EXPLORATION OF LINKS BETWEEN COGNITIVE AND AFFECTIVE GROWTH IN STUDENTS STUDYING A HARD PURE DISCIPLINE

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CHAPTER 1

INTRODUCTION

Within the course of my professional career in medicine, I have had occasion to teach at the undergraduate medical school level and have been director of residents at a post-doctoral educational program. In my observations, the problem students found most difficult to fathom was the need to approach patient care from a holistic perspective. The typical student might respond to a difficult diagnostic situation with a blank stare or, at best, a partial solution.

Initially, when faced with responses such as these, I suspected that the quality of medical students must have declined. Later in my career when, as a residency director, I was confronted with licensed medical graduates in a post-doctoral training program who presented the same problems, I started to examine the system that produced these students.

Undergraduate preparation for medical school centers on the hard pure disciplines of the natural sciences. Since the sixties, seats in medical schools have been available at a premium. Many physicians I have spoken with attribute this first paroxysmal increase in student interest to the television show "M.A.S.H." and to the incentive the Vietnam War gave students to stay in school. The overwhelming crush

of applicants (There were 2700 applicants for the 150 seats in my class.) allowed medical schools to become selective in extremis. Grade point averages and MCAT scores were pursued with a greater fervor than the search for the Holy Grail. The medical schools wanted students who made good grades and excelled on standardized tests. The students who aspired to medical school jumped through whatever hoops the medical schools wanted, and the natural science facilities responded by teaching and testing for data acquisition and regurgitation. Thus, a narrowing educational spiral was set in motion whose product tended to focus on the mastery of a byte of information while ignoring the remainder of the data base. I gradually came to the conclusion that perhaps students had not changed as much as had the system.

In my opinion, the current premedical education system emphasizes the fundamental skills of memorization and recall and ignores the higher cognitive skills of *analysis*, *application*, *synthesis*, and *evaluation*. I doubt that many students could adquately define the terms "affective skills" and "cognitive skills." Their lack of understanding of cognitive and affective attributes creates a critical problem, which stands squarely in the path of quality medical care. The system has taught these students to run their data base to extract a formatted response to a patient's problem. But, patients and their problems simply are too complex to approach on a strictly cause-and-effect basis.

Medical schools decry the type of undergraduate student they have produced over the last thirty years. Although I have been a part of this problem, over the years my intuition led me to the feeling that a better way to approach the designing of curricula should be possible. This research project is an experiment designed to address the void which appears to have developed in the education of our future physicians.

The vehicle for this research project was an upper-division zoology course in human histology. In researching the manner in which this course is taught in Oklahoma universities, I had occasion to interview many faculty and administrators within both the medical field and the zoology discipline. During the course of our conversations, it became obvious that I am not the only person either interested in or concerned about the quality of content or the process used in undergraduate preparation of medical students. The questions I raised with these academics struck a resonant chord. They all expressed interest, and even excitement, in a more holistic approach to disciplinary pedagogy. The prevailing opinion is that a shift toward standardized teaching and assessment has occurred, and most faculty think that the shift has been detrimental.

The faculty with whom I spoke felt this trend has also resulted in a precipitous erosion of scholarly skills and values. One dean mused that few of his students knew "where the library [was], or how to use it."

Having learned scholarly skills such as use of the library--as well as analytical, integrative, and evaluative skills--through trial and error, it occurred to me that there might be a more direct route to the acquisition of these skills and that this more direct route could be consciously taught.

Problem Statement

In this qualitative research study, I propose to explore the extent to which assisting students to gain greater control of their cognitive learning process will enable them to grow in scholarly values.

I was hired as a visiting assistant professor to teach Zoology 4253 (Histology). I have been allowed to structure this course in such a manner that development of cognitive skills is emphasized through the conscious use of case studies and the analysis of research problems. Through a series of interviews with students in the course, I have had the opportunity to track changes that occur in their growth in the affective domain, specifically as related to scholarly values.

This project received its germination in the work of Benjamin S. Bloom, D. R. Krathwohl, and their colleagues. In the late 1950's, this group constructed three handbooks entitled, Taxonomy of Educational Objectives. The taxonomies delineate the cognitive, affective, and psychomotor domains of learning processes. As the titles imply, the taxonomies classify cognitive and affective

attributes of human mentation and emotions. Toward the end of the taxonomy of the affective domain, Bloom discusses the relationship between the cognitive and affective domains. He acknowledges that many authors feel the two areas are inseparable:

> Many take the view that interest will arise from increased information about some area of knowledge--that if we forget about the affective objectives, they will "Naturally" arise from the development of the cognitive objectives.[6]

Bloom further states that "other authors feel that developing skills in students will stimulate the [appropriate interests and attitudes]." Bloom feels that three outcomes are actually possible. Increasing cognitive achievement can produce greater interest or, conversely, disinterest in a subject. He also feels that, even if students' cognitive achievement does not rise, they can be stimulated by the process.[29]

Bloom decries the lack of methodology to study cognitive and affective outcomes simultaneously.[29] His questions give rise to a research study which would be difficult to quantify, but very amenable to illumination with a well grounded qualitative research project.

Statement of Purpose

This study explores an area of our awareness that has not been fully examined. The primary benefit arising from this study will be the design of a model curriculum that incorporates a conscious effort to enhance students'

scholarly values, in addition to enhancing the education of the particular group of students enrolled in this course. While this model will be developed within the framework of a hard pure discipline, it has the potential to be applied to other disciplines and fields. The basic science coursework taken during undergraduate premedical education should enable students to become well founded in the idea that patients are people in need of care, not diseases in need of treatment. Undergraduates in all disciplines can benefit from the incorporation of scholarly values into their personal value systems. The formative nature of the undergraduate experience should provide fertile ground for the initiation of a process stimulating the lifelong love of learning.

As a child, I was not socialized to appreciate scholarship. I know first-hand the frustration faced by individuals attempting to make the transition from just "getting by" to developing this love for learning. There is a personal power associated with the ability to learn for one's self. If, by exploring Bloom's speculation, a well grounded theory evolves, the product of this research can be used to aid students to develop their cognitive and affective learning tools and to adopt scholarly values.

Limitations

Limitations are inherent in any research effort. The reader should be mindful of the following limitations that may affect this study. The vehicle for this study is a one-

semester 4000-level zoology course. Thus, the study is limited to a time span of approximately five months. It seems obvious that a study following a student throughout undergraduate or medical education would ground the theory even more firmly. I would argue, however, that if a model can be shown to produce positive change in five months, it could easily be expanded and improved.

The respondents in this study are volunteers and are aware that they are part of an experiment. To say whether this might influence the study would be speculative; however, I do not feel the respondents' awareness will invalidate the data in this study. In fact, if anything, a study of this nature may actually produce more positive results as a result of the fact that a faculty member is paying close attention to students as individuals.

One might well expect that teaching ability would play a role in such a study. Obviously, an educator of great skill and experience might induce change at a greater rate. However, even though I am an adjunct professor, and this fact is known to the students, they will all be taught the same things at the same time. This should generate clean, consistent, grounded data and should not affect the outcome of the research.

Definition of Terms

This introduction is concluded with definitions of terms central to the problem statement.

COGNITIVE DOMAIN: The cognitive domain includes "those objectives which deal with the recall or recognition of knowledge and the development of intellectual abilities and skills."[6]

AFFECTIVE DOMAIN: The affective domain includes "objectives which describe changes in interest, attitudes, and values and the development of appreciations and adequate adjustment."[29]

SCHOLARLY VALUES: Academic freedom. The quest for knowledge. An appreciation of scholarship and the perceptions of others. An appreciation for scholarly tools and conventions.

The study of the classification system Bloom and his colleagues devised has helped me develop a matrix into which I have been able to position my feelings about the process of learning. This has added to my understanding of myself and, to a certain extent, has already grounded this study for me.

CHAPTER 2

REVIEW OF LITERATURE

Introduction

This review of literature will be separated into two sections. The first section will cover current thinking concerning innovation in premedical and medical pedagogy. Throughout the literature, I will strengthen my assertion that a serious problem exists in the content and form of current disciplinary and professional curricula. The literature will show a bewildering array of partial solutions. In this review I will defend my personal opinion that most of the science taught in the life science branch of the natural sciences is taught at the knowledge and comprehension levels as described by Bloom, *et al.*, in 1956.[6] A second purpose of the review is to address previous approaches to curriculum designed to enhance Bloom's domains.

The second portion of this review will concentrate on the use of qualitative research methodology, in particular Grounded Theory Research as exemplified by Strauss and Corbin.[47] The problem I am exploring deals with the affective side of people. The word "affective" can be defined as loving, valuing, liking, *ad infinitum*. The

infinite variation and complexity contained within the phrase, "I love you," make it clear that this and similar subjects simply defy quantification. Even in Bloom's original piece, he regretted the lack of methodology to illuminate the affective perspective of our personalities.[29] Through this review, I would like to reinforce the conclusion that the research problem as posed requires a qualitative study and, because I am interested in change over time, a grounded theory in particular.

Premedical and Medical Education

In the introduction, I discussed the problems I felt were degrading the quality of premedical and medical education from the natural science perspective. Based on ill-defined assumptions regarding the change in the thrust of this type of pedagogy, my thoughts were crystallized by the study of Bloom's and Perry's work. My assessment that premedical and medical science education has come to rely almost entirely on standardized-recall-type assessment will be shown to be of concern to a number of authors writing in this field. In 1973, O'Morchoe, *et al.*, called into question the entire process of basic science education utilized to educate physicians. Their contention was that analytical thought, so necessary to medical integration and diagnosis, was not broached by the current curriculum.[36]

In an article published in 1985, Canady and Lancaster determined that undergraduate preparation in several basic medical sciences resulted in no increase in performance in

the same courses taken in medical school.[8] This leads one to speculate about the effectiveness of premedical basic sciences as presently taught at the undergraduate level. Reason dictates that courses such as histology, effectively taught at the undergraduate level, should enhance medical school performance.

In a 1985 article, a faculty member of the Sackler Medical School of Tel Aviv, came to a conclusion regarding premedical and medical pedagogy which parallels my own. "Study of pure morphology often consists of short-term memorization which is effective until the examination."[52] Farnsworth, *et al.*, contend that the major problem confronting undergraduate and professional basic science pedagogy is the overemphasis on memorization of facts.[14]

In an excellent article, B. L. Hillcoat speculated that the differences in paradigmatic outlook between the disciplines and medicine had contributed to the problem by the confusion precipitated by two radically relativistic outlooks. His contention is that the paradigms of the basic sciences are oriented toward producing students with a wealth of detail about a given subject (mostly based on recall). The medical field, on the other hand, needs people capable of *analysis, synthesis, evaluation,* and *application* (*i.e.*, Bloom's cognitive taxonomy).[6] In the final analysis, medicine needs practitioners who can diagnose patients' problems.[24] It was not discussed in this article, but I would also offer that premedical and medical students need to develop affective areas and scholarly values. The

summation of this excellent article recounted the perspective or paradigmatic differences which produced, in part, the thalidomide tragedy. "The basic science paradigm truthfully asserted that thalidomide could never be proved to have produced deformed offspring." Since positivist science can only disprove, never prove, the distribution of thalidomide continued long after the applied scientists recognized its teratogenic potential.[24] The author's contention was that these paradigm differences should be explored as they relate to problems present in premedical and medical education.[24] This might lead to an interesting qualitative research project of some importance.

The article on the one-hundredth anniversary of the Department of Histology of the Bucharest Medical School was included as a somewhat whimsical and, in its own way, sad commentary on the teaching of basic medical science. Many of the procedures used in modern medical schools were already in place in Bucharest in 1880.[11]

Medicine is so conservative that it probably should be classified as reactionary. Dr. Basmajian, a faculty member of a Japanese medical school, makes a plea for a return to the old ways of medical education (*i.e.*, memorization and recitation).[1] This man is not alone in his resistance to change, and many doctors I have known still hold with the "what was good enough for dad" philosophy. Attitudes such as these must be dealt with if curriculum advances are to be effective.

The publications listed above are but a part of the literature defining the parameters of the problem produced by the memorization-and-recall syndrome that seems to have evolved in basic science pedagogy. In the next portion of this section we will look at various methods educators have used to rectify these problems.

Since part of this dissertation involved the structuring of a course in histology, consciously designed to enhance control of the cognitive process, I drew from the literature some of the approaches I have incorporated into the curriculum of the course. Several authors felt that audio-visual enhancement added to student performance.[2,26,29,38,40,43,53] These approaches basically facilitate memorization, but they are highly thought of by educators. The microfiche system allows students to have a permanent copy of the slides they must memorize and is time- and cost-effective. I spoke with Drs. William (University of Queensland) and Zac Cornell (Ohio State University) about the use of microfiche. Both men were enthusiastic about their use and felt that the approach allowed students time to develop more important skills.[38,50]

Several studies looked toward case studies as a means of developing students' cognitive skills.[30,37,39,52] Case studies have proven to bring some relevance to basic science courses, as well as requiring students to reason through the abnormal processes rather than just to memorize a group of facts. The author's experience with incorporation of case studies was all favorable.

Unfortunately, the vast majority of the publications reviewed tended to be directed toward more efficient ways to assimilate or memorize large quantities of data. Almost invariably, these authors were interested in the lower cognitive levels as described by Bloom.[1,2,3,5,9,14,15,16,17,18,21,23,24,26,29,34,40,41,50] As this large number of citations indicate, there is still a considerable push for better ways to do the same old thing.

Several articles provided food for thought in designing the course I taught as part of my dissertation. Canady's and Lancaster's article on the deficiencies inherent in undergraduate premedical classes added determination to my desire to explore more relevant curricula for this class.[8] In Haumont's, *et al.*, article the authors equate analysis and synthesis to diagnosis.[25] I agree with their position. Unfortunately, the faculty at the University of Louvain crafted a course which still emphasized memorization.[25]

In 1985, Wolman discussed an experiment conducted at the Sackler Medical School in Tel Aviv. He recognized the problems with memorization, and, as part of his course, he used Socratic methods in small break-out groups to discuss the relevance of the study material. While Bloom's objectives are not mentioned, Wolman's methodology was consistent with the cognitive taxonomy. He states that his results were good and the students had a favorable response to the program.[52] Rhodin used a similar approach which he based on organ systems.[39]

In 1973, O'Morchoe, *et al.*, devised a very holistic program which incorporated several innovations (*i.e.*, incorporation of research data and discussion groups).[36] I spoke by phone with one of the authors, Dr. Donati. He felt the program produced excellent results; however, when the husband-and-wife team of O'Morchoe left the school the program languished. Dr. Donati felt that they had made definite strides in the development of cognitive skills in their students during this three-year study.

