

THE DIALECTIC BETWEEN LEARNING AND  
TEACHING IN A MEDICAL SCHOOL

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## ABSTRACT

Academic Support Programmes in South Africa are confronted with the seemingly impossible task of producing "programmes" which will assist growing numbers of Black students in their adaptation to the academic tasks. These tasks are demanded of Black students within tertiary institutions with a largely westernized cultural form of education. Despite the existence of institutions such as the Medical School of the University of Natal which has been training Black medical students for over thirty five years, little substantive research has been conducted into the processes of adaptation which Black students have undergone in coming to terms with the cognitive demands of academic tasks within universities. Instead, institutions such as the Medical School have found themselves embroiled in long standing controversies which essentially attempt to apportion blame for high failure rates on either students or staff members.

This research adopts a dialectical approach to the learning-teaching situations and focuses specifically on Black medical students' adaptation to the cognitive task demands of Physiology. The research uses a rational reconstructive paradigm to instantiate Feuerstein's "deficient cognitive functions" in the cognitive manifestations of second year medical students. This instantiation lays the groundwork for an investigation into the "contentless cognitive processes" (cf. Feuerstein) underlying the learning-teaching dialectic in Physiology.

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## CHAPTER ONE

### INTRODUCTION

Two specific concerns have made the process of education at the University of Natal Medical School an object of enquiry and research of **relevance** to current debates within open universities:

1. The existence of a Faculty with a population of "African", "Coloured" and "Indian" students within a university dominated by what may be regarded as a "Western" educational content and form of education.
2. Almost four decades of experience in the education of Black students: a long educational history of successes and failures, advances and retreats, contentment and conflict in the learning-teaching dialectic at Medical School.

Both the relatively recent admission of significant numbers of Black students to open universities as well as the emergence of educational conflicts within these open universities have made this study of Natal University's medical students and the process of education in the Medical School a matter of primary concern for the Academic Support Programme in the Faculty of Medicine. This history of educational successes and failures must be analyzed in order to learn from mistakes and build on successes and to provide a model for other institutions. It is with this in mind that this study was undertaken. The information and data for this study of the learning-teaching dialectic during the Pre-Clinical years of medical training was obtained both from past investigations into the second year of study at the Medical School, as well as from a project in progress which specifically focussed on the process of education. The data from past research consisted mainly of statistical data on examination results over the past 30 years of

teaching in Physiology, and historical records of debates in committees and commissions of enquiry within the Medical Faculty. This research included extensive clinical interviews with current second year students and a brief survey of all physiology students' study methods, problems experienced in writing exams, and some biographical information.

At the outset one specific qualification in this study must be made explicit, namely the reason for the use of racial categories. Whilst I have condemned the malicious use of racial categories in South Africa by certain groups, I have recognized designations such as "African", "Coloured" and "Indian" (which are used through this dissertation) as a vital piece of biographical information in the South African context. These terms were used in recognition of the history of unequal access to resources of these groups, an inequality which manifested itself in students' ability to adapt to, benefit from, and contribute to University studies.

Students accepted into Natal's Faculty of Medicine (or any other learning-teaching situation) bring with them established cognitive styles, processes and structures which influence their approaches to the learning-teaching situation. The students' internalized cognitive controls are used in grappling with learning tasks and disciplines which may have been new/foreign to the students both in terms of content and the contentless processes (cf. Feuerstein) which operate during the learning-teaching dialectic. Where the content and form underlying the teaching in the Medical School and the established internalized cognitive controls used by the student are at odds, the foundations of the learning-teaching dialectic will be weak. Evidence of weaknesses in the learning-teaching dialectic have pervaded the history of educational conflicts within the Medical

School. The current problems within the learning-teaching dialectic of the Medical School have barely changed since Branford (1961) outlined the problems in the first decade (1951-1961) of the selection and training of medical students in the Faculty. Since then two commissions of enquiry and numerous debates in Curriculum Committees have continued on the selection and training of medical students and specifically the problems in the second year of study. This previous research has however, highlighted the "products" or the "fossilized" forms of behaviour (cf. Vygotsky) rather than addressing the process or development of **adaptation: Adaptation both of the different student groups to medical studies and the medical curricula to the needs of students.** This current research looked at the **process of education** in the Medical School. In other words, it specifically addressed what Vygotsky referred to as the "process of change":

"To study something historically means to study it in the process of change; that is the dialectical method's basic demand. To encompass in research the process of a given thing's development in all its phases and changes - from birth to death - fundamentally means to discover its nature, its essence, for it is only in movement that a body shows what it is!" (Vygotsky, 1978, p. 65).

CHAPTER TWOTHE EDUCATIONAL CRISIS IN "OPEN" UNIVERSITIES : THE DILEMMA OF  
ACADEMIC SUPPORT

Any discussion of the educational crisis existing within open universities in South Africa can neither afford to make the mistake of neglecting the peculiar socio-political circumstances in South Africa and their impact on each individual in this country nor can it ignore the role which universities have played in perpetuating Apartheid. Rather than enter a lengthy discourse on socio-political effects on education in South Africa, I prefer to state explicitly my own view: Being black in South Africa has meant being denied access to social, political, economic and educational structures, or (where access has been gained) to set ceilings for attainment of empowerment in these structures through the deliberate ideology of Apartheid. The denial of access and the limitation on achievement through Verwoerdian Apartheid is well documented (see Kallaway, 1986). On the role of Universities in perpetuating Apartheid, Moulder (1988) provided statistics for 1987 which showed that universities have not exactly been swimming against the stream (see Appendix 1.) Obviously there are those within the universities (particularly the "open universities") who work towards notions of equal access to universities for all groups in South Africa and for the empowerment of these groups in the context of education in the universities. Also universities and university staff represent a microcosm of South African political views and supporters and opposers of Apartheid are no doubt well represented within university communities. Having made these comments about the broad context of education in South African universities, I now turn to a discussion of the Academic

Support Programmes which were established as a response to the educational crisis within open universities.

Over the past decade Academic Support Programmes were established within all the open universities as an "affirmative action" response to the high failure rate of blacks in open universities. Moulder (1988) calls the Academic Support Programmes a "master strategy" for dealing with black students admitted to open universities. This "master strategy" was adopted by the "open universities" from the Academic Support Services Programmes designed to assist Black and Hispanic students in American Universities. The two objectives of these Academic Support Programmes in America were firstly to increase the number of minority students in American universities to the point where populations in the universities reflected the demographics of populations in America and secondly to increase the retention rate of minority students in universities. Not surprisingly therefore, the major tasks of the Academic Support Programmes in America were research into selection and the establishment of educational development programmes for minority students (Abrams and Jernigan, 1984). The Academic Support Programmes in South African "open" universities provide similar services to students in their own institutions.

Academic Support Programmes in the "open" universities in South Africa have increasingly been called into question on a variety of issues concerning their role in the universities. These debates on the role of Academic Support Programmes in South African open universities concern two broad areas, Academic Support Programmes as a strategy for change within universities and the practical educational development aspects of day to day Academic Support Programme practitioners.

Moulder (1988) is the strongest challenger of Academic Support Programmes in the arena of strategies for organizational change. Moulder (1988) suggests that the Academic Support Programme was an adequate strategy for the early 1980's because there were so few black students within open universities. With the increasing numbers of black students in these universities, Moulder makes the point that Academic Support Programmes are no longer financially viable and that the creation of a strategy which is essentially an "add-on" extra has meant that institutional change has been ignored. Mehl (1988) also argues against the "add-on" strategy and suggests that institutional change in universities should rather be attempted through an "infusion model".

A further criticism of Academic Support strategy is that it has only focussed on students and has ignored the role of teachers in the learning-teaching dialectic. The strategy of focussing only on the learning aspect of the learning-teaching dialectic is fundamentally flawed as a strategy for institutional change, and also at the level of practical instructional programmes in the universities. Craig (1988b), in discussing the significant shift in the discourse used to describe Black students in the open universities, makes the point that changes in strategy are important but that the changes cannot just remain at a strategic level:

"deliberate attempts at renaming aspects of our reality in order to effect a change in the transactional patterns of people is an important moment in the process of change. It may, however, be crucially important to distinguish between strategic, and substantive formulations of a problem and its potential solution(s)

.... we have to make sure that what is achieved is something more than a strategic move". (p. 3).

An understanding of this distinction is crucial to an understanding of the debate raging around Academic Support Programme initiatives in universities. Moulder's (1988) arguments, taken to their logical conclusion mean that Academic Support Programmes should be closed down because they are neither financially nor practically viable. But Moulder argues essentially at a strategic level rather than at the equally important level of substantive formulations of the problem and possible solutions. At the strategic level there is a very wide range of opinion about what strategies should be adopted by Academic Support Programmes and it would seem that no definitive agreement on the strategy for educational programmes is possible at this stage. Indeed, these very different suggestions for Academic Support strategies have led to the creation of two different bodies both concerned with educational development and having members working in essentially similar bodies within different universities. About the only point of agreement between Mehl (1988) and Moulder (1988) is that the universities must change. How and what they must change is hotly debated.

The debate about Academic Support strategy is an important one but, whatever strategy is adopted, the fruits of such strategies will only be seen in the medium or long term. In the short term the Academic Support Programmes are still confronted with black students failing courses in the open universities. And this is the point at which Craig's call (for a "substantive formulation" of the problems and potential solutions) must be heeded. Strangely enough, there is a confluence of agreement from a very wide perspective on the way forward for formulating both the problem and the solution. This confluence of agreement comes

from management of universities (Mehl, 1988), from educational researchers (Craig 1988; Moll and Slonimsky, 1988) and from Academic Support Programme practitioners (Cloete and Schochet, 1986). This confluence of agreement comes in the form of seeking a substantive formulation of the problems of black students in universities in the realm of cognition and includes both learning and teaching in seeking to address the explicit cognitive development of black students in universities. In addition to this there was broad agreement that deficit models of cognition and learning skills should be firmly rejected. The broad confluence of agreement is summarized from four very different perspectives in the points below.

1. Mehl (1988) stated that cognitive deficit models should be rejected and that "it is possible to alter cognitive functions" bearing in mind that students bring with them cognitive repertoires which may not include everything required for success. Mehl (1988) calls for research into the "Learning-Teaching Milieu" in order to make explicit the cognitive operations essential for success in university studies and to devise instructional strategies infused with cognitive operations.
2. Cloete and Schochet (1984) called for a rejection of study skills programmes which were based on a deficit model and for "premiering learning skills on a developmental .... model" (p. 254). They suggested the following broad principles as the basis for a learning skills programme:
  - a) the content should focus on cognitive skills and learning processes, rather than study behaviours;
  - b) the emphasis is on the learning-teaching process and not the mastery of techniques;

- c) the cornerstone is to encourage students and staff to reflect about learning and teaching;
- d) the role of the specialist is to help create an environment that will encourage active participation and the exploration of alternatives;
- e) the responsibility for change is shared between learner, teacher and expert (p. 255-256).

3. Moll and Slonimsky (1988) in a discussion of Academic Support Programme theory and practice state that:

"The appeal here is for a cognitive theory which will avoid the suggestion that all Academic Support Programme students lack the cognitive structures on which university performance depends, but at the same time will explain how and why it is that they find it difficult to mobilize the appropriate contextual skills adequately in a university context" (p. 11).

