 2002)

I worked as a special consultant to the Dean of Old Dominion University's Darden College of Education to create and implement a digital portfolio system for use by the 100 faculty and 500 students in the college.

Multimedia Designer   (1999 – 2001)
At the U.S. Military's Joint Training, Analysis & Simulation Center I worked as project manager on an interactive touch screen kiosk (designed in Director) and as webmaster for the South Eastern European Simulation Network, a multinational military training initiative in South East Europe.

Tidewater Writing Project Technology Liaison   (1998 – 2002)
I served as technology liaison to the Virginia Chapter of the National Writing Project, a program administered by UC Berkley. In addition to providing them with technology training, I work with teachers from all grades and subjects to help them adapt their teaching techniques to incorporate the act of writing in the classroom. I specialize in such topics as group learning through problem solving, how the brain responds to writing, and digital literacy / multimedia storytelling.

Naval Disease Reporting Systems Online Tutorial   (1999)
A team of programmers and I developed and fulfilled a successful bid for a Navy contract to develop an interactive online training program. The program was used to train Navy medical personnel how to report disease epidemics and incidents of biological warfare.

Computer Skills
I have digital production experience in sound and video editing, as well as graphic and web design. I also administer computer networks and have extensive experience designing online instructional environments. My forte, however, is adopting complex technologies to practical learning situations and then training 'tech naïve' teachers how to embrace and harness emerging tools.

References
Dwight Allen, Ph.D.
Eminent Professor of Education Reform
Old Dominion University / Norfolk, VA, USA 23529
Email: dwallen@odu.edu
Phone: (757) 683 5151

Richard Trewby
Chief of Party / QUESTT Project
E.D.C. Lusaka, Zambia
Email: rtrewby@edc.org
Phone: (260) 96687487

Sera Kariuki, Ph.D.
Project Director
E.D.C. Lusaka, Zambia
Email: skaruiki@edc.org
Phone: (260) 97827717

2130 Lusaka Place • Dulles, VA 20189 • Phone (260) 097 853 395
e-mail srichmond@edc.org