A synthesis of the literature concerning premedical and medical pedagogy shows that the system is still replete with "innovations" which improve students' ability to memorize. Positive concepts I have drawn from seventeen years of professional experience and literature review are: use of case studies, incorporation of analysis and evaluation of current research articles, discussion sessions, use of microfiche, and use of Bloom's taxonomy to design curriculum for the course.

Qualitative Research Studies

This section of the literature review encompasses articles about the way Bloom's and Perry's taxonomies are utilized[6,9,13,25,29,36,37,45] and a few of the projects for which Grounded Theory Research has been used.[10,19,27,42,46,47,49,51] I have been especially watchful for any articles which explore any part of the affective domain.[7,20,44,48]

During the late 1950's Bloom and his colleagues crafted three handbooks called Taxonomy of Educational Objectives, which have had a major international impact on pedagogy.[6,48] Even though a few authors[36] are somewhat critical of these works, the overwhelming consensus is favorable.[48] Bloom's group produced three handbooks covering the cognitive, affective, and psychomotor domains. Education has concerned itself primarily with the cognitive domain. Lip service has been paid to the affective domain, while the psychomotor has found limited use.

Handbook 1 (cognitive domain) has been widely used in elementary[15] and higher education pedagogy.[22] Much of the literature concerning Bloom concentrates on the *knowledge* and *comprehension* levels of the taxonomy.[9,13,20,25,45,48] Bloom's work is so clearly grounded in reality and reproducibility that it has become one of the mainstays of curriculum design. In many ways Perry's stage theories parallel Bloom's work. The two are often used hand in hand.[37]

In Krathwohl's and Bloom's affective domain, their group attempts to illuminate and classify the affective domain.[29] Some research has been done in this area; however, all the authors only mentioned the domain or tried to quantify emotions.[7,20,44,48] Bloom himself mourned the difficulty of studying the affective domain quantitatively. His work took place before the full development of the qualitative research movement which has allowed research to examine people's feelings and values.

Grounded Theory Research is an inductive research method which is used to develop theory. Grounded-Theory studies are used in areas which do not lend themselves to quantitative methodology. Some examples of the Grounded Theory are as follows: Kozma, in 1985, used the methodology to develop a theory concerning the implementation of innovations in higher education.[27] The theory was used to design a master's program in science education, also in 1985.[45] The same woman, B. S. Spector, examined the effects teachers experience when they are required to undergo a role change (in this case, to add science courses to their teaching load).[49] In a similar study, Hehrke used the method to study teachers' role conflicts.[19] C. F. Conrad is a great proponent of Grounded Theory and has used the methodology extensively to study problems in higher education.[10] Finally, the nursing profession has embraced the Grounded Theory with great enthusiasm. Nurses are often interested in affective issues as they change with time, and they have found the method ideal.[51]

In 1991, Spector and Gibson conducted an extensive Grounded Research study designed to examine factors which facilite the learning of science.[47] They developed a well grounded theory, part of which was deemed to be affective. In fact, the authors seemed somewhat surprised by the extent to which affective factors influenced the respondents. The respondents were secondary students participating in an intensive science camp. The authors noted the affective

factors, but did not follow up on this aspect of their theory.[47]

Cross studied scientific literacy in 1975 and attempted to quantify affective outcomes. He acknowledged the intrinsic difficulties; however, he feels that the test he devised has merit.[22] He based his study on the Bloom taxonomies. I found no support within this literature review for quantification of the affective domain.

In an article written by Dr. Tamir of Hebrew University, he studied cognitive abilities versus preferences. He placed the study between Bloom's cognitive and affective domains. He found no statistical correlation between the two areas.[48] Some attempts have been made to link learning style instruments such as the Hill Cognitive Style Inventory with affective attributes, but Tamir met with little success.[7]

In Perry's article on cognitive and ethical growth, he took a different tack. He produced a model which characterized cognitive and ethical growth, based on stages of students' intellectual and emotional growth. His theories dovetail nicely with Bloom's taxonomies and provide a powerful tool for this study.[26]

Conclusion

The literature was found to be in agreement with many opinions I have expressed in the introduction concerning the process of educating our premedical and medical students. In some measure, the literature supports the holistic

approach I propose in the methodology to follow. The approach is designed to help students develop greater control of their cognitive processes. There is considerable support within the literature for the use of Bloom's and Perry's work in curriculum design. Bloom's interest in links between the cognitive and affective domains in part inspired the present study.[29]

Grounded Theory Research is a well established and documented qualitative methodology for exploration and examination of a wide range of phenomena which cannot be easily quantified. The method is especially useful in tracking changes in people's feelings over time. Oliver has expanded the concept of Grounded Theory to encompass a new way of looking at science education which he calls grounded knowing.[35] He combines the post-positivist philosophy with the concept of knowledge grounded in reality.[32]

Although several studies, as noted above, have touched upon the affective domain, this extensive literature search did not reveal any studies attempting to examine links between the cognitive and affective domains.

CHAPTER 3

METHODOLOGY

Introduction

In the introductory chapter of this study I spoke to the process of conscious development of scholarly values. In the definition of terms portion of the introduction I crafted a definition of those values. The basis for my definition lies in my own reflections, over the course of my academic and professional career, about what constitutes scholarly values. In an article published in 1991, Rando and Menges speak to making implicit theories explicit through reflection and the questioning of personal theories. The authors postulate that teaching can be enhanced by combining explicit personal theories with formal pedagogical theory.[38] In large part, this research study follows these lines. I have proposed using Bloom's and Perry's theoretical constructs to produce a theory resulting in the possibility of a curricular model which can be used to enhance scholarly values in students. This type of research, to be valid, must take place where reality occurs --in the classroom.

The Project

I was hired as a visiting assistant professor within the zoology department to teach a course in histology (course 4253). The position was offered to me in part to fill a departmental need, but more importantly, as a vehicle to facilitate the completion of this classroom research project. The setting is a research university located in a small midwestern town. The university is one of two large universities in the state.

The histology course is one semester in length (approximately 5 months). It is taught once each academic year in the spring semester. The course deals with human microanatomy and is elected largely by students with a medical orientation.

According to my interviews with faculty, it appears that, in most other institutions, this course has been taught at the *knowledge-comprehension* level as classified by Bloom, *et al*. At the undergraduate and professional levels, the course usually is conducted as a combination of lecture and laboratory that requires students to recognize the morphology and function of microscopic anatomic structures. This course has been dominated by memorization and recall. In fact, in spite of having taken the course twice, I have found myself spending many hours re-learning the material in preparation for teaching this class.

My organization of the course is designed to increase the students' perception of the relevance of histology to their future interests. Towards this end, I have

incorporated case studies, analysis of research articles, discussion sessions, and guest research speakers. In other words, the instruction methods and materials that I have chosen comprise a conscious attempt to aid the students in developing higher cognitive skills and becoming more self-reliant learners.

One of the functions of this project is to teach the subject course in a manner that benefits the students. The purpose of the study taking place within the framework of this course is to document the presence, degree, and type of affective changes taking place, over time and as a result of the conscious inclusion of the above discussed methods and materials, in the students enrolled in the course.

Grounded Theory

Grounded Theory has been defined as theory generated from data that has been systematically obtained through the constant comparative method. It is an inductive method of discovering theory and has most recently been elaborated by Strauss and Corbin.[47]

The constant comparative method is a multifaceted approach to research, designed to maximize flexibility and aid the creative generation of theory. The method combines systematic data collection, coding, and analysis with the theoretical sampling that leads to the generation of theory that is integrated, close to the data, and expressed in a form clear enough for further testing.[10] The approach has been separated into four protocols: (1) the collection and

coding of data into a maximum of categories, (2) the placement of categories into bins on the basis of constant comparison of data with other data, (3) as concepts develop, the linkage of relationships leading to theory development, and (4) the presentation of theory, or of propositions when theoretical saturation has been met.

The primary data was derived from two twenty-minute interactive interviews (a pre- and a post-). I conducted these interviews, constructed the protocols used in them, and analyzed the data generated from them. An analysis of the initial interview placed the students within Bloom's affective domain classification. Using a Grounded Theory approach, the post-interview was formatted from the data generated in the first interview. Since I was exploring an area of knowledge about which little was known, a qualitative study that incorporated the flexibility to change the protocols as the reality of the situation is defined was of utmost importance.

Grounded Theory is especially useful in studies which measure how people's attitudes change with time. Since this is exactly what I am exploring, the choice of this methodology is not only logical, it is also imperative.

By using Grounded Theory, I was able to set up questions for the next interview and use the data from those interviews to determine the next set of questions, rather than predetermining the results by defining the two protocols beforehand. Thus, the methodology becomes an integral part of the conceptual framework by which the study

proceeds. The conceptual framework and the methodology are inseparable and intertwine to produce a theory or proposition which will have value to students and educators.

Protocol for the First Interview

The protocol for the first interview (see Appendix A) is constructed in a manner consistent with the Grounded Theory. The interview instrument was constructed using the variables in Krathwohl's and Bloom's Handbook 2 (affective domain). This classification system breaks the affective domain into five general but hierarchical areas. These areas equate to willingness to receive, willingness to respond, placement of a value on something, organization (conceptualization of a value and organization of a value system), and characterization by a value complex. The initial questions were designed to elicit responses in students that could be interpreted in light of the taxonomy. This enabled me to place the students, as individual respondents and as a group, within the framework of Bloom's affective domain. As the course proceeds and the students' control of their cognitive processes increases, I was able to track any changes which occured in the students' affective growth.

Permission

All research which involves human participants requires approval by the Instititional Review Board. The purpose of this process is the protection of the respondents from physical, emotional, or any other form of harm. The form was completed and presented for approval before the course began (see Appendix B). The board requires that all human subjects give informed consent. This not only requires having volunteers sign the consent form, but also requires giving them a complete explanation of the form and what it represents (see Appendix C). Confidentiality has been assured for the respondents and the university. The identity of the respondents will be known to no one but me. This identity will be used only within the confines of this study and then will be destroyed. The taped interviews are identified by a file number before transcription so that names are not associated with the audio tapes or the transcribed interviews.

Information Selection

Informants were solicited from members of the course. Participation was sought on a voluntary basis, and no incentive, either monetary or grade advantage, was offered to the students. In other words, participation in the study made no difference in the students' grades in the course. In a manner designed not to contaminate the study, I briefly

explained the purpose of the study and requested volunteers in the first class period. As few as ten respondents would have been sufficient to conduct the study. However, eighteen students agreed to participate.

Data Analysis

The data was coded and analyzed to determine a base-line analysis of the students' cognitive and affective positions. I utilized *THE ETHNOGRAPH "An MS-DOS program for the analysis of Qualitative Data"* to facilitate analysis. This software program is a proprietary product of the Qualitative Research Management Company of Desert Hot Springs, California. The program facilitates the grouping of similar concepts or categories.

The *Ethnograph* program is designed as an instrument to be used in qualitative research studies. Codes for bins or categories are entered into the program by eight-digit designations that are representations of the names of the categories. The initial codes for this study are contained in Appendix D. The program has gained wide acceptance within the groups of scholars embracing qualitative research.

Following the analysis of the first paper and interview, I developed a protocol and linked it to Grounded Theory. This process enabled me to make any changes in instructional techniques deemed necessary to maximize the usefulness of the study.

The ultimate result of this study will be a theory illuminating the linkage between the affective and cognitive domains within an instructional setting. If it can be shown that a positive relationship exists between the two domains, this research will produce, as a natural development of its process, a model that can be used by others for further study or in the design of curriculum.

CHAPTER 4

TOWARD AFFECTIVE GROWTH

Introduction

The class (Histology 4253) that provided the subjects for this study consisted of twenty-five students. The class was composed of five women and twenty men. The twenty-two undergraduate students included one biology major, one home economics major, three zoology majors, and eighteen physiology majors. The graduate students were both physiology majors. Whereas twenty-four of the students were taking the course for credit as part of their majors, for the other student the course was elective. Twenty-four of the students aspired to careers in medicine. The home economics student was majoring in poultry science.

In discussing this class with several senior professors before the course began, their most common comment was that this class represented "the best of the best." These students had survived the winnowing process of a difficult department and were still there to be taking a four-thousand level course. Additionally, all but one of the students considered themselves as premedical students. Upon entering the class, the lowest grade point average reported by the

students in this class was a 2.8, whereas the overall departmental average was near a 2.5.

One professor expressed sympathy for me. For my first experience teaching upperclass students, I had to teach a class of largely second-semester seniors. He explained that it is "next to impossible to motivate a group like that. Most of them tend to start to coast around Christmas break."

The purpose of this chapter is to present the data generated during the course of this study. For the sake of organization, the analysis of data is broken down into three time periods and is designed to evaluate the overall change in the students within the time limit of the project. Although separated into three periods, the evolution of the students' cognitive and affective growth was continuous rather than episodic in nature. The segments will be labeled alpha, mu, and omega, signifying in the beginning of the course, in the middle, and in the end, respectively.

In the three segments, I will present a cross-sectional view of the students in the study at the given point in the continuum of their growth. My analysis is based on student performance on assignments and interviews, both of which I designed to assess their cognitive and affective abilities and progress within Bloom's taxonomies. By applying Perry's model of ethical and cognitive development, I was able to further define the students' growth. Throughout the entire process, I closely examined the data for any evidence of linkage possible between the cognitive and affective domains.

Alpha Period

As discussed previously, I used two instruments to provide a baseline for this study. The first written assignment, which required the students to analyze F. H. C. Crick's original article, "The Structure of the Heredity Material," enabled me to evaluate each student's baseline of cognitive abilities. The assignment was made with the instructions, "Please analyze this article." No further instruction was given regarding how this was to be done. This article, first published in the late 1950's, details the work of Watson and Crick regarding the development of the model for DNA. The choice of this particular paper revolved around its importance to the entire area of life science. I assumed that all of the students would be familiar with the concepts presented in the article, if not with the article itself. The students were assigned the paper on the first day of class (Monday predating the first interviews), with a completion date of Friday of the first week.