These two authors suggest the need for an exploration of how cognitive developmental theories construe the cognitive structures and skills requisite for success in universities. They suggest the notion of "ground-rules" as one of the points for exploration, by which they mean the different cognitive skill expectations demanded by different academic contexts. Implicit in this is a focus not just on the learner but also on the cognitive **demands** required of learners by teachers.

4. Craig (1988b) contends that

"an analysis of change which does not address the cognitive constraints associated with change cannot provide an adequate (conceptual) basis for deliberate transformation of

society.... Addressing the problem of under-prepared students, therefore, demands attention to the necessary (cognitive) conditions for adaptation to unfamiliarity" (p. 6).

In agreement with the other authors, Craig postulates that research into problems of Black students must focus on the interaction between teaching and learning and presents

"a basis for re-thinking what has come to be understood as 'learning' and 'teaching' in this site of education: a basis which does justice to both the problems associated with different learning histories meeting in the (integrated or non-racial)' 'classroom' and the desires of the people for excellence in and through education." (Craig 1988b, p. 7)

This current research is informed by the findings of the authors mentioned above (and others) and is an attempt to apply theories of cognition directly to the learning-teaching dialectic within the second year of study in medicine in the University of Natal. It takes seriously the challenge set by the abovementioned authors for a cognitive theory of Academic Support and the task of this research may be summarised as follows:

"The 'Education crisis' as part of the larger socio-political crisis in South Africa may afford us, therefore, unique opportunities to explicate that which generates patterns in human action. Such an explication, in turn, may provide agents of change with a sound basis for the formulation of intervention

models for cognitive and social transformation" (Craig, 1988b, p. 9).

Earlier a distinction was made between strategic formulations and "substantive" formulations of the Academic Support dilemma and solutions to the dilemma. The explication of the **cognitive strategies** mobilized by learners and an **analysis of the cognitive demands of academic tasks** both focus clearly on substantive formulations. Yet at the same time it is strategic because it accepts that educators not only provide the conflict but could also provide "the resources to surmount the conflict, in order to empower all people to exercise their power to change" (Craig, 1988b, p. 28). Whilst not necessarily accepting the changes suggested by Moulder (1988), it incorporates a revision of the Academic Support strategy historically employed by "open universities" in their response to the selection and retention of Black students. In addition to this, it emphasizes that Academic Support is not an "add-on" function but that the responsibility for Academic Support rests with the educators themselves. Having said this, the educators require assistance in explicating the cognitive task demands of their various disciplines and in determining the implications of these task demands for their curricula. Perhaps the valid role for Academic Support is then to assist the educators with their role in providing the resources for students to surmount the learning-teaching conflict and, in this way, empowering the students for their process of adaptation.

CHAPTER THREELEARNING-TEACHING IN THE FACULTY OF MEDICINE

Having outlined the dilemma facing "open universities" in South Africa and the Academic Support Programmes in those universities, I now turn to a brief description of the educational crisis in the Faculty of Medicine. Located within an open university, it has substantial numbers of African students undergoing training in medicine through an essentially westernized form and content of education. The Natal University Faculty of Medicine has, for the last three decades, faced the problems which could possibly confront the "open" universities in the future. This chapter highlights the following as crucial dilemmas within the faculty, dilemmas which could now face "open universities".

1. Persistent and long term, unresolved educational crises which focus on the failure of African students in a traditional curriculum.
2. A student population whose mistrust of the 'intentions' of the Faculty is fuelled by the resistance to change by faculty in both the content and form of education.
3. Academics who are essentially being blamed for the failure of African students. These same academics become alienated from the process of change because they have borne the brunt of student accusations.
4. Changes in the curriculum which have been largely cosmetic and have focussed on the fossilized (cf. Vygotsky) product rather than on the process of change.

The details of students and the selection, administrative and curriculum structures are outlined in Appendices 2, 3, 4 and 5.

The longest standing educational crisis has been the consistently poor second year results of African students over the past thirty

years. The one hundred and sixty four exclusions between 1975 and 1985 bear testimony to the crucial failure of the learning-teaching dialectic over the years (see Appendix 3 for a detailed analysis). The crisis has been further aggravated in recent years by the increase in the number of students' failing the final examinations in Physiology and Anatomy (e.g. 63% failed Anatomy in 1986, for further details refer to Appendix 3).

This conflict in the second year of study has continued over the past two decades and has been the subject of two commissions of enquiry, the so-called Bhagat commission in 1978 and the Adams, Lazarus and Philpott commission in 1987. In addition to this, many hours over the past twenty years have been devoted to discussion and debate of the problems in the second year of study in Admissions and Curriculum Committee meetings as well as Faculty Board Meetings. The effects of previous attempts at resolving second year problems have been the alienation of second year lecturers and the exacerbation of feelings of mistrust amongst students who claim that nothing gets done about their grievances. An analysis of Branford (1961) indicates that the problems of the first decade (1951-1961) were little different from the subsequent twenty-six years (see Appendix 4).

The role of the Bhagat sub-committee (1978) was essentially to provide feedback from medical students to the faculty. In line with Branford's (1961) findings, the Bhagat sub-committee recommended that the volume of work in the second year be addressed by the faculty (see Appendix 5 for a summary of Bhagat's findings). In nineteen years there had been little change in the students perceptions of the problems in the second year of study. A further nine years later, the same recommendation arose from the Philpott, Adams and Lazarus Commission (1987). (For the full recommendations of this commission refer to Appendix 6).

As has already been stated, considerable time has been wasted in Commissions of Enquiry described above from which few substantial changes have arisen. Part of the problem has been the lack of substantive research which has led to dependence solely on teachers' and students' perceptions of the problems. A further part of the problem has been the lack of theory-driven research into the changes needed to address the problem of the failure of students in the second year of study. An analysis of the Bhagat and Philpott Commissions shows no explicit overall guiding principles for the curriculum review of either the content or the process of education.

A further obstacle to positive change has been the lack of focus on both learning **and** teaching and also the lack of focus on the dialectic or interaction between learning and teaching. The lack of focus on both these aspects has meant that the good intentions and bona fides of neither students nor academics has been brought into play in order to resolve the crisis. These good intentions have, instead, been needlessly brought into question by the lack of resolution of the crisis.

The final obstacle to change has been the lack of an explicit theory of organizational change and hence the lack of a coherent strategy for organizational change. The absence of a strategy for institutional change has meant that the Faculty has not overcome the inertia which is an integral component of resistance to change.

The creation of an Academic Support Programme within the medical faculty was originally intended to focus only on students and their problems and was therefore flawed from its inception. Once this became apparent to this author, the search for a workable theory of institutional change and for a substantive analysis of the learning-teaching began. The current research is

really the beginning of a process which must be on-going and it represents only the first tiny steps in the search for the resolution of what Craig (1988a) calls

"the problems associated with different learning histories meeting in the (integrated or non-racial) 'classroom' and the desires of people for excellence in and through education" (p. 3).

CHAPTER 4QUEST FOR THEORY

Consistent with the earlier quotation from Vygotsky I have taken you through a very brief history of the development of the second year learning-teaching situation in its various phases in an attempt to discover its nature and essence. It cannot be denied that change in the learning-teaching dialectic has occurred. For example, the exclusion rules in the second year of study were altered in 1986 and also there have been changes in the curriculum over the years. But the process of adaptation referred to above remains largely unresearched. Adaptation is occurring but the elements of the process of adaptation are not explicit. Two decades of debates have failed to resolve crucial issues in the student/faculty conflict, including such issues such as the volume of work and the relevance of the curriculum to students. What is needed is a way out of the impasse which neither threatens competent academics nor makes students feel incapable of adapting to the demands of medical studies.

In addition to addressing the micro-level of the educational impasse within the Medical faculty discussed above, the quest for theory had to take into consideration the macro-level of the debates around the role of Academic Support within universities which were summarized earlier. The guidelines for the quest for theory were as follows:

1. The theory had to contain an explicit theory of cognition pertinent to the needs of an Academic Support Programme. It also had to be a theory which could "drive educational praxis".

2. The theory had to exclude notions of deficits and of technicist study skills approaches but had to be a "transformation" theory
3. The theory had to avoid "add-on" structures but rather had to be an infusion theory with a viable strategy for institutional change.
4. The theory had to avoid focussing only on either learning or teaching but had to focus on the learning-teaching dialectic. An added corollary to this was that the theory had to locate the resources to surmount the conflict in both teachers and learners.
5. The theory had to address the cognitive constraints associated with change in the South African apartheid education system and with change in the second year of medicine.
6. The theory had to focus on process oriented research rather than on the fossilized (cf. Vygotsky) products of previous research in the faculty.
7. The theory-praxis had to provide a way forward out of the impasse which had virtually suspended substantial change within the Medical faculty.

In a review of cognitive theories, Craig states that a number of these theoretical domains have relevance to a discussion of tertiary education in South Africa. Craig (1988b) emphasizes the eclectic nature of the theory-praxes which need to be addressed to provide the way forward for academic support programmes in South Africa:

"Domains which span both meta-theoretical knowledge and the actual process of intervention; and which span the social and individual levels of analysis. This wide spectrum seems not only necessary given the task at hand

but is also evident in the on-going debates about 'academic support' activities and the future of non-racial, tertiary education in South Africa" (p. 2).

In the same way as a wide spectrum of theory-praxes must be considered by Academic Support Programmes within universities, so these same theory praxes must be reviewed and implemented by Academic Support staff in such localized learning-teaching situations as the Natal Medical School. These theory-praxes must not only account for the disjunction between the cognitive abilities of black students and the demands of university tasks but must also address the process of adaptation within the learning-teaching dialectic.

CHAPTER 5COGNITIVE DEVELOPMENT IN THE PROCESS OF EDUCATION

Faced with such demands for a solution to the learning-teaching dialectic, the need of the Medical School was for theories which dealt with the development of culturally autogenous cultural styles; the ability of the mind to adapt to and transform its way of viewing the world; the cognitive constraints which hinder the process of adaptation within the learning-teaching dialectic; and the ability of instruction to provide both the cognitive conflict or non-balance as the force for change as well as providing the resources to surmount the conflict.

At perhaps the most general level of argument, there was an understanding that studies of cognition and culture in the literature led to the necessity of accepting an eco-cultural approach to socialization. Multi-disciplinary studies have concerned themselves with the traditional styles of reasoning elicited by the eco-cultural demands placed on persons socialized in unschooled contexts. School education (and this includes university education) has context-specific cognitive consequences for individuals. As the Laboratory of Comparative Human Cognition (1986) states:

"modern schools confront children with activity settings that are discontinuous from the other kinds of settings they are likely to have encountered (or will encounter) in the course of their everyday lives. The teaching/learning activities that go on in

schools around the world are a distinct form of cultural practice." (p. 1053).