I began the initial interviews (Appendix A) on the first Friday of the term and continued them through Wednesday of the following week.

Cognitive Baseline

I analyzed the students' first papers on Watson and Crick by considering their action verbs to indicate their

cognitive skill. In this way, I was able to characterize the students' cognitive ability.

The students fell into two distinct patterns or groups, a dominant group, the literalists, and two students whom I have termed the anomalies. The literalists demonstrated mastery of Bloom's literal cognitive skills, that is, *knowledge* and *comprehension*. The two anomalous students possessed the same literal skills exhibited by the literalists, but also possessed considerable control over higher cognitive skills as well.

The Literalists.

Twenty-three students demonstrated a literal approach to the first assignment. Of the group, four were women. All of the juniors and both graduate students were part of this group.

Knowledge and *comprehension* are literal cognitive skills. Bloom breaks knowledge down into several components: (1) knowledge of specifics (terminology, specific facts, ways and means of dealing with specifics), (2) knowledge of conventions, trends and sequences, classifications and categories, criteria, methodology, universals and abstractions in a field, principles and generalizations, and knowledge of theories and structures. Further, comprehension is defined as the "lowest level of understanding" and is broken down into three broad areas: *translation, interpretation,* and *extrapolation. Translation* is "the ability to understand non-literal statements

(metaphor, symbolism, irony, exaggeration)." *Interpretation* is "the ability to grasp the thought of the work as a whole at any desired level of generality." *Extrapolation* is "the ability to deal with conclusions of a work in terms of the immediate inference made from the explicit statements."[6] Bloom states that while all of the skills under comprehension may, and possibly do, extend into the higher cognitive processes, knowledge is a precursor to the higher orders of cognition.

The literalists demonstrated proficiency in the cognitive processes of comprehension: *translation*, *interpretation*, and *extrapolation*. *Translation* (paraphrasing) was a prevalent mode of expression in the initial paper. For example, one senior male physiology major wrote, "this original publication of the theoretical structure of DNA is a broad discussion of many fundamental characteristics of the double helix, including chemical make-up, actual structure, replication procedure, and its function as control center of the cell." This meets Bloom's requirement because the paraphrasing is accurate and faithful to the original article. *Interpretation*, a second process present in this group, was given by a senior male physiology major who wrote, "From physical-chemical measurements and electron microscopy techniques, Crick discovered that not only is the sugar-phosphate backbone structurally significant, but through hydrogen bonding the individual nucleotide base pairs aid in adding rigidity." This is an accurate explanation of a portion of the article.

This meets Bloom's criteria for the process of *interpretation.* Finally, a senior male physiology major wrote, "These findings (perhaps the most significant discovery of the 20th century) laid the foundation for many medical advancements as well as the current research in genetic engineering." This quote discussed the effects of the author's discovery, fitting Bloom's characterization of *extrapolation.* Although the literalists exhibited only basic cognitive skills, their ability to communicate was proficient.

The group demonstrated no significant independence of scholarly thought. They repackaged the thoughts of Crick to fit a two-page paper, giving little or no thought to the deeper implications of the work.

According to Perry's scheme, the literalists appeared to cluster around the multiplicity level. Typical of this position, the students questioned the authority, but could not evaluate where "real authority" comes from. For example, one student somewhat awkwardly wrote, "It makes me wonder if someone else had the same information that the authors possessed, and Watson and Crick rushed into publication with a poorly written article to beat their competitors." This student called into question the integrity and authority of the authors by casting doubt on the research effort and the possible motives Watson and Crick may have had in the way they handled publication of the article. It is indicative of the "Multiplicity correlate: Relativity subordinate" stage in Perry's model.

A student at this stage would exhibit legitimate uncertainty and diversity. Frames of reference other than authority's are seen as extensive and non-temporary.[37]

The Anomalies.

One man and one woman demonstrated cognitive abilities anomalous to the larger group. The two anomalies were senior physiology majors and aspired to careers in medicine. Both students demonstrated responses in the inferential and evaluative area of the cognitive taxonomy. The man in this pair started his analysis by writing:

> F. H. C. Crick's paper reads more like a history novel than what I would expect from a Nobel Prize winning work. The author keeps his paper short and to the point, explaining even basic terms to the reader. Crick doesn't attempt to hide his enthusiasm, a trait sadly lacking in more modern papers. Fortunately for his reading audience, Crick was not aware of the unwritten rule that dryness means scientific.

In this small segment of his analysis, the student evaluated both the paper and the manner in which it was written. This student concluded that "Crick's research was mostly guesswork and luck; his writing style gives the impression that he was simply in the right place at the right time." This is a penetrating analysis of this paper. Many disciplinarians feel that most of the work behind the model produced by Watson and Crick was accomplished by other individuals. Watson and Crick, while brilliant men, were "in the right place at the right time."

The second student in this group introduced her paper by writing:

> An analysis of Crick's The Structure of the Hereditary Material leads me to be amazed at how one person could come up with so many assumptions, and then for them to be accepted as truth almost immediately. Crick made a very good consolidation of the research on DNA going on at the time, and he developed it in such a way that some very innovative answers came out of it. Much in the same way that an ecologist cannot look at properties [or] at one individual, but must study the entire population as a whole to find emergent properties, the new approach that Crick took in his research brought out a whole new rationale, along with a new hypothesis to test.

In this particularly insightful introduction, the student used application and synthesis in her use of ecology perspectives to examine the work of Crick. Her allusion to the methodological norms of the ecologist indicated a working knowledge and understanding of the general paradigm of the discipline. The student continued her critique, "The author uses the research of others such as Wilkin's X-Ray photography, but no sources were cited in the text of Crick's article." This woman demonstrated mastery of synthetic and evaluative skills in this piece. Finally, she made an astute observation about terminology: "[W]hile reading the article I noticed that what is now known as deoxyribose, the sugar residue in DNA, was labeled desoxyribose." This woman's ability to recognize this minor change in spelling demonstrated an acute awareness of technical accuracy.

Both of these students demonstrated their ability to use higher cognitive skills. The students both demonstrated evaluative processes in the initial paper. The woman, in addition, demonstrated inferential skills in her use of ecology perspectives in her argument. Both students clearly exceeded the representative norm of the class in their execution of this initial paper.

Affective Baseline

One major difference in the affective taxonomy versus the cognitive is the hierarchical nature of this domain. Bloom states that affective performance at any given level assumes proficiency at all levels subordinate to the level in discussion. For example, a student's response that indicated *valuing* meant that the student had also mastered the subordinate levels of *receiving* and *responding*.

Values and their acquisition are difficult to measure and evaluate. Affective responses to external and internal stimuli are a blend of many factors. All of these factors seem to be modulated by the individuals' experiential frames of reference. This interplay makes study of the affective domain most difficult.

I used the initial interview to assess the students' placement in the affective domain. All students in the study group demonstrated *receiving* and *responding* attributes in their answers. Bloom explains that in defining receiving,

> We are concerned that the learner be sensitized to the existence of certain phenomena and stimuli; that is, that he be willing to receive or attend to them. This is clearly the first crucial step if the learner is to be properly oriented to learn what the teacher intends that he will.

When asked if they enjoyed their studies now more than in high school, all students answered the question positively. The open nature of this question produced results ranging from the students' simply being aware of the difference between high school and college to the expression of some specific values, such as the appreciation of freedom. On the lower end of the response of receiving and valuing, one student, typical of the group, said, "I guess 'cause I get to choose what I get to take more instead [of] having it pressed on me; I enjoyed that." This student indicated a basic awareness of the difference between high school and college, as well as illustrated satisfaction in response.

Satisfaction in response is defined by Bloom as "behavior accompanied by a feeling of satisfaction, generally of pleasure." Further illustration of *responding* and *satisfaction* was produced by the question, "When you are reading something in your studies, does it irritate you to be interrupted?" A senior female physiology student responds,

> Yeah, I am enjoying it; it's my own personal time that I have put aside to do this and I'm having a certain thought going. I'm reading something that interests me and I'm absorbed in it. Then I get interrupted, I lose that, you know?

The student communicated the pleasure she takes from her studies, but also demonstrated her commitment of time to her studies. She does, however, allow an interruption to interfere with her return to the item she was studying, indicating some lack of scholarly discipline.

Since the affective domain is hierarchical, each level includes the preceding level. Therefore, all of the students having demonstrated the second level, "satisfaction in response," the class baseline is located in this level. The students demonstrated three distinct levels of affective growth: Pre-Scholars, Incipient Scholars, and Apprentice Scholars.

Pre-Scholars.

The least affectively advanced group were the Pre-Scholars, who demonstrated solely responding emotions at the onset of the course. While they produced limited responses that may be interpreted as *valuing*, this was not the dominant pattern of this group. The Pre-Scholars consisted of eight individuals, seven men and one woman. Two of the students were zoology majors, and the remainder were physiology majors. None of the respondents were graduate students.

In response to interview questions, these students demonstrated characteristics of the lower two levels of the affective taxonomy, that is, *receiving* and *responding*. Several characteristics predominate in their responses: the relative absence of scholarly values, the relative

importance placed on social pleasure, and the unquestioning acceptance of family and religious values. In sum, the group exhibited little attempt to take responsibility for their personal and professional growth.

The Pre-Scholars did not exhibit many internally adopted scholarly values. When asked about leisure reading, a senior male physiology student explained, "I like to read magazines like Sports Illustrated. I like to read scary books. I'm just kinda a magazine type person. I don't even get into reading newspapers. Just can't get too much out of that stuff." This student demonstrated little or no interest in disciplinary and scholarly values and was typical of the Pre-Scholars.

When asked about membership in a disciplinary or medical club, the Pre-Scholars showed little enthusiasm and interest in these activities. For example, a junior male physiology major replied, "No, I'm sure not. I went to two meetings, but...I didn't really get anything out of it." These questions were designed to explore several elements of scholarly values: association with other scholars, interest in presentations pertinent to one's field of interest, and indications of preliminary commitment to the field through related reading interest.

These students were bright, willing to work and grow, and, as the previous section indicated, quite proficient in the cognitive areas of knowledge and comprehension. Some had quite remarkable grade point averages, but had attained these marks from their ability to manipulate the tools

inherent in the literal area of the cognitive domain and had yet to develop organized value systems beyond values imparted by their families. These values were accepted based on external authority (what their parents taught them), rather than being self-derived or internally derived values.

The Pre-Scholars appeared to be clustered at the multiplicity position in Perry's model. Perry argues that rapid growth into relativism can take place from this position when student growth reaches a certain point. The Pre-Scholars occasionally gave responses that indicated some dualistic thinking, such as the response given by a male physiology major:

> We started talking about evolution and how evolution could predict the future, and that went against everything I had ever been taught. I left.

Such responses were no indication of relativistic attitudes.

The term Pre-Scholars is apropos for this group. They had mastered the basic tools of scholarship. These students were competent in literal skills and demonstrated a pleasure response associated with their studies. This cohort of students was also poised at the upper reaches of multiplicity, a position from which rapid cognitive and ethical growth is possible, given adequate motivation.

The second group of students are the Incipient Scholars. These students possessed all of the characteristics of the Pre-Scholars, plus demonstrated a number of higher affective characteristics.

Incipient Scholars.

The definition of incipient is "just beginning to appear or occur." This word is particularly applicable to the second group of students. Confirming the hierarchical nature of the affective domain, the students in this group demonstrated the characteristics of the Pre-Scholars as well as higher affective attributes. The Incipient Scholars consisted of six men and one woman. One student was majoring in biology, while the others were physiology majors. This group contained one junior, one graduate student, and five seniors. The responses of this group to protocol questions were consistently more advanced within the affective domain than the Pre-Scholars. As I will discuss, I found clear indications of scholarly values among the Incipient Scholars.

Describing the third level of the affective taxonomy, *valuing*, Bloom says,

> Behavior categorized at this level is sufficiently consistent and stable to have taken on the characteristics of a belief or an attitude. The learner displays this behavior with sufficient consistency in appropriate situations that he comes to be perceived as holding a value. At this level, we are not concerned with the relationships among values but rather with the internalization of a set of specified, ideal values. Viewed from another standpoint, the objectives classified here are the prime stuff from which the conscience of the individual is developed into active control of behavior. This category will be found appropriate for many objectives that use the term "attitude" (as well as, of course, "*value*").[29]

One student illustrated several attributes of *valuing* in response to my question regarding college versus high school studies. "Yeah, it's a lot harder, but it's stuff I enjoy learning about. I don't just do it to get it out of the way and get it done." This student expressed his scholarly value of enjoyment of learning, and also the existence of the early formation of a value system. This same student, when asked to define a discipline, answered, "a dedication." In a sense, this answer distills to the essence what it means to be a disciplinarian in the academic sense.

With regard to his leisure-time reading, a male physiology student said,

> ...[R]ight now, my leisure reading is probably nil, because I do so much reading every night that I just want to get away from that and take a good hour break from it and settle down. The way I look at it is, if I have time to do leisure reading then I should be reading on my studies. They're more important at this time.

He demonstrated the affective level of *valuing*, *scholarly value* (commitment to a scholarly goal) and *commitment* in attainment of his educational goals. This man's response was typical of his group. He was consistent and exhibited conscious development of a value system. The students all placed scholarship, or at least the activities needed to fulfill their medical aspirations, above any leisure activities.

The beginnings of disciplinary values impacting the students' personal value systems are typified by the following statement from a graduate physiology major in

response to a question about personal feelings of responsibility in ethical dilemmas facing his discipline:

> Yeah, I do sorta feel responsible. There's a lot of things in this world that are either--as far as, like, disease or ways that we could better this society. So I do feel some responsibility, as if I'm a specialist in genetic engineering, then I have responsibility to try to make it better and more ethical.

The students demonstrated a growing sense of maturity and development of values. They were at a stage of beginning to assume a shared sense of responsibility for the difficult questions facing the discipline, which is indicative of the value they placed on scholarly activities.

Finally, from a senior physiology major, "You know, when I do have leisure time, I like to read totally different things. I like to read literature; I like to read philosophy, both general and the philosophy of science." Her response covers a lot of ground. Her comments, like those of the other Incipient Scholars, showed a development of scholarly values, such as love of learning for its own sake (reflected in her interest in philosophy). Her interest in the philosophy of science is indicative of the internalization of disciplinary values.

At the beginning of the course, the Incipient Scholars had achieved the third affective level, *valuing*. They had begun to enjoy the process and content of learning and to manifest the early formation of a disciplinary value system. The least advanced of this group demonstrated considerable progress in the affective level of *valuing*. The Incipient

Scholars, while not scholars yet, were, at the very least, scholars-in-progress.

Classifying this group according to Perry's scheme is fairly straightforward. In addition to exhibiting multiplicity traits, their responses indicated that they were also willing to make commitments characteristic of disciplinary values. This attribute distinguishes the group from the Pre-Scholars within the Perry model.

Apprentice Scholars.

This last group, which consisted of three women, were also well grounded in the *receiving* and *responding* categories of the affective domain. Two of the women were seniors, while the other was a graduate student. All three students were majoring in physiology and all were interested in medical fields. One woman additionally aspired to the Ph.D. in physiology as well as the medical degree. One of the undergraduate women was one of the two anomalous students with highly developed inferential and evaluative cognitive skills. All three respondents clearly demonstrated the development of well-reasoned and relativistic value systems. They possess professional goals and have begun to understand and embrace scholarly values. These students have advanced beyond their classmates into a stage of organizing their own value systems.

The Apprentice Scholars have adopted a relativistic approach toward their academic careers and their value systems in general. This characteristic distinguishes them

within Perry's scheme from their classmates. The data indicate that these students are "establishing their identity through commitments."

The Apprentice Scholars characteristically demonstrate *commitment* and *relativism*, a convergence of Bloom's affective domain and Perry's model at a high level. In the first protocol, I asked the students, "What problems do you see in genetic engineering?" One Apprentice Scholar said,

> Well, it would certainly be easy to use in certain trivial ways, and there needs to be certain guidelines, I think, and they should be set forth by zoologists. I mean there is a certain area of understanding that zoologists have that legislatures are not going to have, and there needs to be discussion between them, and a certain amount of self-regulation. I see a serious problem with self-regulation. I don't know if it would work or not. I just can see it being used in the wrong ways.

This senior woman apparently understands that research outcomes can be relative. She *conceptualized* a *value* in that she realized that the results of experimentation cannot be divorced from the effects of that research upon society. She demonstrated that she possesses a relativistic attitude in her view of authority, and one that is quite cynical. Unfortunately, in terms of her disciplinary preparation to deal with ethical problems, she indicated that she has not been prepared--"As far as my education, I don't think so."

When the graduate woman was asked about the authority of educators, the woman traced her own affective growth:

> I guess the older I get, the more I question. Like, you know, [as a] freshman, whatever they said I believed,

> and the older I get, the more questioning I [do]. You know, if a professor says something kinda off-handed about something, you know, I don't necessarily confront him. I don't think that would be taken well around here.

Her response illustrated her relativistic thinking. The student is aware of the changes that have occurred within her own perceptions in the course of her education. She also recognizes that, as her education progressed, her view of authority changed to a relativistic attitude. This is indicative of her organization of her value system. Bloom states, "In many instances, the organization of values may result into a new value or value complex of a higher order." The maturation process is indicative of this process.

Finally, when asked about the difficulty of revising her judgments or values, the other undergraduate responded:

> I think I'm open-minded, but I don't accept things unless I am thoroughly convinced. If I have looked at the facts that they have shown, analyzed what they say, I am open-minded enough to say, "Look, I am not going to just accept something for, just say, a simple hypothesis at all." I need facts, and I need to be convinced before I would change my views. But I'm open-minded, and I realize that things are continually changing.

The relativistic nature of this student's thought processes is evident in her understanding that knowledge is in a state of flux. She reported that she requires extensive evidence to alter a value she has incorporated into her value system. The type of affective thinking indicated by this response is at the higher levels of the

affective taxonomy. Implicit in her response is an indication of a commitment to certain values.

Summary

At the beginning of the course, the entire group of students was quite sophisticated in the knowledge and comprehension areas within the cognitive taxonomy. Overall, they were bright, willing to grow, and enthusiastic. Although individual students demonstrated achievement in the advanced cognitive skills, all of the students had mastered the *literal* skills of the cognitive domain. Evaluating the data from Perry's perspective, the students appeared to be clustered around the multiplicity stage.

Affectively, the students fell into three groups identified by the degree to which they articulated values related to scholarship. While all three groups were well-founded in the first two affective categories, *receiving* and *responding*, the Incipient and Apprentice Scholars produced progressively higher levels of development in the affective domain.

Development of scholarly values was chosen as an indication of affective growth. Scholarly values were conspicuously absent in Pre-Scholars. However, significant evidence of these values was present in the Incipient and Apprentice groups.

The preceding information characterizes the germinal attributes of the student pool at the initiation of this research project. The goal of the research from this point

was to explore the degree to which students might develop their cognitive processes through consciously devised instructional methods, specifically through progressively more sophisticated tasks in our Friday discussion group. Changes on the affective side will be tracked through the interview process and student journals, culminating with a final paper.

Mu Period

During the middle of the course, I taught the nature and use of inference and evaluation. I introduced progressively more difficult learning situations that required the students to utilize all cognitive skills from *knowledge* to *evaluation*. The class spent one Friday in the library, under the instruction of the chief scientific librarian, learning library research skills. The speaker used a hands-on approach, and the students appeared to enjoy learning to use the CD-ROM disks pertaining to their disciplines and fields. I used research articles, case studies, and the presentations of guest speakers to provide a variety of formats for teaching complex cognitive skills.

Bloom's cognitive taxonomy served as the framework for these assignments and discussions. I used his descriptions and examples of *application*, *analysis*, *synthesis*, and *evaluation* to teach and discuss the nature and use of the various processes. For example, I gave the students copies of a research article on Monday and instructed them to break the articles down into their components. They were then

instructed to discuss the processes involved in these components and be prepared to discuss them on Friday. The students were also instructed to evaluate the article. On the following Friday, the students were encouraged to present their analyses and evaluations of the article. I went through the same process required of the students, and we compared our work. In this manner, I was able to stimulate class discussion and create an environment in which the students could develop higher cognitive skills and enjoy the process. Using Bloom's criteria, I went over the higher cognitive process or processes I had selected for the particular problem. I also tried to reinforce good work in a positive manner. Over the course of the first half of the semester, the students started to contextualize the processes. The speakers and case studies were used in the same manner.

Following the mid-term examination, I asked the students to respond to a two-question protocol regarding the research project. I asked, "What part of the course has proved most useful to you to this point?" and "In our Friday discussion group, what has created more interest: analysis of research papers, case studies, or our guest speakers?"

Most of the students wrote that they found the Friday discussion group to be of the most value. One senior male wrote, "The Friday discussion involved the entire class. That was unusual and made Fridays fun." Similar comments were quite prevalent regarding this question and indicated that the class was starting to have fun in a learning

experience. This is an affective response that illustrated "the love of learning" as a scholarly value. A senior female wrote, "The Friday discussions have the entire class enthused about the methods of analysis we are learning. They were definitely the most beneficial part of the course so far." This student's use of the word "enthused" is indicative of Bloom's example of acceptance of a value--in this case, the desire to master a given cognitive process. The final response I will use was written by the female graduate student. "The Friday discussions tended to make the rest of the course seem more relevant and, because of this, more enjoyable." This student linked the discussions with what the students considered important: their aspirations to gain entrance to medicine. She also indicated the enjoyment of the process.

The second question, regarding the format of the Friday discussions, was an almost unanimous endorsement of case studies. A junior male wrote:

> Case studies are the most interesting. They deal with what is actually going to take place in the "real world." This adds more to our knowledge than the papers or speakers. The papers or speakers may cover something we don't totally grasp.

This response is indicative of the scholarly value of enjoying the process of learning, as well as understanding the application of the analysis we were studying. Another student answered, "Case studies by far. They put to practice (*application*) everything we have learned the past four years." Another student commented, "Case studies. I

am really interested in looking into these cases. They are very interesting and stimulating." Both of these students also demonstrated the scholarly value of enjoyment of learning.

The case studies had helped the students begin to place *value* on some of the scholarly values. The case study was the only format I used in the initial one-half of the course that required the students to use the library and to develop and use inferential and evaluative skills.

The case studies used in class were purposely selected to force students to use complex cognitive skills. For students to perform well in our Friday discussions of the case studies, it was necessary for them to use all six cognitive processes, from knowledge to evaluation. To prepare for the discussions, the students were required to use the library CD ROM medline, their texts, and other sources of information. The case-study methodology put the students into the role of diagnostician. As such, they were able to assume a role that matched their career aspirations.

The cases were woven into the fabric of the course. They covered the histoloy material we were currently studying and a type of pathology that might affect a tissue, organ, or organ system. While enough information was provided for the students to solve the problem posed by the case, enough information was deleted that the students were required to exercise all of their cognitive skills to be successful. Many students stated that case studies started

as an assignment and, to their surprise, became a passion. One junior stated:

> I found the case studies to be a lot more interesting. You know, looking up ahead of time, trying to look at the problems. Trying to decide and then be able to go in and have you discuss each area and pick out pieces of the puzzle we might have missed and putting them together. I thought that was really pretty interesting.

This woman's comments demonstrated the scholarly value of *enjoyment of learning*. When she spoke about picking out the pieces of the puzzle and putting them together, she was illustrating her use of *analysis* and *synthesis*. Almost all the students were enthusiastic and indicated that the process of *analysis* was intriguing for them. Another student, a graduate male physiology major, made the following comment about our case studies:

> It made you think more than just what your gut feeling was. You know, when we wrote all of those diseases or symptoms that could happen, you would look at it and they would all basically look the same, but you had to look further in and you had to think. Everything had to be relevant, and it really made you see in a broad sense--You were looking at a person, not just symptoms. I like that; that was fun. It was more than the medical aspect. It was kind of their personality, their behavior. I thought that was fun.

In addition to making learning fun and developing cognitive processes, the case studies helped this man to learn that reality is often different from your "gut feeling." His response is indicative of progress toward relativistic thought.

Comparing the case studies to other types of class activities, one student explained:

> I think it gives us an opportunity to learn what things are going to be like. A lot of classes we take now are just read-and-regurgitate. You just have to memorize what someone tells you, or you read and spit it back out. We are not forced to think much any more. Case studies are different. They're fascinating.

This woman understood that the role-playing nature of the case studies forced her to use her cognitive skills, and she enjoyed the process.

Many students mentioned the "puzzle" or "game" nature of the case studies, as did this student:

> Being able to communicate out loud, we used that a lot because you'd ask us questions, and we would volunteer and stuff like that. With case studies, we were able to take a puzzle and look at all of the different sides and try to figure out what was going on without jumping in too quick. I like how you did those case studies on Fridays.

This student was expressing how much "fun" an assignment designed to develop advanced cognitive skills was to him.

The final quote is somewhat lengthy. However, it gives a good overview of the Friday experience and case studies:

> The Friday experience started off a little bit rocky. No one knew exactly what was expected of us. That freedom I thought was really good, the freedom to decide what we thought we were supposed to do and not being told what exactly was done. As soon as we mastered the tools we needed to use, there got to be a little competition between us, which I think was very good. ...Then it just kept getting better and better. Over the last couple of weeks, the case

> studies were wonderful. Every student was involved.

This male graduate student's response illustrates the development of several scholarly values. The student mentioned freedom to decide what approach to the case to take. Enjoyment of learning is evident throughout his statement. This student spoke about the fun of scholarly competition and how he enjoyed the fact that the entire class got caught up in the enjoyment of that competition. He also understood that, through the case studies, he had come to master the cognitive processes necessary to deal with a "real world" situation. Like all of the students in the study, this student was very enthusiastic about the case-study format. His enthusiasm could distinctly be detected on the tape of his interview. As he talked, his speech quickened, grew more animated, and increased in volume.

The effectiveness of the case studies in the development of cognitive skills and the personal impressions I recorded at the mid-point of the term dictated a greater emphasis on case studies for the remainder of the course. The students were becoming more proficient in their use of inferential and evaluative skills and were growing cognitively. The three affective groups from the alpha period, Pre-Scholars, Incipient Scholars, and Apprentice Scholars, were all participating in the Friday discussions, and, judging by their comments, they were all developing scholarly values. The primary comment I heard during this time referred to the extent of students' enjoyment of and interest in the case

studies. There were also some comments about enjoyment of the library as a tool. The success of the case studies continued for the remainder of the semester and aided a smooth transition into the final or omega segment of this study.

Omega Period

The data that I discuss within this last time period arises from students' journals, final papers, and the terminal interviews that I conducted. Through the data, I demonstrate that all of the students in the study grew cognitively and affectively and illustrate a linkage between the two domains. In addition, the students all progressed toward a greater understanding and appreciation of scholarly values. Finally, I discuss the ramifications of using case studies as an instructional tool for the development of cognitive and affective skills.

Cognitive Growth: "Literalists to Cognitivists"

The cognitive process of the literalists grew from the use of *knowledge* and *comprehension* skills at the beginning of the course to the use of *inferential* and *evaluative* skills at the end.

The primary instrument I used for determination of cognitive skills was the final paper. The topics assigned for the final paper and the instructions given were as follows:

> Choose one of the following topics considered to be controversial within your discipline or field. Take a position; research and defend your point of view. Use the techniques we have discussed during our Friday classes to write your paper.
>
> 1. Euthanasia
> 2. Genetic Engineering
> 3. The Use of Living Animals for Scientific Research
> 4. The Use of Fetal Tissue for Research

Topics for the paper covered disciplinary and medical dilemmas. The paper was to be ten to fifteen pages in length and required at least ten references. No other instructions or help was furnished to the students. The final cognitive achievements of the students were evaluated in the same manner as the initial analysis. The students' papers and journals were examined for *literal*, *inferential*, and *evaluative* processes.

As a group, the literalists showed evidence of the development of both inferential and evaluative skills in the final paper. The two anomalies had also developed cognitively. However, the anomalies were initially producing work in the inferential and evaluative areas of the cognitive taxonomy. Therefore, while their growth was demonstrable, it was not as dramatic as that of the literalists. As a whole, the class learned the nature and the use of all the cognitive skills.

Changes in the Literalists

The four processes described by Bloom as complex cognitive processes are *application*, *analysis*, *synthesis*,

and *evaluation*[6] (Appendix E). The literalists gained understanding of the nature of the inferential and evaluative processes.