Considerable research has been conducted around the cognitive consequences of participation in the cultural practice of formal schooling. Rogoff (Ibid, p. 1053) summarizes the specific features of the effect of schooling on individuals in comparison with those who have not had the benefit of schooling as follows:

"Schooled individuals have gained skills both in the use of graphic conventions to represent depth in two-dimensional stimuli and in the fine-grained analysis of two-dimensional patterns. They have increased facility in deliberately remembering disconnected bits of information, and spontaneously engage in strategies that provide greater organization for the unrelated items. Schooled people are more likely to organize objects on a taxonomic basis, putting categorically similar objects together, whereas non-schooled people often use functional arrangements of objects that are used together. Schooled groups show greater facility shifting to alternative dimensions of classification and in explaining the basis of their organization. Schooling appears to have no effect on rule learning nor on logical thought as long as the subject has understood the problem in the way the experimenter intended. Nonschooled subjects seem to prefer, however, to come to conclusions on the basis of experience rather

than by relying on the information in the problem alone."

There exists in the literature evidence from a number of sources of the performance of traditional peoples on cognitive tasks. This cognitive performance of non-schooled persons contrasts strikingly with the cognitive performance of persons socialized in school settings. Examples of such research are as follows:

1. Traditional people demonstrate what Luria calls "empirical reasoning" when confronted with the task of responding to a syllogism. A syllogism is an exercise in logic which requires that the individual make deductions from a set of statements. These logical deductions would invariably be an "academic" verbal exercise divorced from the real world e.g.

"All clocks are slow

John has a clock ..."

Schooled populations have little difficulty in completing the task, though the ability to successfully perform the task is dependent on the number of years of schooling which the person had completed. Traditional populations, however, draw on real situations in the world rather than on logical considerations applying to the imaginary world of the syllogism. Craig (1988b) stated that the traditional person does not recognize the syllogism as an exercise in pure contextless logic.

2. The Laboratory of Comparative Human Cognition (1986) suggest that a major difference between schooled and unschooled populations which was widely supported in the literature was the way in which word meanings are re-oriented in a 'free association' task"

"In the literature on free associations, it has been found that the mode of free associating to

words undergo a change .... from a predominance of 'thematic', 'syntagmatic' and 'situational' associates to 'categorical', 'paradigmatic' and 'decontextualized' modes of organizing meaning chains." (p. 1054) .

For example, schooled adults would respond with paradigmatic associates such as "goose, turkey, fowl" when asked to "freely associate" with the word "duck". In contrast the unschooled traditional person was found to use associate word responses of a syntagmatic nature such as "swim, fly, food".

3. Okonji (In Lloyd and Gay, 1981) suggests that the traditional person is more likely to exhibit field dependence in response to a cognitive task than someone who has had formal schooling.
4. Pascual-Leone (quoted in Craig 1988e) claims that the traditional person is likely to demonstrate meriological thought rather than the logo-logical thought demanded by schooling.

The medical students in this study could not be considered "traditional" people because each medical student would have had more than twelve years of schooling. While the cognitive features mentioned above relate specifically to "unschooled" populations, the medical students displayed (in varying degrees) some of these features. The fact that there were similarities between the "unschooled" population discussed above that the "schooled" population of this current study must reflect on the disempowering nature of apartheid education. It must also be said that not all the students in this study displayed the cognitive functioning described above and each was in a different phase of adaptation to the specific learning/teaching culture of the Medical School. This then leads to a significant question: How have so many

African students successfully adapted to this education which is essentially dislocated from their everyday experiences? Craig states that the academic tasks typically demanded of students at university require cognitive functioning at the level of logico-mathematical thought (cf. Piaget). Taking into account the eco-cultural background in which most of the African students at the Medical School have been socialized, one must turn to Piaget for an answer to the development of logico-mathematical thought. Piaget views logico-mathematical thought as a universal cognitive level attainable by all persons:

"By adolescence, the human mind is capable of what Piaget has called logico-mathematical thought or thought which is logical, abstract and flexible: thought which can generate and test hypotheses about any aspect of reality and which recognizes reality as a part of a larger totality." (Craig 1988a, p. 3).

The basis of the Piagetian paradigm is the notion that the child-learner constructs knowledge via intrinsic generative mechanisms. In Craig and Miller's (1988) terms, cognitive change for Piaget occurs through an intra-psychological process of the transformation of the cognitions of the learner:

"Transformation is the complementary aspect of change in which the intrinsic generative mechanisms of a system are imposed on extant forms and alter their essential nature" (p. 4).

For Piaget the process of construction of knowledge refers to an active, conscious, goal-directed way in which cognitive development occurs. The concept of "equilibration" postulated by Piaget is a central postulate of his theory of the origin and growth of knowledge and was invented as an explanatory model for

the way in which knowledge develops for learners (Craig, 1987).

**Equilibration** is stated as a process leading from certain states of equilibrium to others, qualitatively different, and passing through multiple 'non-balances' and re-equilibrations (Piaget, 1977). Piaget makes the claim that these equilibrations consist of various mechanisms such as assimilation and accommodation which interact between existing forms of knowledge (internal cognitive schemes) and new objects of knowledge and provides the resources for surmounting the conflict. The individual strives to achieve a balance between external objects and the existing internal cognitive schemes. The introduction of imbalance into the cognitive scheme is regarded by Piaget (1977) to be the "driving force of development" (p. 13).

Craig (1987) explains non-balance 'in the following way:

"Central to this model is the concept of 'non-balance' which indicates a conflict between what the subject can do and does know at the moment of interaction with an object of knowledge (people, ideas, events, things etc) and what the object demands in terms of its historical constitution" (p. 79).

What Piaget failed to address was:

1. the analysis of limitations imposed on cognitive development by a social context and
2. the extrinsic generative mechanisms that regulate cognitive development - the transactions between people (i.e. the process of socialization).

Craig (1985) points out that the learning-teaching process is an important link between the power of mind to construct reality (from a Piagetian paradigm) and the social formation of mind (from the Vygotskian paradigm) (Craig, 1985). In addition to the importance of instruction in the development of cognition, Craig

(1988a) claims Vygotsky and Piaget share, in combination, a conceptual basis for the transformation of society:

".... 'the knowing subject' viewed as an active, purpose-seeking instrument of praxis (from the Piagetian paradigm in cognitive studies) and as the internalized, historical and culturally rooted social forms, communication and symbols (from the Vygotskian paradigm in cognitive studies) becomes a legitimate explanatory focus in an analysis of the necessary conditions for change" (p. 78).

For Vygotsky the generative mechanisms for the construction of knowledge are not viewed as internal as in Piaget's theory but are external generative mechanisms mediated to the individual via the social processes/culturally prescribed patterns of control. Vygotsky postulates "the process of internalization" as the core process for the internal cognitive reconstruction of an external social operation. Vygotsky cites as evidence for "internalization" the ontogenesis of pointing behaviour in children. This internalization is viewed as consisting of the following series of transformations:

1. An operation that is an external activity is reconstructed as an internalized cognition.
2. An interpersonal process is transformed into an intrapersonal cognitive scheme. "Every function in the child's cultural development appears twice: first, on the social level, and later, on the individual level; first, **between** people (interpsychological), and then **inside** the child (intrapsychological)." (Vygotsky, 1978, p. 57).
3. A long series of **developmental events** precedes the transformation of an interpersonal social process into a culturally mediated intrapersonal function.

The principles of instruction in the Vygotskian paradigm lay bare the social context of the acquisition of knowledge. For Vygotsky the key figure in the ontogenesis of intra-psychological functioning is the mother or caregiver and the key role is the role of the mother/caregiver in the mediation of culture to the child. Placed in the context of formal or non-formal education, the key figure is the teacher and the key role is the mediating function of the teacher. The mediators in the lives of learners determine the ability of the learners to adapt to and to transform society. To put this in the negative context, the inadequacies of the mediation determine the cognitive constraints which will hinder the ability of the learner to adapt to and transform the learning-teaching dialectic. This mediation (in the education context we have called it 'instruction') leads to the creation of what Vygotsky has called the "Zone of Proximal Development."

Vygotsky (1978) defined the Zone of Proximal Development (ZPD) as follows:

"the distance between the actual developmental level as determined by independent problem solving and the level of potential development as determined through problem solving under adult guidance or in collaboration with more capable peers" (p. 86).

Vygotsky was concerned with the relationship between these two levels. The difference or distance between these two levels defines "the boundaries of the zone of proximal development" (Wertsch in Rogoff and Wertsch, 1984, p. 2). For Vygotsky, traditional intelligence testing measured only the actual developmental level of the learner. What was important to Vygotsky was to assess the potential level of development.

"That which the child turns out to be able to do with the help of an adult points us towards the zone of his

or her proximal development. This means that with the help of this method we can take stock not only of today's completed process of development, not only the cycles that are already concluded and done; we can also take stock of processes which are now in the state of coming into being, are only ripening, or are only developing" (Vygotsky, 1956 quoted by Wertsch in Rogoff and Wertsch, 1984, p. 3).

The enormity of the implications of this claim demand that research be focussed on both the role of mediation in cognitive development and on the evidence for the creation of a zone of proximal development. For Wertsch (in Rogoff and Wertsch, 1984) the important research focus which emanated from Vygotsky's work was the examination of the "specific patterns of social interaction in which children participate" (p. 2). The original project initiated by Wertsch (quoted in Smith, 1988) analyzed the verbal and non-verbal strategies used by the adult to regulate the behaviour of the child in an instructional setting.

Feuerstein (1979) hones in on further explicating Vygotsky's role of mediation in cognitive development or what he calls the "Mediated Learning Experience" as pivotal to the acquisition of knowledge. Feuerstein states that two aspects relate to cognitive development, firstly the direct exposure to stimuli consistent with the representation of the object in Piaget's Theory and secondly, the Mediated Learning experience of the individual consistent with Vygotsky's theory of mediation. Feuerstein attempts a synthesis of the cognitive developmental theories of Vygotsky and Piaget.

"In our view, the cognitive development of the child is not solely the outcome of the process of maturation of the human organism itself and its autonomous independent

interaction with the objectal world. Rather it is the combined result of the direct exposure to the world and what we have termed the mediated experience by which cultures are transmitted" (Feuerstein, 1979, p. 16).

Feuerstein elucidates the Mediated Learning Experience as follows:

"By mediated learning experience (MLE) we refer to the way in which stimuli emitted by the environment are transformed by a 'mediating' agent, usually a parent, sibling or other caregiver. This mediating agent, guided by his intentions, culture and emotional investment, selects and organizes the world of stimuli for the child. The mediator selects stimuli that are most appropriate and then frames, filters, and schedules them: he determines the appearance or disappearance of certain stimuli and ignores others. Through this process of mediation, the cognitive structure of the child is affected. The child acquires behaviour patterns and learning sets, which in turn become important ingredients of his capacity to become modified through direct exposure to stimuli." (Feuerstein, 1979, p. 15,16).

The unique contribution of Feuerstein comes not only from his synthesis of Piagetian and Vygotskian theories of cognitive development but from his analysis of the **cognitive constraints** which hindered the process of adaptation for a variety of uprooted cultures transported to Israel in the early 1960's. The aetiology of the poor performance of culturally different individuals is, for Feuerstein, the lack of Mediated Learning experiences. Thus Feuerstein's approach is that of the need to intervene in the instructional process through Mediated Learning Experiences for

developmentally delayed immigrants to Israel. This need to intervene is shared by the need for an "educational" intervention in the present project.