Bloom explains *application* by using an analogy: "the ability to predict the probable effect of a change in a factor on a biological situation previously at equilibrium." One senior male zoology student demonstrated this process in this segment from his argument regarding euthanasia:

> To those opposed, probably the most important reason not to legalize euthanasia is the concept of the slippery slope. The slippery slope is a concept saying that, if given an inch, people will take a mile. Their biggest fear is that, if authorized killing were legal for suffering, terminally ill patients, it could open the door to a policy of killing patients for the sake of social benefits such as reducing financial burdens.

This student read a great deal of the literature on this subject, evaluated it, and found a common theme. He has demonstrated *application* in this segment of writing. Bloom states that the use of the abstraction (the "slippery slope") is a typical example of the more complex cognitive process, *application*.

Students also demonstrated that they were now able to evaluate and analyze a journal article. A male graduate physiology major illustrated this ability.

> The literature review for the article is extensive compared to the small amount of literature available on the disease AIDS. For such a serious disease, the amount of literature is small and mostly inconclusive.

> The materials and methods section was very straightforward. Forty-one subjects, composed of males, females, smokers, and nonsmokers, with and without P.carinii, were studied....The people with P.carinii showed a decrease in cellularity and a smaller percentage of CD57+NK, compared to those without P.carinii. The study agreed with previous studies that showed that the AIDS virus may be lung-specific, but no remarkable discoveries were made about a possible cure for AIDS or about a treatment.

The student not only translated the article, but also analyzed it, breaking it down into its constituent elements. The students demonstrated that he understood the construction of a scientific article and the manner in which such articles convey their ideas or effects. Further, his comment regarding the use of literature represented a judgment of external criteria, that is, the ability to compare a work with the highest known standards in its field. This type of judgment is one of the two sub-units of the evaluation processes. The student judged that the article largely covered subject matter already published and contributed little to our knowledge of the disease. The student also questioned the authority in his criticism of the author's use of the literature. This was a valid criticism because the literature generated over the last five years regarding the AIDS virus is extensive.

Finally, the literalists demonstrated their ability to synthesize. *Synthesis* is defined as the "putting together of elements and parts so as to form a whole."[6] One of the sub-categories Bloom uses to characterize this area is

"Production of a unique communication." Bloom suggests that "the development of a communication in which the writer or speaker attempts to convey ideas, feelings, and/or experiences to others" is an example of synthesis. A senior male literalist used this process in his argument for passive euthanasia:

> On June 25, 1974, [girl's name] and her brother, [boy's name], were born. Like most twins, [girl and boy] were several weeks premature. [Boy], the first to be born, was slightly underweight, but otherwise normal. Next week, he will go to his senior prom. [Girl] was not as fortunate as her brother. Born with Down's Syndrome and a variety of other serious ailments, [girl] relied on constant medical attention just to survive. During a particularly serious incident in which [girl] had to depend on a machine just to breathe, her parents decided to authorize passive euthanasia. As my mother explained to me when I was eight years old, "No one could help her. We decided that the best thing we could do for her was to tell the doctors to pull the plug."

This student used a personal experience to effectively strengthen his argument for euthanasia. This segment of the man's argument demonstrated one of the specific components of *synthesis*. In addition, this piece was an example of *application*. The man had taken a personal experience and applied it to his argument.

In Bloom's taxonomy, *evaluation* means making judgments. In the final paper, the entire class made judgments. A junior male introduced his topic by writing:

> Arguments for and against using fetal tissue for research purposes will be presented here. Most of the arguments against are based on moral or ethical

aspects of the abortion issue. They have little or no scientific basis.

This man evaluated the literature and made a judgment about its applicability to the question he was arguing. He continued his thesis statement by writing, "I unquestionably support the use of fetal tissue for the improvement of the quality of life." By using the cognitive processes he learned through my teaching, this student analyzed, synthesized, and evaluated the literature and produced a strong thesis statement.

A junior female student wrote on the same subject: "I agree with using fetal tissue for biomedical research and donor purposes. I will argue my position with a variety of articles from the scientific literature in this field." This woman had reviewed the literature and made a judgment about the value of material for a given purpose.[6]

Summary

The evidence demonstrates that the literalists had gained mastery of their cognitive processes as described by Bloom. In their final papers, they demonstrated *inferential* and *evaluative* skills. All the literalists in the class wrote well organized and well argued papers. They all used the processes they learned in the Friday discussions to analyze and synthesize the literature they used in their arguments. They all were able to craft strong thesis statements and then apply the proper evidence to argue their positions, using all or most of the categories of the

cognitive domain. The class had experienced rapid growth in the cognitive area.

The Anomalies

The anomalies experienced similar but less dramatic growth. These two students started the term with considerable control of their cognitive processes. In fact, both individuals demonstrated skill in all areas of the cognitive taxonomy. These students gained an in-depth knowledge of complex cognitive skills and learned to use them with greater ease. This fact brought into play the "law of diminishing returns," and this group had relatively little room for cognitive growth.

The female anomalous student used *synthesis* when she wrote:

> There should be a separation between the decisions regarding abortion and tissue donation, but there should also be a separation of the arguments. Abortion ethics should not be considered in this argument, and moral views on the subject should be separated.
>
> However, there should not be a law requiring women to give consent, except in certain circumstances already discussed. With all the controversy over whether or not the government should fund it, fetal tissue research and transplantation is important to the further benefit of society. Ethical questions about this, as well as abortion, whether or not it should occur, are irrelevant. Let science further progress medicine through experimentation.

This woman used *analysis* and *synthesis* to evaluate entangled issues in the arguments over abortion and the use

of fetal tissue. She made the judgment that moral, legal, and personal arguments should not be used to decide this issue. Her feet are firmly planted in the science camp. This woman's analysis was very sophisticated in that she considered issues not discussed in the arguments of other students (*e.g.*, legal considerations). Bloom writes that the "production of a plan or solution"[6] is indicative of a high level of synthetic thought. This woman was one of only two students who employed this particular type of synthesis. This student's argument revealed her disciplinary ground of "science over all." This demonstrated acceptance of her disciplinary paradigm and was further evidence of the development of scholarly values. She was very much aware of her own progress through the course. In her own words from the final protocol, "I feel I was pretty good at analysis before I started college. I haven't been required to use these skills while I've been here. This course gave me practice and helped me sharpen these skills."

The anomalous male chose to write on the same issue. He wrote, "The use of fetal tissue for research and donor purposes is a necessary and acceptable practice, which should continue regardless of any opposition." While his argument was essentially the same as the woman's, he did not propose a solution to the problem. He did use *synthesis* and *evaluation* in his judgments regarding the issues. Bloom states that "evaluation of material with reference to selected criteria...." In this student's judgment regarding

euthanasia, he demonstrated this concept. He made a further evaluation regarding this problem:

> By allowing the use of tissue from induced aborted fetuses and increasing research in this area many people could be helped. Research in the United States has been hampered by the regulations on the use of fetal tissue.

The student used internal ("judging of internal standards") and external ("comparison of conflicting studies") criteria to evaluate the issues and develop his position. He synthesized the literature and developed the issue of "greater good." This is an *application* of the material he had evaluated.

While this man was an anomaly at the beginning of the course, the other students in the group grew closer to his complex cognitive skills than to those of the woman anomaly. The anomalies experienced overall growth in mastery of the affective domain during the course of the semester. In large part, this growth was precipitated by the use of case studies. The case studies required the students to use both *inferential* and *evaluative* skills. This group had already demonstrated the ability to use these skills, so this project served to sharpen their existing skills.

Affective Growth: "Toward Higher Ground"

At the beginning of the course, the students fell into three groups: Pre-Scholars, Incipient Scholars, and Apprentice Scholars. All of them demonstrated indications of *receiving* and *responding* in the taxonomy. The Pre-

Scholars showed only glimpses of higher responses. Further, these students were distinguished from the other groups by their total lack of scholarly values. They placed a high value on social pleasure and tended not to question the value systems taught them by others. Within Perry's model, this group had attained the multiplicity position.

The Incipient Scholars had developed and demonstrated *valuing* as an emotive response. These students were beginning to establish not only a system of personal values, but also the first evidence of the development of scholarly values. The Incipient Scholars were positioned at the multiplicity level; however, they were approaching relativistic thought.

Finally, the Apprentice Scholars were able, in some manner, to respond at all levels of the affective taxonomy. They had demonstrated some appreciation for scholarly values. This group was firmly in Perry's relativistic position.

All of the students grew affectively. Their responses in the final interview, while demonstrating this growth, did not indicate uniform growth. I attribute this to the complex nature of the human emotional response.

The three groups were evident in the final interviews; however, the distribution of students by group had changed. Since affective growth was evident in all students, I elected to add the descriptive word "Plus" to the original group titles.

Pre-Scholars Plus

Two seniors, one male and one female, appeared to change minimally. As such, they represent the lower end of the affective hierarchy. The students developed some personal values. By the end of the term, these two students showed evidence of the genesis of scholarly values.

When I asked about the nature of his commitments, the man answered, "...getting into medical school. Even though I did not get accepted this year, I will next year. I also am committed to my hobbies." While the student demonstrated *valuing-commitment* to entrance to medical school, he did not distinguish between commitment to pleasure activities and commitment to medicine. The willingness to study another year and try again is indicative of commitment. When asked the question, "Do you feel a commitment to medicine?", the same student answered, "Yes, in a sense. Of course, it is not my whole life yet, but I will do something in the medical field." The student voiced a tentative commitment to medicine by appending "not my whole life yet." By including "yet," he tacitly admitted that his commitment is less than it might be in the future. The student appeared to be aware of the rules of the game, but he seemed to lack the necessary inner drive at this point.

I asked the same student a question regarding the effect of freedom on his studies at the university. He answered, "The freedom let me study more of what I want. I enjoyed my studies more."

While this response did indicate evidence of the scholarly value of *enjoyment of learning*, this enjoyment apparently had not yet translated into an increase in scholarly activities. The final sequence from the second protocol of this student is in answer to a question about the scholarly use of the library:

> S: Yes, the only time I used the library this year is for this course.
>
> I: Did that part of it make the library seem more useful?
>
> S: Yes. I actually enjoyed it.

Clearly, he had grown and was actually surprised by his new-found enjoyment. Even though the student was externally driven to use the library (response to authority), he surprised himself and actually enjoyed the experience. This student combines the scholarly values of enjoyment of learning and the value scholars place on the library.

The female student who remained in this group, when asked about the effect of her freedom on her college education, answered, "It was nice to be away from [my parents]; but, being so close to home, it wasn't that different." This student interpreted the question from a social-pleasure perspective, not from a scholar's viewpoint. When asked about the case studies, she stated:

> O, I really liked them....The case studies are very interesting, and I've learned a lot. It makes me realize how different....If you look at something, and you have a list of possible diseases. there is more than one thing it could be. The symptoms could show

> more than one disease. You have to look at all aspects.

In this response, the student demonstrated *enjoyment of learning*. This response and the one that follows indicate that the student was beginning to understand and respond in a relativistic manner. In another question seeking evidence of value development, she answered:

> Analyzing the diseases, not only the case studies, but the papers too. Analyzing the papers and critiquing them. Yeah, I think I have learned a lot from that. I feel more prepared for medical school because of some of the things taught in the class as far as analyzing the case studies and looking at all of the options. Realizing it could be this or it could be that for another reason.

This student's excitement when talking about the case studies could be heard on the tape of the interview. Her speed of speaking and her vocal volume increased. In this segment, she clearly indicated the development of the scholarly value, *enjoyment of learning*. She had learned to enjoy her cognitive ability (analysis).

From Perry's perspective, these two students had progressed from Multiplicity to Relativism. For example, the young man explained:

> I have my own set of values, what I was taught by my parents and my peers. But I realize there are things out there that are different than my values. So, even though I think my values are right and correct in my own way, I can understand how a person would have a totally different set of values. I might respect those, but I might not agree with them.

At first, he stated that his value system was derived from family and friends. In other words, his value system was externally driven. However, his acceptance of the rights of others to disagree was relativistic. The man still had tendencies to revert to multiplicity, as indicated by his comments about his final paper, "The most difficult [part] was finding medical reports which supported the opposite of my views. I didn't enjoy that. I didn't want to find anything that disproved what I wanted to prove." Here, the student wants his authorities to be right, regardless. He did exhibit scholarly discipline and seek out opposing references, but apparently only because he had to do so to complete his assignment. This action was externally driven. His personal, or internal, commitment to relativism was suspect at this time.

Incipient-Plus Scholars

The majority of the students (13) progressed to what I will call the Incipient-Plus Scholar stage. Responses at levels higher than *receiving* and *responding* were quite common; and, by the end of the term, enthusiasm for scholarly values grew dramatically in this group.

The next deeper level of affect beyond *responding* is *valuing*. Bloom explained that, "behavior characterized by valuing is motivated not by the desire to comply or obey, but by the individual's commitment to the underlying value guiding the behavior."[29] This definition provides us with the elements necessary for analysis. First, valuing means

that behavior is driven from within an individual based on his/her rational commitment to a particular value or set of values that have replaced the former non-rational acceptance of external authority. But, exactly what values are represented here? Within this study, certainly we find several different, but complementary, sets of values: values that arise from the discipline, from scholarship or academe, and from within the self.

The responses of the Incipient-Plus Scholars indicated that they had felt increasingly autonomous as a result of their own initiatives. The autonomy appeared to begin a feedback loop that fostered greater control of their cognitive processes and strengthened their commitment to their profession. For example, one student stated,

> The freedom to choose what you are interested in and try to excel, and a field you can do well in. Most of the students who come in here don't have a fixed idea on what exactly they want to do. I know that I was a junior before I knew exactly that I was going to be a physiology major. My parents kept wanting me to be a business major, and I just kept looking for the one course that I could excel in. That is basically what freedom did for me academically. It allowed me to find my niche in life. Obviously, I value this freedom.

This student was beginning to understand what freedom means to the scholar, and he valued self-development. He was also distancing himself from authority (his parents) by finding his own way. Another student answered the same question, "Yeah, quite a bit. I find...with the freedom, the more courses you take in the desired area, the more they

weave together." This student, while discussing freedom, also demonstrated that she was gaining cognitive mastery. She indicated that she understood how the tapestry of a discipline begins to unfold.

A male physiology student stated:

> Basically, what I have really enjoyed is the feeling of accomplishment. Being able to apply what I have learned. If what I know was something I thought everybody else in the world knew, then I would not feel very good about my degree. But it is the fact that I have picked something that was interesting to me and was something that most people didn't have an understanding of. That was the greatest thing about my undergraduate education.

Expressions of the development of self-esteem and the inherent uniqueness of the individual were part of the Incipient-Plus Scholars' system of values. This was an indication of the scholarly value of "knowledge as power."

Another attribute of *valuing* is *commitment*. One student described commitment as follows:

> It is just setting your mind to do something and not wavering from it. You know you are going to study all day Saturday, and you don't say "Okay" when your boyfriend pulls up and says "Let's go to Joe's."

Like the other students in this group, she had started to incorporate this value into her value system.

Even students who did not have well developed value systems at this time had commitment to the requirements which would allow them to go to medical school. This group knew the criteria that were required to gain entrance into medicine. They were willing to "pay their dues"--to do

whatever was required to realize their aspirations. Their internal commitment to their aspirations differentiated them from the Pre-Scholars Plus. The Pre-Scholars knew the rules, but demonstrated that they still were externally influenced and had yet to fully commit to the means to their desired ends.

The Incipient-Plus Scholars demonstrated evidence of internally adopted values. Internal values are derived from the individual's commitment to the underlying value-grounding behavior.[29] According to Bloom, the first step in the development of an individual's value system is the conceptualization of a value. By this Bloom means that individuals see how a value relates to those that they already hold or to new ones they are coming to hold.

By the end of the course, the Incipient-Plus Scholars were beginning to develop internalized value systems. One senior male physiology student wrote, "I feel that euthanasia should be allowed in the passive form when all other forms of medicine cannot treat an illness and artificial means only prolong death." This student realized that medicine has limitations and that these limitations can degrade the quality of life. The student had placed a value on the quality of life. This internally developed value altered the way he approached the final paper.

As a whole, the group demonstrated the development of self-esteem, as discussed above, and tended, through their own internal value of self-esteem, to support the right of others to self-esteem. The students afforded others the

right to maintain self-esteem through control over the ending of their lives. A male student wrote:

> After presenting arguments for and against active euthanasia, I would...like to present one further argument for allowing euthanasia in certain limited cases. It is my concern that, all too often, doctors prolong agony in the hope of saving a patient's life. When the treatment fails or the money ends [doctors] abandon the patient. I believe it is unethical for doctors to bring patients to a state of extended suffering and...justify it by saying that euthanasia violates the oath of their profession.

This student placed a value on alleviating human suffering, as well as on preserving the patient's right to be self-determinate.

While all of these statements are different, they all represent a process in which the students approached a serious problem facing society, reasoned their way through the problem, and formed judgments. Their judgments were based on the students' value systems regarding medicine's role in society and on their research using new-found cognitive skills.

The Incipient-Plus Scholars group demonstrated a considerable amount of relativistic thought. For example, a senior woman physiology major explained:

> ...You have to be aware that science is always changing. What was true once is no longer accepted as true. ...Dr XX teaches this class...off of current materials. He has textbooks--about a million and a half of them--and he doesn't really use them....He is always telling us how people used to believe this thing, and now we think it might be this thing. You can never know what it

> really is. I think it is good that people realize that.

This student was representative of her group. The group had migrated away from their reliance on external authority as the basis for their value systems.

By the end of the course, the group had also moved toward relativism. In fact, most of the members of the Incipient-Plus Scholars developed relativism with commitment. For the most part, this commitment followed the path of their aspirations and tended to place value on scholarly values as well as medicine's values.

Apprentice Scholars Plus

The Apprentice Scholars initially were characterized by cognitive skills and clear indications of the development of personal value systems. Their view of the world was relativistic in nature. All members of this group were women.

These three women remained in this group. They finished first through third in the class scholastically. During the course, they grew affectively and cognitively. However, due to their relatively advanced starting point in this study, the "law of diminishing returns" limited their growth. The characteristics demonstrated by this group at the end of the course were as follows: The group functioned well in all inferential cognitive skills. They were clearly relativistic and demonstrated emotive development consistent with the highest levels of Bloom's affective taxonomy. In addition to demonstrating development of personal value

systems, the students in this group demonstrated a definite increase in the incorporation of scholarly values into their systems of values.

This group of students differentiated themselves from their classmates by the degree of development in the two domains. By the end of the course, the majority of the class demonstrated higher cognitive and affective skills. This group demonstrated cognitive mastery and a high level of affective development. I will discuss their affective development in the following order: development of scholarly values, development of personal values, and demonstration of affective development by the way they approach life.

When discussing the value of academic freedom, one woman replied:

> Academic freedom is basically part of the academic experience. The professor can teach what he wants to teach, and I am free to study what I want to study. It is both things, without the government coming in and saying, "You will take History 101" and the teachers saying what the government wants them to say. I think this is necessary.

Like the group as a whole, this student embraced the ideology behind this scholarly value. By stating that academic freedom "is necessary" to foster the proper learning environment, the quote I chose dealt most directly with the subject. However, all individuals in this group understood academic freedom and the acknowledged fact that it was a part of their value systems. At the end of the course, the group held many scholarly values. Another

example of this type of value was described by the female graduate student when she discussed our Friday experience. She states:

> I think the case studies gave us an opportunity to experience a little bit of what it's like in the real world when we get out of school. Almost all of our classes we take now are just "read and regurgitate." We just have to memorize what someone tells us, or we read it and spit it back out. We are not forced to think very much any more. I think this is quite sad.

This entire group demonstrated the scholarly value which I describe as the enjoyment of learning. The manner in which this particular student chose to express her enjoyment of true learning experiences was the negative statement that the lack of this stimulation makes her "sad." My personal observation of this group over the course of the semester convinced me that they demonstrated the majority of the values that a person interested in scholarship would hold dear. Along this same line, another student spoke to the issue of links between the cognitive and affective domains:

> I think there is a link. It makes sense to me that, if you are...inclined to do something, you will excel in it. I mean, in zoology or biology classes I see a certain logic, whether it is in whatever class. There is a lot of logic in certain things. The first couple of times I was exposed to it, it just went way over my head, and I didn't understand what was going on. And then there were times, since I am used to the pattern of logic, so it was so much easier and so much more fun.

On reflection, this student was able to evaluate her own progress over the educational process. Like the Apprentice

Scholars Plus group as a whole, she understood how the knowledge of the paradigm weaves together to define the discipline. In this case, the student chose to express these ideals as patterns of logic, which her discipline uses, and commented on how these connect to a greater enjoyment of her studies.

The group was also quite relativistic. One woman wrote:

> It's just my philosophy. I think everybody has their own opinions, and it's not anybody's place to push their opinions on somebody else. It makes me mad when somebody tries to push their opinion on me.

The entire group demonstrated this characteristic. It was so ingrained in their thought processes that it had become part of their personal *characterization*. Bloom described this affective level as a group of attitudes, beliefs, or values which, by their internal consistency, tend to identify the person or group to external observers. These three women's adherence to their value systems was so consistent that they tended to personify Bloom's description of this level of the taxonomy.

Another attribute which Perry and Bloom consider an important indicator of emotive growth is the ability to commit. On the subject of commitment, one woman stated, "That would be to stand by it strongly and defend yourself if someone says or accuses you or something, or you don't believe it is true." This group all held strong, well reasoned opinions and indicated a willingness to commit to

their values. As the woman stated above, the group was willing to defend their values.

The final affective attribute that this group demonstrated was Bloom's highest level, *characterization by a value or value complex*. Bloom describes this level of development in the following manner: "The individual acts consistently in accordance with the values he/she has internalized at this level." In other words, the individual is characterized or perceived in a manner which reflects his/her value system.

While discussing case studies, one woman stated:

> It was very different. I like it very much. I guess it was a good way to get other people's input on a bunch of different areas, and the way other people thought about things. Instead of a straight lecture where you are spoon fed everything, it gives you a chance for people to come up with their own ideas.

Another of the group discussed reality in the following manner, "I think reality is probably something that can never be known. Sometimes you take theories and look at them as if they are reality, but they are not." The last student in the group gave the following opinion about the course upon which this research was based: "At the beginning [of the course], I felt more confident of my analytical ability. Now, it seems like there is a huge area ahead of me. I learned a lot, and I feel like I made progress." This segment of quotations are but a few of the statements the women made which could be used to demonstrate to others that they could be characterized by their value

systems. While all individuals have widely divergent systems of values, these women shared many values. The group was relativistic and committed and embraced scholarly values.

Summary

The data have demonstrated that the students in the class grew cognitively and affectively. This cohort of students gained in their mastery of the skills Bloom lists in the cognitive domain. They all moved higher in the hierarchy of the affective domain. The students were also shown to have increased their positions in Perry's model of cognitive and ethical growth. In the final chapter, I will discuss the conclusions I have reached concerning cognitive and affective growth and possible links between the two domains, as well as discuss recommendations for further research that became evident during this study.

CHAPTER 5

ASPIRATIONS: THE TIE THAT BINDS

Introduction

Much of the basis for this research project was derived from the work of Benjamin Bloom and his colleagues in the 1950's. His group developed three taxonomies describing the cognitive, affective, and psychomotor domains. Educators have intensively studied and utilized the cognitive handbook and, to a lesser extent, have researched the affective domain. The psychomotor domain has not developed a great deal of interest among pedagogical researchers.

In his work on the affective domain, Bloom speculated that there might be a link between the cognitive and affective domains. He writes, "Clearly, there is need for conclusive experimentation and research on the relations between the two domains."[6] My literature search produced no studies which addressed Bloom's speculation. I elected to explore possible links between the cognitive and affective domains. I also was interested to ascertain whether scholarly values could be produced through teaching students mastery of their cognitive processes. I chose to apply Perry's model of cognitive and ethical growth to the data and interrelate the two approaches to student growth.

Some of the questions which arose in completing this project were as follows:

a. Can the development of cognitive processes and affective growth be useful to the medical paradigm?
b. Can complex cognitive processes, as described by Bloom, be developed in students in a one-semester course?
c. Can perceptible affective growth be accomplished in one semester?
d. Can scholarly values be consciously developed?
e. Is there a positive link between the cognitive and affective domains?
f. What is the nature of such a link?
g. Can a model be developed that will illustrate students' development over the length of the term?
h. Can the model be used to help students internalize paradigmatic values?
i. What recommendations for further research presented themselves during the study?

In this chapter, I will discuss what the data revealed about the preceding questions and how they relate to what was observed in the classroom. I will begin by discussing the nature of paradigms in general, and medicine's paradigm in particular.

The Paradigm

In 1970, Thomas S. Kuhn characterized a paradigm as a set of rules or protocols through which a group of people view the world.[28] Another way of saying this is that a paradigm consists of theories, concepts, values, methods, epistemological concepts, and rules of behavior. Students need to learn knowledge, but they also need to learn tools and conventions. They must be socialized into the social values and attitudes of the discipline or profession. Kuhn, writing about paradigms, states:

> These are the traditions....that mainly prepare the student for membership in the particular scientific community with which he will later practice. Because he there joins men who learned the bases of their field from the same concrete models, his subsequent practice will seldom evoke overt disagreement over fundamentals.[28]

In this quote, he was writing about disciplinary paradigms. Disciplines are basically the study of one subject, such as chemistry. Fields are areas of practice or work that draw their component parts from more than one discipline. Medicine is a field of study; however, the ideas Kuhn discussed are still applicable.

The various paradigms are placed together into a global, or inclusive, medical paradigm. In large measure, medicine is based on the natural sciences. The paradigm is made more complex by incorporation of soft disciplines, such as the social sciences, and of metaphysical concepts, such as ethics. In one form or another, medicine incorporates most disciplines within its paradigm. To these disciplinary

components of medicine Becher adds the ideas of tribal and territorial customs.[4] Becher writes:

> Initiates are steeped in a folklore and a code of accepted or required practice which conditions the way they see the world. ...Another [tribal territory] is the medical school, showing in fascinating detail how professional attitudes and values are gradually shaped through the interaction of students with one another, with their instructors, and with their work.[4]

Becher writes about the broad, overall paradigm of the medical profession. He continues,

> Within a core speciality like internal medicine there are many different kinds of practice, ranging from that of a "family doctor" to highly specialized consultation [doctors]; but more profound divisions...frequently arise around the exploitation of a method or technique like radiology.[4]

Becher here discusses the tendency of medicine to become more specialized and continues with the tendency for these groups to act as tribal members. The undergraduate students start to develop the "we're all in this together" mentality, even though they are forced to be competitive. This scenario was first explored by Becker, *et al.*, in Boys in White, published in 1961.[5] One of the earliest examples of a qualitative study applied to medicine, this book came to many of the same conclusions Becher discovered in his later work.[4] Medical schools also engender an elitist attitude in their aspirants by publishing, with a certain amount of pride, the stellar grade point averages and Medical College Admission Test scores required to obtain entrance into their schools.

Medicine has always been a conservative field of study. It has resisted change and opposed those who would offer alternative methods of patient care. With minor changes, the medical curriculum has remained unchanged since the invention of the microscope and the scientific renaissance of the late 1800's.[11] The nature of the field has produced a pronounced reverence for tradition that pervades medicine.[39] One of the primary goals of the medical education is the development within students of a common paradigm. This endeavor has been successful.

Since medicine is very concerned with the students' ability to internalize the medical paradigm, I felt it would be beneficial to the field and the disciplines which support the study of medicine to have a model, or methodology, which would facilitate the understanding and internalization of the paradigm. Throughout this study, I have used the development of scholarly values as a measure of this affective growth.

In a 1993 article, researchers interested in assessment of cognitive skills wrote:

> It is not at all uncommon in job settings to hear supervisors lament the fact that newly trained workers "don't know anything" and will have to be trained on the job. It is very likely that this lament is associated with the fact that many training schools are designed to meet standards of performance that have little to do with actual job performance. Moreover, it is also likely that the setting of standards of performance has been strongly influenced by measurement procedures that focus on acquisition of

> knowledge rather than on indexes associated with skilled performance.
>
> Educators have been concerned for many years that assessment has been driving the curriculum. The most often voiced concern is that standardized tests are dictating curriculum content. A more recent concern is that tests are guiding not only the content to be learned but also the way it is being learned. Specifically, educators have expressed the concern that tests encourage the learning of material skills (*e.g.*,the memorization of facts) that are not transferable to real-world activities.[54]

The entire purpose of the extant research project is an exploration of ways to teach students more complex cognitive processes than *knowledge* and *comprehension*. During the rest of this chapter, I will discuss explorations of methodologies consciously designed to help solve this problem. Based on the data produced by this research project, it is evident that many of the cognitive, affective, and ethical characteristics important to the medical paradigm can be initiated at the premedical level.