Feuerstein's intervention is aimed primarily at providing Mediated Learning Experiences directed at the learner in order to enhance cognitive and meta-cognitive learning strategies rather than at external factors. This intervention is based explicitly on the assumption that such cognitive and meta-cognitive strategies **can be changed** by Mediated Learning Experiences:

"In terms of Mediated Learning Experiences, the human organism is viewed as an open system within which modifiability is not limited to specific ages or stages of development" (Feuerstein, 1979, p. 68).

For Feuerstein, Mediated Learning experiences are more than just social interactions and are situations which contain specific features:

"Learning how to learn (or, in our terms, cognitive modifiability) is a direct function of what we refer to as Mediated Learning Experience (MLE). In contrast to learning by direct exposure, mediated learning occurs when a mediator interposes himself between the learner and the environment and interprets the world to the learner. Thus MLE is not necessarily synonymous with social interaction. The issue is not whether the individual receives stimulus information from inanimate or animate sources but the kind of information that is received. The essence of a mediated interaction is that in the process of mediating information, a transformation

occurs that facilitates the transmission of meaning not inherent in the raw stimulus or sensory information impinging on the organism." (Feuerstein et al, 1981).

The two features highlighted in the quote above are firstly a deliberate intention on the part of the mediator to interpret the world to the learner and secondly an interpretation of the world which transforms the meaning of the stimulus to the learner. Specific to the African medical students is the need for an instructional environment which provides the required Mediated Learning Experiences. The intervention procedures used to assist medical students must in turn be focussed on the identification of the cognitive functions which need to be modified and the provision for the individual of the functional prerequisites which enable the individual to construct the conditions for cognitive modifiability. By doing this, the researcher would be explicating the Zones of Proximal Development for African students caught in the process of adaptation to the demands of university tasks. The engagement of African students in university tasks and the cognitive strategies which African students bring to bear on these tasks is the explicit focus of this research. This focus on the cognitive strategies or cognitive functioning of African students constitutes what Craig (1988c) calls a task analysis of "the different (cognitive) moments or levels in the process of knowledge construction when the learner, task, and teacher meet in transaction" (p. 29). The focus of this research was just such a task analysis, an analysis of the (sometimes inadequate) cognitive functions which African students employ in coming to terms with the (sometimes) unfamiliar tasks required of second year Medical students. Feuerstein (1979) provides just such a list of inadequate cognitive functioning from which the cognitions of African medical students can be instantiated.

In a study in the same tradition Craig (1985) proposed ten ideal adult mediational strategies for an instructional setting which provides for the development of autonomous problem solving skills. These ten "mediational operators" were as follows:

1. Task readiness
2. Gathering information
3. Specifying means and goals
4. Making the problem explicit
5. Attending to detail
6. Visual transport
7. Emphasizing invariant aspects of the task
8. Dealing with different sources of information
9. Discovering causal relationships
10. Co-ordination and integration" (Smith, 1988, p. 145).

Craig's analysis "highlights important moments in the instructional process which, if present will contribute critically to the learning process and generate effective adaptation to and mastery of formal (western) educational demands (Craig 1988a, p. 5). Craig incorporated Vygotsky's idea of the zone of proximal development and the emphasis on the mediator's role as pivotal to the cognitive development of the child. Feuerstein's clinical work and Vygotsky's theory provided the derivations for the mediational operators.

#### Theoretical Framework for the present project

The theoretical framework for the present project was derived from the broad theoretical frameworks of the authors reviewed—Piaget, Vygotsky, Feuerstein, Craig and Wertsch. The reasons for the acceptance of such a broad theoretical framework are closely allied to the points elucidated on the section on the "Quest for a

theory" and the requirements for a viable theory of the learning-teaching dialectic in the medical school.

1. Vygotsky's theory and method are explicitly dialectical
2. Both the Piagetian and Vygotskian paradigms as well as the research of Craig, Wertsch and Feuerstein accept the focus on both learning and teaching and the interaction between teaching and learning: instruction is central to cognitive development.
3. Both Piaget and Vygotsky propose theories of cognitive development that are transformational. Piaget's theory proposes transformation through intrinsic generative mechanisms and starts from the assumption that all adults are capable of logico-mathematical thought (i.e. flexible and abstract cognitive processes.) Vygotsky's theory is a theory of extrinsic generative mechanisms (cultural forms that regulate cognitive activity in the course of cognitive development) and is a theory of socialization.
4. A synthesis of Piaget and Vygotsky locates both the conflict (i.e non-balance in Piaget's terms) and resources to surmount the conflict as within the instructional setting itself.
5. Implicit in the Vygotskian paradigm and Feuerstein's theory is the notion that cognitions can be modified through the intervention of a Mediated Learning Experience and that the theory is not based on a deficit model.
6. Vygotsky's theory-method is a process analysis which "reveals real, causal or dynamic relations as opposed to enumeration of a process's outer features, that is explanatory, not descriptive analysis" (Vygotsky, 1978, p.65).
7. Feuerstein instantiated through clinical studies the cognitive constraints placed on the adaptation of people from one culture to the cultural forms of an unfamiliar culture.

The present project instantiates the meta-cognitive functioning which African students from an apartheid educational system bring to the everyday demands of academic tasks at university.

## CHAPTER 6

### METHODOLOGY

Consistent with previous research in this tradition, the theoretical bases were provided by the works of Vygotsky and Piaget (cf. Craig 1985). Vygotsky devised the theoretical construct of the "Zone of Proximal Development" which provided the means in this study for the investigation of the mechanisms whereby individual cognitive strategy is shaped by cultural factors. Feuerstein used Vygotsky's notion of mediation as central to his focus on the impact of Mediated Learning Experiences on individual's cognitions. Feuerstein's subjects were individuals who had been uprooted from familiar cultures into foreign cultures and Feuerstein instantiated cognitive functions typical of individuals who lacked Mediated Learning Experiences and who were in a process of adaptation to the cognitive demands of a new culture. In this present study the subjects were African medical students in their second year of study within an academic context which placed cognitive demands on learners which were not typically required of African students in their formal or non-formal schooling prior to entering university.

The methodology (or meta-method as Craig [1988f] calls it) used by Vygotsky (1978) is an "enabling theory method" (p. 8) which enables the construction of psychological explanations in terms of manifestations of cognitive processes. Catán (1986) calls this method the Microgenetic method:

"the microgenetic method provides an innovative approach to process-oriented work on cognitive development in specific social contexts" (p. 252).

In the current research, specific "occasions for surprise" (Craig

1988f) consistent with the microgenetic method's aims of developmental approach, (cf. Catan, 1986 for descriptions of actualization, primitivization, miniaturization, acceleration and externalization) provided the data for the research process.

Specific preceding projects in this tradition which made use of the combination of Vygotskian and Piagetian theoretical paradigms were as follows:

1. Wertsch et al (1980): Wertsch focussed on the verbal interactions of mother child dyads and analyzed the interviews for the verbal and non-verbal cues used by adults in the regulation of the activities of children.
2. Miller (1984) investigated the development in children of self-regulation through instructional settings.
3. Kok and Beinart (1983) encoded into seven categories the processes of task engagement of mother-child dyads. These seven categories were instantiated from videotapes of mother-child dyads engaged in joint problem-solving exercises.
4. Mindry (1984) analyzed video tapes of teachers and children engaged in joint problem-solving exercises and instantiated several of Feuerstein's deficient cognitive operations from the analysis of the videotapes. Smith (1988) observes that Mindry imposed a theory-guided order on the video tapes in order to instantiate Feuerstein's theoretically derived constructs.
5. Craig (1985) videotaped both mother-child dyads and teacher-child dyads engaged in joint problem-solving in order to explicate mediational operators within the instructional setting. From this Craig devised an indigenous theory of childhood.
6. Kok (1986) focussed on the indigenous operators reconstructed from Craig's (1985) indigenous theory of childhood.

## 6.1 Procedure

Consistent with the Microgenetic method (Catan, 1986), the subjects selected for the current study were in the earlier phases of **adaptation** to the cognitive task demands required of university students, each having had less than a year and a half at the Medical School. The subjects were chosen because they were, in the clinical judgement of the researcher, at different phases in the process of adaptation to the task demands required of successful students at university.

Craig (1988a) highlights the need to use the products of students' thinking and thoughts in order to reconstruct "what must be occurring, hidden, behind the facial facade of the knowing subject" (p. 4). The products are then used to postulate the intrinsic and extrinsic generative mechanisms which impact on the cognitive structures and processes of the mind. Feuerstein (1979) drew out his observations by analyzing children engaged in typical educational tasks. This current research used, (to elicit the products of university students cognitions), the following tasks typical of the cognitive tasks demanded of university students:

1. engagement in verbal debates around a specific academic topic. Included in this task is the ability to assimilate and accommodate new information (Piaget, 1977), to categorize the information (Donald, 1986) and to mobilize such information in addressing an unfamiliar task (Craig, 1988b). In this research the students were second year medical students who faced oral examinations in both Physiology and Anatomy as part of the overall assessment of their academic ability.
2. memorizing parts of a Physiology text and summarizing (in a written form) the knowledge memorized. Once again this was a task typically required of university students. The written

products were then used as products of the cognitive structures mobilized to engage in memorizing and summarizing.

3. dealing with information given in a diagrammatic rather than written or oral form. In this research students were presented with a diagram which they were required to memorize and reproduce, this being a fairly typical university task. The diagrams produced were then used as products of cognitions from which cognitive structures of the mind were extrapolated.

The "typical" university tasks used in the research were specifically presented as "ill-structured problems" (Craig, 1988b) in order to provide "occasions for surprise". These "occasions for surprise" make explicit the learning-teaching dialectic and the intrinsic generative mechanisms of the learner in the university context.

The students interviewed in this study were specifically selected because of the likelihood that their cognitive structures were in the process of change, the process of adaptation to the tasks demanded of students in a University with a largely Westernized eco-culture. Second year medical students at the University of Natal are confronted with academic tasks which call for them to mobilize every adaptive cognitive resource which they have in order to surmount the conflict. Both the fear of failing second year and the mal-adaptive cognitive strategies cultivated in the "Bantu-education" system need to be surmounted in order to survive in the Medical School. And the Medical School learning environment is certainly not one in which the essential cognitive strategies for success are made explicit to the learner.

The students were also chosen on their likelihood of having a broad range of productive and counter-productive cognitive strategies to bring to bear on the learning-teaching dialectic in

the Medical School. To put it another way, the students represented a broad range of understanding, lack of understanding and misunderstanding of the "rules of the game" (Moll and Slonimsky, 1988), that is the "rules of the game" for students to succeed in the Medical School.

The crucial focus of the current research was the dialectic between the cognitive operations of the learner and the task demands placed on the learner by the teaching 'tasks'. The interviews were conducted in English which was consistent with the use of English as the sole language of instruction used within the Medical School. The subject matter used as the basis for the interview was the Physiology covered in the second year of medical studies:

"The researcher must choose or devise situations wherein the phenomenon will best manifest its complete structure and lend itself to data generation and analysis. The researcher has a finger in the pie most strongly when he/she constructs the situation" (Van Zuuren, Wertz and Mook, 1987, p. 13).