Scholarly Values and Ethical Growth

One of the facets present in the medical paradigm is something approaching a reverence for many values scholars hold dear. In fact, the physicians afforded the most esteem in medicine are the M.D.-Ph.D.'s. While not all doctors are specifically interested in scholarship from the academics perspective, they are interested in many of the values scholars hold dear.

The data established that the students grew affectively. The generation of scholarly values was not

unexpected. In fact, two of the areas which were apparent in the overall affective growth of the students were scholarly values and ethical growth. In his model, Perry links cognitive and ethical growth. Since I have shown that the two domains are linked, this study effectively reinforces Perry's model as it concerns ethical growth. One conclusion I have drawn from the data is that many scholarly and ethical values can develop and, furthermore, that this can be accomplished in a relatively short period of time.

In Bloom's discussion of the relationships between the cognitive and affective domains, he writes the following:

> Hopefully, the analysis of the two domains will have a heuristic value so that we may better understand the nature of each as well as the relationship of one to the other.[6]

In this study, I taught the students *inferential* and *evaluative* skills. As I stated earlier, the students clearly demonstrated cognitive mastery. I did not attempt to teach the affective domain; however, growth in the affective domain definitely took place. It appears obvious that affective growth took place as a result of the students' cognitive growth. Therefore, I conclude that the two domains are indeed linked. The "tie that binds" is student aspirations. These aspirations produced the initial interest in the "puzzles" presented by the case studies and, as I discussed above, drove them deeper into the affective domain. The net result of cognitive growth, modulated by aspirations, was affective growth. The fourth conclusion I have drawn is that the two domains are or can be linked

together by designing pedagogical environments that center on students' aspirations.

The strongest findings of this study are as follows: Through the course, I gave the students opportunities to experience the methodologies of analysis through case studies. Through the Friday discussions I enabled them to compare their efforts and judgements with mine. Through the paper, by using value-laden topics, I facilitated the students' willingness and ability to confront ethical dilemmas. All of this worked because of their aspirations, which gave them a taste of real life.

The Genesis of the Model

In lecture, most instructors attempt to model real-life situations. In this course, I gave the students a hands-on medical activity within a safe and supportive environment. Competition spurred it on and made it fun because the students were not concerned about grades in this experience.

In the following model, I have developed a graphic representation of the processes which took place during this study.

Figure 1

The Model

The Initiator

To start the process of cognitive and affective growth, something must catch the students' interest. Two factors were involved in this process:

1. The aspirations of the students themselves
2. My knowledge, from a personal standpoint, of the power of those aspirations

Therefore, the initiator necessary for use of this model is the teacher and his/her ability to determine what aspirations drive the students in a given class. The teacher must also be able to translate these aspirations into the development of case studies or some form of problem-oriented teaching situation which draws power from the students' aspirations. In the case of this research, I drew on personal experience. However, through a brief interview process, any teacher can determine the aspirations that drive the majority of students taking his/her class.

Student aspirations can then be used to construct problems or case studies that can illustrate or teach a large variety of concepts. The studies in this project were designed to develop mastery of the cognitive skills espoused by Bloom in his taxonomy, and were applied to premedical paradigmatic development.

Cognitive Mastery

During the semester, all members of the test group developed mastery of both the *inferential* and *evaluative* components of Bloom's cognitive domain. This mastery was demonstrated by the students' ability to properly use *knowledge, comprehension, application, analysis,* and *evaluation.* The entire class grew from a position that centered around the *knowledge* and *comprehension* areas to full use of their cognitive skills. This mastery was produced by the use of various techniques discussed in chapters four and five. The case studies proved to be the most effective tool I utilized for this process.

The second crucial part of the study was to track by the interview process the students' growth in the affective domain.

Affective Growth

All of the students in the study grew affectively. Since I made no effort to assist the students to grow in these areas, I conclude that affective growth can indeed be a result of cognitive growth. All students were able to function in the *characterization by a value* or *value complex* (highest level of the hierarchy) level of the affective taxonomy. The case studies proved to be the key element in the pedagogical process. The case studies were placed in the course to add relevance to the study of histology. They proved to be the central element in the cognitive and affective development of the class. The case studies were

based on real-life situations. Elements of data were withheld, requiring the students to go to the literature for solutions. In this manner, I was able to structure case studies that forced practice in all areas of cognitive development. The case studies were very popular with the class, and I attribute this *pleasure-in-learning* phenomenon to the aspirations of the students.

Aspirations

Webster's II[54] defines aspiration as "a strong desire for high achievement or for the realization of an ideal and an object of this desire or goal." Twenty-four of the twenty-five students in the class are pursuing careers in medicine. The students' comments in the interviews and class evaluations were very forceful in their agreement with this type of teaching technique. The reason for this enthusiasm and the rapid progress of the class was the manner in which the case studies played into the students' personal and professional aspirations. In the model I developed, aspirations were the initiator of the entire learning process. Many of the students said that the case studies allowed them to experience, in some measure, the career they aspired to. The technique produced an in-depth interest, which, according to Bloom, is the initial step in the process of cognitive and affective growth. In fact, this growth began when we started the case studies.

The students' aspirations facilitate the development of these skills and make the process enjoyable. Development of

these skills produces reactions in two directions. One direction is toward cognitive mastery. The data demonstrated this development. The other direction is toward the affective driver, which is in turn driven by aspirations. Aspirations become the engine which powers the entire model. From this position, the power or energy derived from aspirations can return to the development of cognitive skills circle to reinforce learning in this area. It can flow up to facilitate the mastery of cognitive skills. Aspirations also drive the development of affective growth. The model, in effect, becomes an oscillating circuit driven by students' aspirations. In this study and in my model, aspirations become the link between the cognitive and affective domains speculated about by Bloom.

This methodology can be adapted to almost any major or discipline. Students' aspirations, if not already known, can be ascertained by a short interview at the beginning of a course, and case studies designed around them can be used to teach almost any subject matter. This study also has demonstrated that significant growth in cognition can be obtained in advanced students in the course of one semester - though obviously dependent upon the students' starting points. However, the development of scholarly values in students who did not possess them is the most valuable contribution of the method. The aspiration-driven, structured case study method can be used to help students to become scholars.

The model I developed from this project shows the relationship of the teacher to cognitive and affective growth and helps to inform the faculty about this approach. The model also can be instrumental in ethical and scholarly growth. In fact, from medicine's perspective, the model can be used to teach and help the students begin to internalize the medical paradigm. This is the final, and perhaps the most important, conclusion I have drawn from the research data.

Recommendations for Further Research

During the course of this study, several problems and situations were discovered that can be used for further research. The first and most obvious recommendation is to replicate the study using several cohorts of students. Time limitations did not allow a longitudinal study. However, this type of study could only serve to generate more data density and, possibly, to identify further patterns of student response. This study should be followed by further study in the life science discipline, as well as in other disciplines. The data did not indicate that this model would only be suited to a histology course, but research needs to be done to prove its applicability in the disciplines somewhat removed from a hard pure discipline.

Other areas worthy of research flowed from this study. One would be a project designed to follow up on the gender differences present in this cohort of students. This study was conducted in the environment of a research university.

Additional study in technical schools, professional schools, and other pedagogical situations would produce meaningful data. A final area of interest would be a study designed to determine how far the effect of the students' career aspirations could be extended to course work not readily perceived by the students as relevant to their majors.

REFERENCES

1. BASMAJIAN, J. V. Trends in Teaching Anatomy in American Medical Colleges. Kobe Journal of Medical Science. 17:207-209, 1971.

2. BATTEN, E. H. Teaching Aids in Veterinary Histology. Proceedings of the Physiological Society. 55-57, 1974.

3. BAUER, T., METCALF, N. F., METCALF, W. K., and PRENTICE, E. D. Auto-Instruction in Histology and Cell Biology as a Substitute for Traditional Laboratory Activities. Proceedings of the Physiological Society. 55-56, 1976.

4. BECHER, TONY. Academic Tribes and Territories: Intellectual Inquiry and the Culture of Disciplinary Tribes, Society of Research into Higher Education, Open University Press, Bristol, PA, 1987.

5. BECKER, H. S., GEER, B., HUGHES, E. L., and STRAUSS, A. L. Boys in White, The University of Chicago Press, Chicago, 1966.

6. BLOOM, B. S., ENGELHART, M.D., FURST, E. J., HILL, W. H., and KRATHWOHL, D. R. Taxonomy of Educational Objectives: Handbook 1 - Cognitive Domain. David McKay Co., Inc., New York, 1956.

7. BONHAN, L. A. Learning Style Instruments: Let the Buyer Beware. Lifelong Learning 11:10-14, 1988.

8. CANADAY, S. D. and LANCASTER, J. L. Impacts of Undergraduate Courses on Medical Student Performances in Basic Sciences. Journal of Medical Education. 13:79-81, 1979.

9. CLEVENSTINE, R. B. A Classification of the ISIS Program Using Bloom's Cognitive Taxonomy. Journal of Research in Science Teaching. 24:699-712, 1987.

10. CONRAD, E. F. Grounded Theory: An Alternative Approach to Research in Higher Education. The Review of Higher Education. 5:259-269, 1982.

11. THE FACULTY. The Hundredth Anniversary of the Department of Histology of the Bucharest Faculty of Medicine. Morphol-Embrol. 24:199-204, 1980.

12. FARNSWORTH, W. E., MEDIO, F., NELSON, K., MANN, E., NORWELL, D., and VAN WINKLE, L. J. Integrating Clinical Problem-Solving Workshops and Lectures in a Biochemistry Course. Biochemical Education. 16:196-200, 1988.

13. FREZZA, Y. Using Bloom's Taxonomy to Plan Participation Projects. Elementary Viewpoints. Serial 24:26-30, 1980.

14. GASPAR, S. and KLIKA, E. Experiences with the Construction and Long-Term Use of the Examination Test in Histology. Folia Morphologica. 22:278-281, 1974.

15. GASPAR, S. and KLIKA, E. On the Question of the Effectiveness of Tests in the Teaching of Histology. Folia Morphologica. 24:107-113, 1976.

16. GASPAR, S. and KLIKA, E. A Study of the Predictive Validity of Histological Tests. Folia Morphologica. 24:264-269, 1976.

17. GASPAR, S. and KLIKA, E. A Test of Histological Details. Folia Morphologica. 25:114-118, 1977.

18. GASPAR, S. and KLIKA, E. A Test of Histological Preparations. Folia Morphologica. 22:37-40, 1974.

19. GEHRKE, N. J. Teacher's Role Conflicts: A Grounded Theory-in-Process. Journal of Teacher Education. 33:41-48, 1982.

20. GROSS, B. F. Scientific Literacy and the Nonscience Major. Journal of College Science Teaching. 2:10-14, 1975.

21. HARPCHAK, B. B. Evaluation of a Self-Instructional Unit for Use in Educational Programs in Histologic Technique. American Journal of Medical Technology. 43:319-324, 1976.

22. HARRIS, T. M. Closed-Circuit Television as an Integrating Medium in Teaching Medical and Dental Histology. Journal of Medical Education. 44:548-550,1987.

23. HAUMONT, S., CORDIER, A., DAMBRAIN, R., HERVEG, J. P., ROUSSEAU, P. and SPRUMONT, P. A New Approach to Teaching Histology at the University of Louvain. Medical and Biological Illustration. 24:202-206, 1974.

24. HILLCOAT, B. L. Paradigms in Medicine: Consequences for Medical Education. Journal of Medical Education. 50:66-69, 1975.

25. HOSTE, R. What Do Examination Items Test? An Investigation of Construct Validity in a Biology Examination. Journal of Biological Education. 60:51-58, 1982.

26. JENSH, R. P. Use of Interactive-Video Programs in Education in Basic Medical Science. Journal of Medical Education. 62:942-944, 1987.

27. KOZMA, R. B. A Grounded Theory of Instructional Innovation in Higher Education. Journal of Higher Education. 56:300-319, 1985.

28. KRATHWOHL, D. R., BLOOM, B. S., and MASIA, B. B. Taxonomy of Educational Objectives: Handbook 2 - Affective Domain. David McKay Co., Inc., New York, 1956.

29. KUHN, THOMAS. The Structure of Scientific R , 2nd edition, University of Chicago Press, Chicago, 1970.

30. MORGAN, H. R. A Problem-Oriented Independent Studies Program in Basic Medical Sciences. Medical Education, 11:394-398, 1977.

31. NOTZER, N. and ARONSON, M. Differential Evaluation of Students' Performance in Histology. Medical Education. 13:79-81, 1979.

32. OLIVER, D. Grounded Knowing: A Postmodern Perspective on Teaching and Learning. Educational Leadership. 64-69, September 1990.

33. O'MORCHOE, C. C., O'MORCHOE, P. J., and DONATI, E. J. The Question of Relevance in Basic Medical Science: A Study in Histology. Journal of Medical Education. 48:686-689, 1973.

34. PALAFREY, A. J. The Medical Teacher's Viewpoint. Journal of Audiovisual Media in Medicine. 3:132-133, 1980.

35. PALKUTI, G. A. and WISEMAN, B. L. Microfiche as a Teaching Tool. Journal of the Biological Photographic Association. 40:30-35, 1972.

36. PAUL, R. W. Critical Thinking. The Foundation for Critical Thinking. Santa Rosa, CA, 1992.

37. PERRY, W. G. Cognitive and Ethical Growth: The Making of Meaning.

38. RANDO, W. C. and MENGES, R. J. How Practice is Shaped by Personal Theories. New Directions for Teaching and Learning. Jossey-Bass, Inc., 45:7-14, 1991.

39. RHODIN, J. A. G. New Approaches to the Teaching of Anatomy. Nordisk Medicine. 9:1419-1424, 1969.

40. ROGERS, A. W. and TAYLOR, D. A. Experiments with Closed-Circuit Television in Teaching Histology. Medical Biology, 19:239-245, 1969.

41. SIMS, D. E., SINGH, A. and AMEND, J. Linking the Basic Sciences in Teaching: Suggestions for Histology Instruction. Anatomy, Histol, Embrol. 20:189-191, 1991.

42. SPECTOR, B. S. Generating a Desired State for Master's Degree Programs in Science Education Through Grounded Theory Research. Journal of Research in Science Teaching. 22:327-345, 1985.

43. SPECTOR, B. S. Qualitative Research: Data Analysis Framework Generating Grounded Theory Applicable to the Crisis in Science Education. Journal of Research in Science Teaching. 21:459-467, 1984.

44. SPECTOR, B. S. and GIBSON, C. W. A Qualitative Study of Middle School Students' Perceptions of Factors Facilitating the Learning of Science. Grounded Theory and Existing Theory. Journal of Research in Science Teaching. 28:467-484, 1991.

45. STEDMAN, C. H. An Analysis of the Assumptions Underlying the Taxonomy of Educational Objectives: Cognitive Domain. Journal of Research in Science Teaching. 10:235-241, 1973.

46. STOWARD, P. J. Self-Instruction Through Reading: The Keller Plan. Medical Education. 10:316-326, 1976.

47. STRAUSS, A. and CORBIN, J. Basics of Qualitative Research: Grounded Theory Procedures and Techniques. Sage Publications, London, 1990.

48. TAMIR, P. Are Cognitive Preferences Just an Expression of Cognitive Abilities? Journal of Experimental Education. 43:60-65, 1980.

49. TURNER, J. H. The Structure of Sociological Theory. Dorsey Press, Homewood, IL, 1986.

50. WILLIAMS, L. Microfiches as an Aid to Teaching Histology. Medical Education. 16:269-272, 1982.

51. WILSON, H. S. and HUTCHINSON, S. A. Pearls, Pith, and Provocation: The Trangulation of Qualitative Methods: Heideggerian Hermeneutics and Grounded Theory. Qualitative Health Research. 1:263-276, 1991.

52. WOLMAN, M. An Experiment in Teaching Histology and Cell Biology. Medical Trainer. 7:209-220, 1985.

53. WOODS, D. R. Nurturing Intellectual Development. JCST. 250-252, February 1990.

54. ZOLLINGER, H. U. A Programmed Course in Histopathology: Design and Use. Medical and Biological Illustration. 22:159-161, 1972.

APPENDIX A

PROTOCOL FOR THE FIRST INTERVIEW

Awareness/Willingness to Receive:

1. Do you enjoy your studies more now than when you were in high school? Why?

2. What do you think the term discipline means?

Responding:

3. How do you feel when you go to class with your assignment completed? Not completed?

4. When you are reading something that interests you, does it irritate you to be interrupted? Why? SR

5. What do you do when confronted with a new problem which you find fascinating? SR/V

Valuing:

6. What do you read in your leisure time? V/AV

7. Have you considered joining the Oklahoma Academy of Science? Why or why not? C

Organization:

8. Creationists disagree with all evolutionary models. Would you feel compelled to defend the models accepted by your discipline if a discussion developed involving a group of your friends? Why? Why not? C of a V

9. Do you feel a responsibility to help deal with some of the controversial problems confronting society which fall within our discipline (such as genetic engineering or experimentation with recombinent DNA)? What are the ramifications of these problems? ORG V S

Generalized Set:

10. How difficult do you find it to revise your judgments and to change what you value when you are confronted with new compelling evidence? GS

APPENDIX B

OKLAHOMA STATE UNIVERSITY
INSTITUTIONAL REVIEW BOARD
FOR HUMAN SUBJECTS RESEARCH

Date: 1-11-93 **IRB#:** ED-93-045

Proposal Title: EXPLORATION OF LINKS BETWEEN COGNITITVE AND AFFECTIVE GROWTH IN A HARD PURE DISCIPLINE

Principal Investigator(s): Dorothy Finnegan, F. Earl Johnston

Reviewed and Processed as: Exempt

Approval Status Recommended by Reviewer(s): Approved

APPROVAL STATUS PERIOD VALID FOR ONE CALENDAR YEAR AFTER WHICH A CONTINUATION OR RENEWAL REQUEST IS REQUIRED TO BE SUBMITTED FOR BOARD APPROVAL. ANY MODIFICATIONS TO APPROVED PROJECT MUST ALSO BE SUBMITTED FOR APPROVAL.

Comments, Modifications/Conditions for Approval or Reasons for Deferral or Disapproval are as follows:

Signature: Marcia S. Tilley
Chair of Institutional Review Board

Date:January 13, 1993

APPENDIX C

CONSENT FORM

CLASSROOM RESEARCH

Histology Spring 1993 Dr. F. Earl Johnston

"I,_____, hereby authorize or direct Dr. F. Earl Johnston, or associates or assistants of his or her choosing, to perform the following procedures:"

Three twenty minute interviews designed to explore affective growth during this course. The interviews will be conducted at the beginning, middle and the end of the course.

Interviews will be recorded and transcribed numerically for comparison, interview to interview, however, no list connecting names and numbers will be retained.

There are no discomforts or risks associated with this project. No questions of a sensitive nature will be asked.

The study may benefit the student in developing both cognitive and affective thought processes.

"This is done as part of an investigation titled Exploration of Links Between Cognitive and Affective Growth in a Hard Pure Discipline."

"The purpose of the procedure is to track affective growth within the conceptual framework of Bloom"s Taxonomy and Perry's student stage resulting from assisting the students to assert greater control over their cognitive growth processes."

"I understand that participation is voluntary, that there is no penalty for refusal to participate, and that I am free to withdraw my consent and participation in this project at any time without penalty after notifying the project director.

I may contact Dorothy Finnegan,PhD. at telephone number (405) 744-6411 should I wish further information about the research. I may also contact Terry Maciula, University Research Services, 001 Life Sciences East, Oklahoma State University, Stillwater, OK 74078; Telephone: (405) 744-5700.

I have read and fully understand the consent form. I sign it freely and voluntarily. A copy has been given to me.

"Date: _____ Time _____(a.m./p.m.)

"Signed _____
(Signature of Subject)

_____
(person authorized to sign for subject, if required)

"Witness(es) if required _____

_____

"I certify that I have personally explained all elements of this form to the subject or his/her representative before requesting the subject or his/her representative to sign it."

"Signed _____"
(project director or his/her authorized representative)

NOTE: There are circumstances under which (a) some or all of the elements in the above form may be altered or waived and/or (b) the requirement for the consent form to be signed may be waived. See 45 CFR 46, Sections 46.116 and 46.117.

APPROVED 10-13-88

APPENDIX D

ANALYSIS CODES

First Protocol

Large Bins

CATEGORY	CODE
Receiving	1.0REC
Responding	2.0RES
Valuing	3.0VAL
Organization	4.0ORG
Value Complex	5.0VALCX

Sub-Categories

Awareness	AWARE
Willingness	WILLREC
Selected Attention	SELATTN
Acquiescence Res	ACQRES
Willingness Res	WILLRES
Satisfaction Res	SATRES
Acceptance Val	ACCVAL
Preference Val	PREFVAL
Commitment	COMMIT

CATEGORY	CODE
Conceptualization Val	CONVAL
Organization of Val	ORGANVS
Generalized Set	GENSET
Charactrization	CHARACT

Perry's Stage Scheme

Large Bins

CATEGORY	CODE
Dualism	DUALP
Multiplicity	MULTIP
Relativism	RELP
Commitment	COMMITP

If any of these codes is followed by a T, this equates to temporising; if followed by an E, this equates to escape; if followed by an R, this equates with retreat; if followed by a TR, this represents a transition state.

CURRICULUM VITRE

F. Earl Johnston

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1988 Utica Square Medical Center
#651
Tulsa, Oklahoma 74114
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DEGREES

1994 Doctor of Education, Oklahoma State University
Stillwater, Oklahoma 74878

Major: Higher Education
Dissertation: Exploration of Links Between Cognitive and Affective Growth in A Case Based Medical/Science Curriculum.
Dorothy E. Finnegan, Dissertation Advisor

1976 Doctor of Podiatric Medicine, Ohio College of Podiatric Medicine, Cleveland, Ohio.

Major: Medicine

1967 Bachelor of Science, University of Central Oklahoma
Edmond, Oklahoma

Majors: Chemistry and Biology

PROFESSIONAL EXPERIENCE:

INSTRUCTIONAL EXPERIENCE:

1993	Department of Zoology Oklahoma State University
	Visiting Assistant Professor, Zoology
	Responsibilities: Teaching-Human Histology(4253) designed curriculum for this course emphasizing cognitive growth. Supervised laboratory graduate assistant.
1992-93	Division of Science and Mathematics Tulsa Junior College(Metro) Tulsa, Oklahoma
	Adjunct Professor Responsibilities: Teaching Anatomy and Physiology. Supervision of A&P Lab.
1975-1977	Department of Clinical Sciences Ohio College of Podiatric Medicine, Cleveland, Ohio.
	Assistant Professor Clinical Sciences
	Responsibilities: Teaching Clinical Pathology
	Programs and Service: Member Admission Committee, Member Tissue Committee, Member Quality Assurance Committee.
1977-	Speaker at over 20 Post-Doctoral Seminars Organized and presented 6 Post-Doctoral Seminars
	Oklahoma Academy of Science Fall 93

ADMINISTRATIVE EXPERIENCE:

1989-1991	Loma Linda Ambulatory Surgical Center, Loma Linda, California. Director of Residents Responsibilities: Responsible for all phases of post-doctoral teaching and surgical training. Programs and Service: Developed and implemented the residency program. Developed objectives, outcomes and protocol's. Took program through accreditation process, including the on-site visit.
1975-1977	Department of Clinical Sciences, Ohio College of Podiatric Medicine, Cleveland, Ohio. Assistant Director Clinical Laboratories. Responsibilities: General administrative duties.
1977-1986	Ada Foot Clinic, administered all phases of this business.
1973-1977	Registered Medical Technologist (RMT), Chardon and Bedford hospitals, Ohio
1968-73	Goodyear Tire and Rubber Co. Progressed to lower management. Final position involved total responsibility for 38M in sales.
1967-1968	Conoco Oil Co. Plant Chemist.
1962-1965	Pittsburgh Plate Glass. Statistical Quality Control Engineer.

ADDITIONAL EDUCATION:

1976-1977	Women's Hospital/Cleveland Foot Clinic, Cleveland, Ohio
	Surgical Resident
1976	Lindell Hospital, St. Louis, Missouri.
	Surgical Extern
1976	Francis Rogers, D.P.M., Kent, Ohio
	Preceptor
1974	Fred Brown, D.P.M., Cleveland, Ohio
	Preceptor
1973-1975	Department of Health, City of Cleveland, Ohio
	Surgical Extern
1977-	Approximately 1000 hours Continuing Education.

PROFESSIONAL ACTIVITIES:

NATIONAL APPOINTMENTS:

1998	Member advisory committee, American Board of Podiatric Orthopedics on residency genesis.
1998	Member Examining committee, American Board of Podiatric Orthopedics.
1977-1987	Member Board of Trustees and Co-Founder of the American College of Podopediatrics.

FELLOWSHIPS:

1977-	Fellow American College of Podopediatrics.
1977-	Fellow American College of Foot Orthopedists.

CERTIFICATIONS:

1989-	Diplomat, American Board of Podiatric Orthopedics.
1988-	Certified, Ankle Surgeon State of California. By examination.

PUBLICATIONS:

199?	F. Earl Johnston, William Meek, and David Henderson, *Electronmicroscopic Identification of Human Papova Virus in Verruca Plantaris.* The Journal of the American Podiatric Medical Association. Reviewed and accepted.
1991	F. Earl Johnston and Robert Lee, *Accessory Sesamoids Associated with Saddle Deformity,* Current Podiatric Medicine.
1988	Sheldon Collis and F. Earl Johnston, *Malignant Melanoma of the Hallux Nail,* Current Podiatric Medicine.
1979	F. Earl Johnston, *Gram Negative Bacilli and the Lower Extremity,* Current Podiatry.

RESEARCH INTERESTS:

1993-	Electron microscopy HPV-1 Verruca Plantaris, Oklahoma State University-College of Osteopathic Medicine.
1988-	Plantar calcaneal exostosis, Surgical Implications,

Loma Linda Surgical Center.

1976 Ankle implant research, Cleveland Clinic Foundation.

1975 Taxonomy and Antibiosis of Organisms effecting the lower
1976 Extremity.

EDUCATIONAL RESEARCH INTERESTS:

1992- Undergraduate and Medical Curriculum Modification
Aspiration Driven Cognitive and Affective Growth

HONORS AND AWARDS:

1976 Highest Honors Graduate, Ohio College of Podiatric Medicine
1976 Member Pi Delta, National Honor Society, Podiatric Medicine

1973 Class officer 1st and 2nd year, OCPM

CURRICULUM DEVELOPMENT:

Courses Developed and taught (Undergraduate)
Human Histology (Cognitive Emphasis)

PERSONAL DATA:

Health: Good
Born: Henryetta, Oklahoma 1943
Married: Bonnie L. Johnston 1967-pres
Three children: Heather, Shannon, Tres.
Hobbies: Reading, Tennis, and Amateur Radio.

VITA

F. Earl Johnston

Candidate for the Degree of

Doctor of Education

Thesis: EXPLORATION OF LINKS BETWEEN COGNITIVE AND AFFECTIVE GROWTH IN STUDENTS STUDYING A HARD PURE DISCIPLINE

Major Field: Higher Education

Biographical:

Personal Data: Born in Henryetta, Oklahoma, 1943; married to Bonnie L. Johnston, 1967; three children.

Education: Received Bachelor of Science degree in Chemistry and Biology from Central State University, Edmond, Oklahoma, in 1967; completed requirements for Doctor of Podiatric Medicine degree at Ohio College of Podiatric Medicine, Cleveland, Ohio, in 1976.

Professional Experience: Assistant Director of Clinical Laboratories (taught Clinical Pathology), Department of Clinical Sciences, Ohio College of Podiatric Medicine, Cleveland, Ohio, 1975-1977; organized and presented post-doctoral seminars in 1977; Director of Residents (responsible for all phases of post-doctoral teaching and surgical training), Loma Linda Ambulatory Surgical Center, Loma Linda, California, 1989-1991; Adjunct Professor of Anatomy and Physiology, Tulsa Junior College, Metro Campus, Tulsa, Oklahoma, 1992-1993; Visiting Assistant Professor (designed curriculum and taught a course in Human Histology [4253]; supervised laboratory graduate assistant), Department of Zoology, Oklahoma State University, Stillwater, Oklahoma, 1993.