Wertz and Van Zuuren (in Van Zuuren et al, 1987) state that the two means of data collection most consistent with qualitative research are participant observation and a phenomenological approach to psychological research. Whilst the current research is in these traditions, the term "activity-based observations" used by Hedegaard (in Van Zuuren et al, 1987) is probably a more accurate term for the method of research. The current research has the following features in common with Hedegaard's "activity based observations":

1. The context of research is the instruction process in a learning-teaching environment.
2. The researchers role is not passive - the researcher actively

engages in interaction with the subject.

3. The researcher brings a specific theoretical framework to bear on the data collection.
4. The researcher actively seeks to instantiate internal psychological mechanisms from the products of the interactions.
5. The interview protocol becomes the focus for further interpretation of the results.

#### 6.2 Interviewing and Interpretation of interviews as a method in the Phenomenological tradition

The controversy raging between the positivist scientific method and the anti-positivist traditions of phenomenology and symbolic interactionism (participant, observation) is highlighted by different approaches to data gathered from interviews. The scientific method's use of the clinical interview and its concomitant application of validity and reliability as standardized scientific means of assessing interviews are rejected by Honey (1987):

"It is true that the interview method can make use of inter-rater and inter-reviewer reliability procedures so as to insure the reliability and validity of the interview technique. However, this perspective on interview research continues to leave us with the problem of how to establish a methodology that can be distinguished from traditionally positivistic conceptions of research which insists that knowledge can be 'value-free', 'objective', 'disinterested', and ethically neutral" (p. 70) .

In wresting clinical interviews from the clutches of positivistic, scientific methods, Honey claims that, due to the very nature of the interview, it **cannot** yield objective and quantifiable data but that the use of the clinical interview "implies a hermeneutic mode of understanding .... (which is) .... unscientific for a positivist philosophy of science." (Ibid, p. 70). Honey continues by stating that the clinical research interview lends itself to hermeneutics. Support for this view is found in Kvale (in Van Zuuren et al, 1987):

"The objective of the qualitative research interview may be described as one of obtaining qualitative descriptions of the interviewee's life-world in order to interpret the meaning of the described phenomena. Contrary to the positivist philosophy of science, which has influenced so many discussions within the social sciences, the specific character of the interview method can best be understood on the basis of a phenomenological and hermeneutical philosophy" (p. 25).

The acceptance in the current research of this phenomenological/hermeneutical understanding of the interview protocol underpins the complete processes of description and interpretation which are used in coming to an understanding of the interview protocol and was in keeping with the previous research in this tradition. Furthermore, the phenomenological/hermeneutical method underscores the dialectical process used in the instantiation of Feuerstein's cognitive functions in the interview protocols of second year African medical students.

### 6.3 Method used for analyzing human interactions recorded on audio-tape

The process of analysis of the audio-tapes occurred in the following stages:

1. Initial immersion
2. Establishing the transcript of data
3. Elaboration of data
4. Applying "thick description"
5. Explanatory account

#### 1. Initial Immersion

The first stage of the process of analysis began with listening to the entire tapes of all the clinical interviews conducted with the subjects. The data in this present study consisted of the audio-tapes of three in-depth clinical research interviews of second year medical students conducted by two experienced interviewers. The role of the interviewers was to attempt to make manifest those aspects of the learning-teaching dialectic pertinent to the cognitive strategies which second year medical students bring to bear on learning tasks in medicine. Once the information in the audio-tapes had been absorbed through what Craig (1988f) calls immersion in the data, then it proceeds to establish the first level of interpretation:

"This viewing of tapes involves stopping and starting the 'reality' recorded and involves working towards building an interpretive network or building a 'picture' of the data" (p. 97).

#### 2. Establishing the transcript of data

Once a sense of the overall meaning conveyed by the audio-tapes had been attained, the entire clinical interviews were

transcribed into written form and checked and re-checked against the audio-tapes. Craig (1985) obtained video-recordings of mother-child dyads engaged in joint problem-solving activities and makes the following comment about the transcripts of video-recordings:

"An important point to be made about such transcripts of video-recordings concerns the fixing of that which is fleeting, namely, the event which, of course, is preserved on the videotape. The 'dullness' of a transcript in comparison to the 'richness' of the 'slice of life' preserved on tape, characterizes the loss of force (or meaning) which is evident in most forms of fixing an event..... A video-recording remains available for the analyst to return to and, therefore, records the event or object of interpretation in a medium much more suited to an analysis aimed at capturing the meaning of an event" (p. 97).

Whilst Craig's comment referred to video-recordings, the same claim to the "fixing of that which is fleeting" can be made for audio-taping, albeit that audio-tapes cannot indicate non-verbal gestures. Despite the "dullness of a transcript", the original audio-tapes remain available for reference and further analysis. The transcript then becomes the major focus for further analysis and the

"readers or audience or analysts construct a reading of the actions in which the meanings of the actions for the analysts (in terms of their 'preunderstandings and theoretical commitments) and their speculation about the intentions of the actors, form an unordered mix" (Craig, 1988f, p. 98).

### 3. Elaboration of data

Wertz and Van Zuuren (in Van Zuuren et al, 1987) describe the first phase of the elaboration of the data as 'handling' the data. They describe 'handling' the data as follows:

"One starts reading, or listening to the data openly, attending to and perhaps explicitly demarcating changes in meaning or specifying constituent unities of meaning. Repetition is often recognized and eliminated, although one should realize that in some cases repetition itself expresses an emphasis or a meaning that is crucial in understanding the phenomenon. Also, description not revelatory of the phenomenon or relevant to the research interest should be judged as such and discarded."

(p. 15).

The essential part of handling the data is the selection of illustrative extracts from the tapes and transcripts. These illustrative extracts are selected in order to follow on from the initial imposition of meaning on the extracts, namely the reconstruction by the analyst of the interactions of the actors and the meaning of their actions. The extracts are selected in order to further refine the meaning and the intentions of the actors and are the first dialectic between method and theory:

"The interpretation is a dialectical process between the protocol and the theory. A theoretical frame of reference is a necessary precondition of writing the protocol and starting the interpretation of the protocol. Using a theoretical frame of reference in relation to a specific protocol both changes the content of this protocol and develops the theoretical considerations into a framework." (Hedegaard in Van Zuuren et al, 1987, p. 56).

In the present research the dialectic was between Feuerstein's description and instantiation of cognitive functions and the cognitive functions of second year medical students expressed in the activity based observations.

Craig makes the following 3 crucial points for this stage in the process of analysis:

- i) the emergent ideas are not regarded as the final truth but remain in uncertainty
- ii) the dialectic between the meaning and intentions of the authors and their explanation continues through this stage until coherence is achieved

"At each point of decision or moment of interpretation, the emergent idea is pitted against what is already regarded as substantiated and the latter is pitted against the new idea or bit (part) of data in a continuous critical examination of each part in relation to the whole, and the whole in relation to the part" (Craig 1988f, p. 98).

- iii) a distantiatioin between actors performance of a task and the "experts" performance of a task allows the analyst to observe the process of change from one to the other.

The second order imposition of meaning was completed once the illustrative extracts had been selected and becomes a "theoretical rendering of the data" (Craig, 1988f, p. 99). These data essentially describe in the current research the manifest forms of Feuerstein's cognitive functions.

#### 4. Applying "thick description"

For Craig (1988f) the essence of applying thick description

is to apply specific questions to the data, questions such as the following:

- What may the data mean?
- What is the context or goal?
- What is the network of associated beliefs?

Applying 'thick description' is the application of a coherent story to pieces of data in order to make sense of the data and to continue and extend the dialectical method of the previous stage. This application of thick description contains a

"mixing of interpretive elements, that is, speculation about intentions and possible consequences of this, propositions about the meaning of actions and evaluations of appropriate goals in such a situation" (Craig, 1988f, p. 100).

#### 5. Explanatory account

Craig (1988f) states that the explanatory account requires the explication of the **generative mechanisms** for patterns in behaviour. For Craig (1988f) the explanatory account shifts to a further epistemological level:

"The transition from the phenomenological level of analysis to the generative level of analysis involves reconstructing the generative mechanisms for the patterns in the actors' actions identified through the previous stages of analysis" (p. 100).

The application of "thick description" to the data brings it to the level of a phenomenological understanding of the data and in the current project the application of Vygotskian and Piagetian generative mechanisms (i.e. extrinsic generative mechanisms for Vygotsky and intrinsic generative mechanisms for Piaget) to the data transforms the data into an explanatory account. This exposé of generative mechanisms is the same theoretical basis which

Feuerstein applies to elicit his cognitive functions from subjects in a state of cultural transition. In this sense the current project follows on from the work of Feuerstein but is more explicitly linked to the enabling theory-method applied by Craig (1985).

The list of "contentless cognitive processes" (Feuerstein, 1978) used by the African students is not intended to be a comprehensive one from Feuerstein's work but focusses on those strategies specifically mobilized by the students in response to the task required of them in this research. In addition to this, the focus of research has been on developmentally delayed cognitive functioning which interferes with the learning-teaching situation. It is not suggested that these cognitive processes were entirely absent or distorted for each subject or for each task which confronted the subject.

## CHAPTER 7

### RESULTS

Feuerstein established through clinical observation twenty seven types of inadequate cognitive functions which interfere in the learning-teaching situation. The following are the categories of inadequate cognitive functioning established by Feuerstein:

#### Input phase

"Blurred and sweeping perception

Lack of, or impaired, receptive verbal tools and concepts which affect discrimination

Lack of, or impaired, spatial orientation, including the lack of stable systems of reference which impair the organization of space

Lack of, or impaired, temporal orientation

Lack of, or impaired, conservation of constancies (i.e. in size, shape, quantity, orientation) across variations in certain dimensions of the perceived object

Lack of, or deficient need for, precision and accuracy in data gathering

Lack of, or impaired, capacity for considering two sources of information at once, reflected in dealing with data in a piecemeal fashion rather than as a unit of organized facts" (Feuerstein, 1979, p. 73).

#### Elaborational phase

"Inadequacy in experiencing the existence of an actual problem and subsequently defining it

Inability to select relevant, as opposed to irrelevant, cues in defining a problem

Lack of spontaneous comparative behaviour or limitation

of its appearance to a restricted field of needs  
 Narrowness of the mental field  
 Lack of, or impaired, need for summative behaviour  
 Difficulties in projecting virtual relationships  
 Lack of orientation toward the need for logical evidence  
 as an interactional modality with one's objectal and  
 social environment  
 Lack of, or limited, interiorization of one's behaviour  
 Lack of, or restricted, inferential-hypothetical  
 thinking  
 Lack of, or impaired, strategies for hypothesis testing  
 Lack of, or impaired, planning behaviour  
 Non-elaboration of certain cognitive categories because  
 the necessary labels either are not part of the  
 individual's verbal inventory on the receptive level or  
 are not mobilized at the expressive level  
 Episodic grasp of reality" (Feuerstein, 1979, p.73, 74).

#### Output phase

Egocentric communicational modalities  
 Blocking  
 Trial-and-error responses  
 Lack of, or impaired, verbal tools for communicating  
 adequately elaborated responses  
 Deficiency of visual transport  
 Lack of, or impaired, need for precision and accuracy in  
 communicating one's response  
 Impulsive acting-out behaviour, affecting the nature of  
 the communication process" (Feuerstein, (1979), p. 74).

Feuerstein views the low level of scholastic achievement and the  
 low level of cognitive adaptation to be the product of an  
 inefficient use of the cognitive functions which are prerequisites

to thinking. For Feuerstein, the categories given above emerged from clinical observations of children and adolescents in the process of adapting from their own eco-cultural histories to a novel culture (in Feuerstein's case it was the Israeli culture). The categories shown above were not intended to be comprehensive nor to be immutable but were, rather, provided by Feuerstein as a basis for further research. Also, Feuerstein suggested that not all of these inadequate cognitive functions would be represented in the cognitive repertoire of each socio-culturally disadvantaged individual, and that the cognitive functions would not necessarily be totally missing from the cognitive repertoire. In establishing the categories Feuerstein elected to construct a theory/explanation consistent with the clinical observations made from "a great variety of situations in the life space of culturally deprived children" (Feuerstein p. 70, 1979). Central to Feuerstein's explanation was the etiology of the inadequate cognitive functioning: he claimed that an absence of Mediated Learning Experiences interfered with the natural cognitive development of individuals and led to the lack of development of the pre-requisites for thinking. Feuerstein conceived of the phenomenon of the lack of Mediated Learning Experience as one which could be addressed through provision of Mediated Learning Experiences in a highly constructed fashion, what Feuerstein termed an "Instrumental Enrichment" programme:

"However debilitating the prolonged effects of a lack of MLE may be, there can be no good reason for believing that its effects need remain permanent or that MLE cannot be instituted at any stage of development with positive and constructive results." (Feuerstein, 1979, p. 68).

In contrast to Feuerstein's work the current project focussed on

young adults rather than on children. The context of the current research was that the instructional process (for learning-teaching dialectic) was the part of the process which exposed the cognitive functions for analysis. Because of the age of difference between Feuerstein's subjects and the subjects of this research, it was anticipated that there would be both qualitative and quantitative differences in the cognitive functioning of young adults when compared with the cognitive functioning of children. It was, therefore, also anticipated that there would be differences in the structure of Feuerstein's categories and also differences in the inherent hierarchy amongst the categories. It was also to be expected that certain aspects of Feuerstein's categories would be absent from young adults' cognitive functioning, for example, "Biological Impulsivity" was specifically a feature found in children's cognitive manifestations - but entirely absent from adults' cognitive manifestations. The overlap amongst categories was also expected to be greater due to the age of the subjects in the current study, leading to certain categories being subsumed under the other headings.

The pilot project supported the existence of the following differences between the cognitive functioning of young adults and those of the children used in Feuerstein's research:

1. Quantitative differences: The quantitative differences in cognitive functioning found between young adults in this study and the children in Feuerstein's study were relatively small and related chiefly to what could be expected from the natural maturational processes. An example of this was the more extensive vocabulary of the young adults.
2. Qualitative differences: The qualitative differences between the cognitive functioning of the young adults in this study and the children of Feuerstein's study related more to the

overall structure and constellation of Feuerstein's categories. The major implication for this study was the hierarchy of categories which emerged, as well as the greater overlapping in Feuerstein's categories for the adult population of this study. Feuerstein's category of "Episodic Grasp of Reality" was found to be a super-ordinate category in the cognitive functioning of the black medical students. In this research a number of Feuerstein's categories were subsumed under the heading of "Episodic Grasp of Reality". Amongst those categories which were subsumed under "Episodic Grasp of Reality" were the following categories:

Lack of comparative behaviour

Lack of spontaneous comparative behaviour

Impaired need for summative behaviour

This conflation of categories is in line with Feuerstein's findings. In his research he suggests that "Episodic Grasp of Reality" holds a central position in his categories and that it has an overarching role in relation to the other categories. Support for the use of "Episodic Grasp of Reality" as an overarching category in this study was also found in the greater degree of overlap in Feuerstein's categories for adult learners.

In order to further the research a survey of the perceptions of second year medical students was conducted. The survey of the perceptions of students was specifically used to elicit the typical problems experienced by second year medical students. The survey also enhanced the information gleaned from past investigations into the learning problems experienced by second year medical students. This survey of all second year medical students in 1987 (for a copy of the questionnaire see Appendix 7) extended the context of this research beyond a narrow conception

of Feuerstein's categories of cognitive functioning and provided a scaffold for what is termed a "task analysis" by Craig (1989). By task analyses, Craig means an analysis of the problem solving situations embedded in typical university tasks and an analysis of the nature of adult cognition i.e. the way in which the cognitive construction of knowledge occurs in adults.

The survey of second year students' perceptions of the learning-teaching situation in second year medicine included all second year medical students. As this research focuses specifically on African students, the summary of findings below is only for the sixty-five African students in second year in 1987.

TABLE 1A : SECOND YEAR QUESTIONNAIRE

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What was the most difficult part in studying for exams? (N=65)

	<u>% Response</u>
1. The volume of work expected of second year medical students was too great (including such comments as "too little time for the volume of work", "too much detail given in lecture books" and "inability to recall such an extensive amount of detail" and "long hours of study").	60%
2. Students uncertain of lecturers' expectations ("scope of study too wide", "insufficient guidelines on what to study for exams", "uncertain of what is important", "uncertain of what is relevant")	34%
3. Students struggling to retain and recall information ("fear that I will not be able to recall information", "not certain that I will remember important details", "I forget too easily")	9,2%

---

TABLE 1B : SECOND YEAR QUESTIONNAIRE

---

<u>What was the most difficult part of writing exams?</u>	<u>% Response</u>
1. Not knowing what answer is expected by the lecturer ("not sure if question is understood and if the required information has been given", "inability to write systematically", "we should be told what to learn for a paper", and "to write what was not asked")	43%
2. Inability to manage time appropriately in the exam ("lack of sufficient time to complete exam", "exams are too long" and "slow in writing)	22%
3. Difficulty in recalling relevant bits from the vast amount of information required to be learnt.	11%
4. Feeling demoralized and fear of failure.	5%

---

From the findings of the preliminary survey in the Table above, the researchers were able to construct learning-teaching tasks which linked the students comments to specific features highlighted by Feuerstein. The preliminary survey gave guidance to the researchers in which of Feuerstein's categories may be in evidence in the cognitions of second-year Black medical students. It was anticipated that the following categories would be found:

1. Blurred and Sweeping Perception
2. Unsystematic exploratory behaviour
3. Lack of need for precision in data gathering and communicating.
4. Impaired capacity for comparing two sources of information
5. Inability to seek relevant cues
6. Impaired need for summative behaviour
7. Impaired planning behaviour.

It was not presumed that other categories would be absent from the cognitive manifestations of young adults in second year medicine, but rather that the students' perceptions provided guidance in

searching for the manifestations which were most likely to be found. Furthermore, the questions asked pertained to only two parts of the learning-teaching dialectic, namely studying for exams and writing exams and excluded many other aspects. The complaint about the volume of work was expected to link up with such categories as "Blurred and Sweeping Perception", "Inability to Seek Relevant Cues" and an "Impaired Need for Summative Behaviour", whereas the complaint about not knowing lecturers expectations was expected to link with "Unsystematic Exploratory Behaviour" and "Impaired Planning Behaviour".

#### 7.1 EPISODIC GRASP OF REALITY

As has already been stated, Episodic Grasp of Reality was found to hold a central position as an umbrella concept for a number of other categories. For this reason it was appropriate to begin with Episodic Grasp of Reality as the super-ordinate category which provided the hierarchy within which a number of other categories could be subsumed.

Feuerstein suggests that an episodic grasp of reality is a common thread running through a number of other cognitive manifestations of the poor learner and that "it represents both a cognitive modality of interaction with reality and an energetic principle that determines the nature of the interaction" (Feuerstein, 1979, p. 102). For Feuerstein grasping the world in an episodic fashion means experiencing each object or event in isolation without any attempt to establish relationships amongst experiences. "No attempt is made by the individual to actively contribute to his experience by organizing, ordering, summing or comparing events and thereby placing them within a broader and more meaningful context." (Feuerstein, 1979, p. 102). Each object or experience is treated in isolation without attempts to link it

to previous experiences or to anticipated experiences. It represents a passive attitude towards experiences because no attempt is made to make sense of the novel object by locating it into existing frames of reference or by ordering or summing the data using existing cognitive schemes.

Feuerstein links the lack of organizing, ordering, summing and comparing data to a cognitive difficulty in extrinsic and intrinsic need systems. Grasping an event episodically reduces it to vague, ill-defined dimensions which blur the relationship between relevant characteristics of the event and relevant characteristics of other events which have preceded it. The lack of comparative behaviour further limits the individual to concrete sensorimotor modalities and inhibits the development of higher order cognitions.

Feuerstein seeks evidence for the existence of an "Episodic Grasp of Reality" in the lack of actively sought after perceptual relationships amongst events (organization of data), in the lack of spontaneous comparison of events which limits experiences to isolated concrete events and in a lack of summative behaviour. (Feuerstein defines summative behaviour as representing "a basic need to produce relationships in the world and it reflects the active contribution of the organism in his interaction with the external and internal processing of stimuli" (Feuerstein, 1979, p. 94).

A pervasive impression from the data in this study was that the medical students had created two distinct cognitive worlds, the world of medicine and the world of their everyday experiences. In Table 2 below is an example of a student grappling with a problem in which he was required to bridge the two cognitive realities.

TABLE 2: EPISODIC GRASP OF REALITY

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(The interviewer selected a term from the student's prescribed anatomy text for clarification by the student. The discussion proceeded as follows):

Interviewer: And "cytoarchitectonics!", what does that mean?  
 "Cytoarchitectonics"?

Student 2: I only know that "cyto" means a "cell".

Interviewer: Um. Um. And what does "architecture" mean?

Student 2: "Architecture" means the structure of the building.

Interviewer: So if you put those two meanings together-  
 cytoarchitectonics?

Student 2: I'd say its the study of the structure of the cell.

Interviewer: Sounds good enough.

---

In this situation the interviewer presented the student with a task with which he ought to have been familiar: the student was required to define a word which he had seen in writing and which consisted of two components "cyto" and "architectonics". The student is required to identify and define the stem of each of the two components - "cyto" is rightly defined as pertaining to cells but the student fails to identify "architec" as pertaining to the word architecture. He does, however, succeed in partly defining the word "architecture" when the interviewer prompts him. The learner functioning at a logico-mathematical level (Piaget, 1977) of cognitive processing would have little difficulty in disembedding familiar terms from an unfamiliar word (essentially an identification task) and in reaching a definition of each word stem in order to attempt a definition of the unknown word. The tasks of disembedding and identifying the word-stem of "architectonics" is essentially a task which demands the seeking of a relationship between a non-medical word "architecture" and the medical term "architectonics". To do this task requires the ability to disembed the word from one context to another

completely different context, the world of medicine. Despite the fact that the student initially fails to identify and transform the root of "architectonics" as "architecture" he does show himself to be familiar with the term "architecture". Once the student received assistance from the interviewer in transforming the word into manageable word-stems he was able to reach an adequate definition of the whole term "cyto-architectonics".

In this instance the medical student fails on his first attempt to bridge two existing cognitive schemes, that of knowledge acquired in the medical school context and knowledge acquired elsewhere. As has already been stated, a pervasive sense of the student "living" in two distinct cognitive worlds was found in the data. One of the aspects of Feuerstein's notion of an Episodic Grasp of Reality, that of experiencing events in isolation without actively seeking to establish relationships amongst experiences, would lead poor learners to create two such discrete, cognitive worlds. In the example above the student demonstrates that he knows the word "cyto" by immediately stating that it means "a cell". He fails however in the task of seeking to bridge the understanding which he has of the term "architecture" (that he understands the word "architecture" is apparent from his response once the interviewer has disembedded the word stem "architect" from the complete term "cyto-architectonics") and the transformed version "architect". Once the interviewer had disembedded the word "architect" from the medical cognitive schemes, the student had little difficulty in achieving a definition of the word "architecture" from his own "common-sense" cognitive schemes. This, then is presented as evidence for the medical students' experiencing events in isolation without actively seeking relationships.

In the following extract the student again fails to bridge his own cognitive worlds of "common-sense" and "medicine".

TABLE 3 : EPISODIC GRASP OF REALITY

- 
- Interviewer: OK. If I said to you that this first paragraph sounds, to somebody who's not in medicine - I don't know anything about medicine - if some organ that is hollow in the inside, the muscles and its shape controls to what degree it can go 'out' or 'in'- it's "bounded by muscles" - and that's what controls its movement. What would you then say? Or don't you think that's a correct description I gave?
- Student 3: I guess its partly true.
- Interviewer: OK. Partly true in what way?
- Student 3: The definition is not complete.
- Interviewer: What is the definition?
- Student 3: Well ....
- Interviewer: Can you define it then?
- Student 3: You have to explain the situation, you have to explain what makes it up. Then it shows, as you said, that it is bounded by muscles. It is quite true that ah, it controls the muscles and controls the extension of the abdomen, and also the peripheral organs, the peripheral structures, around the abdomen.
- Interviewer: And which are they? Which are the different structures?
- Student 3: The liver, the spleen, the kidneys, there's more ....
- 

In this extract the student fails to recognize that the interviewer presented a common-sense description of the abdomen which he was required to recognize and to give a verbal label. This failure to transform (Feuerstein, 1979) occurs despite the fact that there was little difference between his own definition (given later on in the extract) and the interviewer's definition. Analysis indicates that the major qualitative difference between the two descriptions is that the student's definition includes

words such as "extension of the abdomen", "peripheral structures" and "liver, spleen and kidneys" while the interviewer uses words which would be in common usage. Thus the task which the student fails to perform is a conservation of constancies task: he fails to transform the common sense description into a medical description and hence, fails to recognize the common-sense definition as the definition of the abdomen.

More important than the finding that the student fails to conserve across constancies is the further evidence that the medical student, through not seeking active relationships amongst experiences, experiences events in isolation and fails to bridge the cognitive worlds of "common-sense" and "medicine". This in turn supports the existence of an "Episodic Grasp of Reality". Some African medical students create two distinct cognitive worlds and certainly at second year level, fail to cognitively bridge the two worlds. In the Piagetian sense, the new, unfamiliar knowledge about medicine is not assimilated into existing cognitive schemes of knowledge. This, possibly, links into what medical students describe as "lack of relevance of medicine" taught by Medical School to their everyday existence.

For any learner to interact effectively with a new object of knowledge (i.e. to reach a higher form of equilibrium in Piaget's terms) the learner must be capable of experiencing the difference/similarity between what is already known (past experience, knowledge etc.) and the new object of knowledge. As in the example above, the student in Table 3 showed a marked lack of appreciation for the differences/similarities between a lay-person's account of phenomena and their medical terminology for those phenomena. In Table 4 below the student's inability to bridge the cognitive gap between the 'world of medicine' and his own experiential 'real world' is aggravated by the force of the

memorized medical terminology interfering with the student's performance on a purely logical task.

When presented with a syllogism the student in the transcript below failed to dissociate himself from the medical world situation to perform an exercise in logic. The student attempts to use medical terminology and this use of terminology prevents the successful completion of the logical task.

TABLE 4: EPISODIC GRASP OF REALITY

---

Interviewer: Ok let me just say Senegal, I'm just taking a Country. If I said to you, um: "All men over twenty in Senegal will get Aids. John is a man in Senegal". What must you conclude about John?

Student 1: Ah. He may be at a - I think it would depend. John is a man.

Interviewer: Ya.

Student 1: In Senegal.

Interviewer: Um.

Student 1: That would mean he too is at risk.

Interviewer: Ya.

Student 1: But then that would depend on his age.

Interviewer: Ok. So John, John is a man and his - what age did I give?

Student 1: Twenty.

Interviewer: Ok. John is a man and is twenty five and he lives in Senegal.

Student 1: That would mean that he is at risk.

---

Instead of accepting the syllogism as a purely logical exercise and producing a logically justifiable answer, the student concludes that "John is at risk". The conclusion demanded the response that "John would get AIDS" In this example a "real world bias" (cf. Gelatelly, 1986) of the world of medicine evidences itself in what was intended simply as an exercise in logic. This interference of the cognitive world of medicine in tasks demanding "pure logic" (and the converse, namely the interference of the cognitive world of "other knowledge" in the world of medicine) and the inability to achieve a higher order equilibrium of the

cognitive schemes would cause a medical student to locate his perceptions at any one time in only one cognitive world. Where the major emphasis is on "medicine", as in the task situation above, then it could be expected that the student would have difficulty with tasks which demand the use of different cognitive schemes.

The feature of an "Episodic Grasp of Reality" addressed in the examples above (namely the inability to establish relationships amongst events) is essential in understanding the creation of isolated cognitive schemes evidenced in medical students cognitive manifestations. The example given below, however, expands the "Episodic Grasp of Reality" to incorporate other aspects of the cognitive functioning of medical students.

In Table 5 below is a copy of one of the student's written responses to a formal examination set by the Physiology Department. The students were required to answer the following examination question: "Briefly describe the role of the Sympathetic Nervous System in the human body during stress." The student produced the following answer in response to the question:

TABLE 5 : EPISODIC GRASP OF REALITY

---

The sympathetic nervous system (SNS) dilates the pupil of the eye so that the person in danger may see the enemy clearly and run away (Flight). It also increases the heart-rate which leads to the dilation of coronary vessels so that the blood may run smoothly in the vessels since its speed will increase during flight. SNS dilates the bronchi of the lungs so that the person who is "frightened" may take in enough O<sub>2</sub> during his process of running away from danger. SNS opens the pores on the skin widely when the person is "frightened" or even "fighting" which will result in the hair on the skin protruding more to the outside. SNS dilates the gall-bladder and the pancreas so that no secretions are made available since digestion is not needed during "flight".

---

The inability to demonstrate summative, ordering, organizing and comparative behaviour in the way in which the question is answered would provide further support for the existence of an "Episodic Grasp of Reality". These inabilityes to order, organize summate and compare events emerged as subordinate cognitive functions to "Episodic Grasp of Reality" in this study. In this instance the student's answer was compared with the "expert" answer provided in a Physiology textbook (Vander, 1986 p. 639). In comparison to the textbook answer, the answer to the examination question in Table 5 was poorly ordered, organized and summated in the following ways:

1. The answer fails to make the point that increased general sympathetic activity occurs in response to stress.
2. There is little ordering of the response to stress in the answer. No indication of the hierarchy (or ordering) of stress responses is given - the answer merely moves from the eye to the heart rate to skin to gall bladder. In the textbook the answer begins with the secretion of hormones, followed by a specific sequence of events including some of those mentioned in the student's answer.
3. The adaptive value of the fight or flight response is presumed i.e. it is not stated explicitly.
4. The fight/flight responses to stress are mentioned as responses to stress but little is made of the fact that they are alternative actions, actions which are facilitated by the body's physiological responses. Also, no comparison is made between fight and flight responses.

The existence of an Episodic Grasp of Reality is evidenced in the lack of ordering, organizing, summing and comparing shown in the four preceding points. Table 5 also indicates support for Feuerstein's notion of Blurred and Sweeping Perception described

below. The clustering of Feuerstein's categories with "Episodic Grasp of Reality" as a central, superordinate category were found to weave their way throughout the cognitive manifestation of the Black medical students. This constellation of categories around the "Episodic Grasp of Reality" pervades most of the cognitive categories instantiated. Each of the categories instantiated provided further evidence for the existence of an "Episodic Grasp of Reality" in the cognitions of Black medical students.

## 7.2 LACK OF APPROPRIATE VERBAL LABELS

Feuerstein maintains that learners who have come from the eco-cultural learning/teaching histories which fail to develop operational thinking in learners will produce learners who are bound to specific tasks which demand a **concrete level of cognition** and that this would be particularly evident in a lack of verbal labels. These learners will find it difficult to master learning tasks which demand abstract thinking (Piaget's level of formal logical operations). An example of formal logical operations which learners with a lack of appropriate verbal labels will not manifest is an ability to generalize i.e. the ability to move from the specific to the general. These learners will reduce the intake of information and will limit the learners' capacity to generalize from a task which demands only concrete cognitions to tasks differing in both content and complexity. Thus it can be expected that learners who lack appropriate verbal labels will be most disadvantaged in the typical university tasks which demand the use of complex and abstract relationships at the level of formal logical operations. For example Craig (1988c) describes an inability to make use of figures of speech in English as directly affecting the learner's cognitive capacities to transcend concrete descriptions.

Feuerstein suggests two specific ways in which the lack of

appropriate verbal labels is manifested in the learner's verbal behaviour:

- i) Students who demonstrate that they understand basic concepts but have difficulty in selecting and using the corresponding linguistic label given for the basic concept.
- ii) Students who demonstrate that they do not understand the basic concepts but use the correct verbal label for these concepts.

In the Table 6 below the student is asked to give the meaning of the word "homeostasis". Note the absence of a definition of the word "homeostasis".

TABLE 6: LACK OF VERBAL LABELS

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Student 3: Well, ah. You may say homeostasis and then vascular system all goes under homeostasis.  
 Interviewer: What does homeostasis mean?  
 Student 3: It's the mechanism by which the rest of the body tries to maintain homeostasis.

---

In the extract above the student, by failing to illustrate an understanding of the term "homeostasis", demonstrates that he uses the word in the correct context but that he does not comprehend the meaning of the concept.

In the extract in the Table 7 below the student does not demonstrate an understanding of the term "system", a term which is repeatedly used in the lectures and in the textbook.

TABLE 7: LACK OF VERBAL LABELS

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Interviewer: What does it mean when one says, "Lots of different organs make up a system, like the circulation system?". What does that word system mean?  
 Student 3: It, ah. System, it's ah, made up of organs which have the same control.

---

The central issue in "systems" for the student is the issue of control, or as he puts it, a system is made up of organs which have the same control. This description misses the mark by failing to discuss the issues of co-ordination and integration and by failing to discuss notions of systems and sub-systems. The student had used the term "systems" correctly but, when questioned, had not demonstrated a full understanding of the term.

In Table 8 below the student was making a comparison between learning anatomy and learning Physiology.

TABLE 8: LACK OF VERBAL LABELS

---

Interviewer: Anatomy is lots of memorizing.  
 Student 2: Ya, but I mean its mostly just ah, medical terminology.  
 Interviewer: Um.  
 Student 2: Unlike physio where you have to memorize certain concepts ....  
 Interviewer: And causes.  
 Student 2: Ya.  
 Interviewer: And factors determining things.  
 Student 2: So those things are easily forgotten, unlike in anatomy. In anatomy the thing is we actually see the things.  
 Interviewer: Oh you mean when you cut up the cadavers?  
 Student 2: Ya, when you cut up.

---

The distinction made by the student between Anatomy and Physiology is that learning Anatomy means memorizing of medical names of structures which can be seen during dissection (veins, muscles, organs etc) whereas learning Physiology means learning things which "are easily forgotten" such as concepts. That concepts are harder to learn than the names of visible organs is not surprising, but this example does demonstrate that the learner finds himself bound to tasks demanding a concrete level of cognition. When it comes to "concepts" removed from the visible world, and particularly concepts demanding cognitive functioning

at the level of formal logical operations, then the poor learner is likely to be able to use the verbal label but will not demonstrate an understanding of the concepts underlying the verbal label. Just as Craig's (1988c) English students were unable to transcend concrete descriptions because of an inability to make use of figures of speech, so medical students who do not grasp physiological concepts (despite correct use of the terms for the concepts) will be unable to use these concepts as "building blocks" for higher level concepts and will also then not transcend concrete descriptions. In the example below, note how the student uses the terms "egg" and "placenta" incorrectly and then corrects himself.

TABLE 9: LACK OF VERBAL LABELS

---

Student 2:       The egg, I mean the sperm fertilizes the egg in the fallopian tube and from there the egg divides so that it increases and then from there it is implanted so it travels to the uterus and is implanted on the womb so by the time its released, the uterus is being prepared by hormones that are released mostly by the hormones so by the time its implanted in the placenta. I mean the uterus so they'll be prepared for implantation and from there the growth and differentiation of organs, the differentiation of cells, different organs and also increase in cells.

---

In the first line of his description of the fertilization and differentiation process the student uses the word "egg" where he meant to use the word "sperm" and further on the student uses the word "placenta" where he meant to use the word "uterus". In both cases he corrects himself immediately which indicates that he understood the basic concepts in the words but showed a manifestation of the first notion of Feuerstein's lack of verbal

labels, namely he had difficulty in selecting and using the corresponding linguistic label for basic concepts. The same inability to select and use a corresponding verbal label is in evidence in the extracts of students comments provided in Table 10 below.

TABLE 10: LACK OF VERBAL LABELS

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Student 3: . . . . . they should have more or less the same **what what** and **what what** you won't find that in Physiology and that they just use it like a society, we mean just aggregation of cells.

---



---

Student 3: . Or what. Like some other things, Negroes **what what** like we are doing spleen or what what and the Negroes and **what what**. It's a bit different in the causal development because of the type of food they eat and what what and that is why.

---

Throughout the interviews with this particular student, he used the term "what what" where he had difficulty in selecting the correct linguistic labels for a whole variety of medical terms as well as concepts in everyday use. At the point just prior to his use of the term "what what", the student would momentarily pause as he struggled with his inability to select the appropriate verbal label. In this particular case the lack of verbal labels would lead the student to attempt to reduce his intake of information.

### 7.3 BLURRED AND SWEEPING PERCEPTIONS

Feuerstein's Instrumental Enrichment programme was specifically aimed at addressing the educational needs of new immigrants to Israel who had been uprooted from cultures outside of Israel and were in the process of adjusting to Israeli life and

culture. The Instrumental Enrichment programme was designed to provide Mediated Learning Experiences for these children and adolescents uprooted from their own cultures in order to speed up their adaptation. It was in this context that Feuerstein evolved his understanding of the cognitive functioning of poor learners. "Blurred and Sweeping" perceptions were a feature found by Feuerstein in this uprooted population to be characteristic of students who came from what Feuerstein calls a "culturally deprived" background. Feuerstein specifically excluded from this category of Blurred and Sweeping perceptions any notion of a problem with the sensory organs themselves or with the neural transmission of perceptions (though, of course, students with these perceptual limitations may also exhibit "Blurred and Sweeping" perceptions). Referring to children from a "culturally deprived" background Feuerstein (1979) makes the following observation: "In these children perceptual inadequacy arises because purpose, focussing, and investment are not the result of an intrinsic need system of the organism" (p. 77).

Feuerstein focussed on a limitation resident in the mental work or meta-cognitive processing of "culturally deprived" learners. (Note that Feuerstein cites examples where learners are culturally **different** but are not culturally **deprived** and makes a distinction between these categories). This mental work of culturally deprived learners is specifically characterized by an unfocussed interpretation of perceptions (e.g. too much attention to unimportant details) and an inability to deal effectively with the perceived stimulus (e.g. inability to discriminate between familiar stimuli and unfamiliar or simple and complex stimuli). Thus Feuerstein found that a learner whose cognitions manifest "Blurred and Sweeping" perceptions would demonstrate a lack of persistence in focussing on stimuli, an inability to allocate time

to a perceptual task according to its complexity and would sweep over the characteristics of stimuli in a highly indiscriminate way. In contrast to this, effective learners are able to scan information and selectively discriminate according to the nature of the stimulus and to vary the time invested in perceptual stimuli. Feuerstein (1979) states about the effective learner that he or she would have a learning style characterized by "a generalized and pervasive mode of functioning" (p. 77) with an intrinsic perceptual need to seek purpose in stimuli, to perceive stimuli accurately and to vary the time invested according to the nature of the stimuli. Evidence for the existence of "Blurred and Sweeping" perceptions may be sought from the following features of student's work (Feuerstein, 1979).

- a) poverty of details.
- b) poor quality of sharpness.
- c) imprecise definition of borders.
- d) incompleteness of the data necessary for proper distinction and descriptions.

Just prior to the portion of the interview presented in Table 11 below the student had been read a portion of text from a Physiology textbook (see Appendix 8) with which he was already familiar. The task given to the student was to write down in summary fashion the main points discussed in the text. The student abandoned taking notes after only a few lines and thereafter relied on his memory to recall the details of the information.

TABLE 11: BLURRED AND SWEEPING PERCEPTIONS

- 
- Interviewer: If, say that was a lecture now, what kind of notes would you take?
- Student 3: Ah. I think I'd say from what Mr Bezuidenhout has read, what I picked up was that the superolateral surfaces of the cortex they merge and in the wall of the hemisphere the limbic lobe develops and this

is found between the two diencephalons, that is the right and left. This system is responsible for the integration of the visceral olfactory, and I can't remember which other two, but there were two others that he mentioned, and that's all.

---

Feuerstein suggested that one of the characteristics of Blurred and Sweeping perceptions was a poverty of details in the recall of information previously committed to memory. In the passage above the student recalls two of the structures for which the limbic lobe is responsible but fails to recall two others despite the fact that he knows that two others were discussed in the text. Bearing in mind that the text was not novel to the student and that he had read it both for tests and for exams, his inability to fully recall the functions of the limbic lobe is worthy of note. Feuerstein claims that where there is an incompleteness of the data essential for a proper distinction and description, as in the example above, "Slow perceptual processes, combined with limited focussing, may result in reduced or inappropriate input; reflected in blurred perception" (Feuerstein 1979 p. 76). The sporadic recall of information in evidence in Table 11 above clearly instantiates the "Blurred and Sweeping" cognitive style used by the student when confronted with new learning tasks.

Further evidence of "Blurred and Sweeping" perceptions is to be found where there is a lack of clarity in the details ("poor quality of sharpness") and an incompleteness of data necessary for proper distinction. In Table 12 below the student was asked where the concept of mind fitted in to his studies in Physiology. His response was as given in Table 12 below.

TABLE 12: BLURRED AND SWEEPING PERCEPTION

---

Student 2: I think mind is part of the central nervous system central nervous system. It's an integral part of the central nervous system.....

Ya. I mean it's ..... That's why I said it's part of the central nervous system, because you know, the brain is part of the central nervous system, so the mind should be part of the central nervous system.

---

In this extract the student demonstrates an inability to distinguish between the concepts of "central nervous system", "brain" and "mind". The lack of distinction between these three concepts reflects an unfocussed engagement in the overall functioning of the whole body (Part/whole relationships). In the absence of an understanding of the whole/part relationships inherent in the CNS/brain/mind interrelationships the perception of these three concepts would be typically blurred and unfocussed as in the description given by the student above. ("poor quality of sharpness"). The evidence for "Blurred and Sweeping" perceptions is further reinforced in the inability of the student to distinguish between "brain" and "mind", again a distinction crucial to the medical understanding of the body. Put in another way, the student demonstrates an imprecise definition of borders in his description of "brain" and "mind". Thus in the extract given above the student displays evidence of two of the key characteristics of "Blurred and Sweeping perception", namely the incompleteness in the data essential for distinguishing between concepts and the typical blurredness and lack of clarity in the details.

Feuerstein states in support of his notion of 'Blurred and Sweeping perception' that: "The perception of stimuli is marked by a blurredness of the various dimensions that characterize or define them" (Feuerstein, 1979, p. 76). In Table 13 below the student provides a classic example of blurredness in the distinction between "bacteria" and "viruses". The major distinction between "bacteria" and "viruses" stated by the student is that the virus is smaller. When asked if this is the "biggest

difference" between the two, he states "yes". In terms of medical knowledge the difference in size between viruses and bacteria is of trivial importance in comparison to the different ways in which viruses and bacteria operate within the human body. Clearly in this case the students perceptual investment has been focussed on less important details in the distinction between the two concepts.

TABLE 13: BLURRED AND SWEEPING PERCEPTIONS

---

Student 3: Well the bacteria as compared to the, the virus I should say is very small.  
 Interviewer: Little thing and the bacteria is a big thing:  
 Student 3: No, it's small, but then they are not of the same size, there's a difference.  
 Interviewer: Is that the biggest difference between a bacteria and a virus? Is the size?  
 Student 3: Yes.....

---

In Table 14 below the same student indicates poverty in the details when describing what causes the blood flow.

TABLE 14: BLURRED AND SWEEPING PERCEPTIONS

---

Interviewer: Ya. OK. And if I ask you, what causes blood flow? What would you answer? What causes blood to flow?  
 Student 3: The pump of the heart.  
 Interviewer: The heart pump?  
 Student 3: It's the vessel, it's kept ....  
 Interviewer: OK. And what causes the heart to pump? You say, what causes the blood to flow, then you say its the heart that pumps.  
 Student 3: Yes.  
 Interviewer: Now I ask you, what causes the heart to pump?  
 Student 3: Muscular contractions.  
 Interviewer: And what causes the muscular contractions?  
 Student 3: Impulses.  
 Interviewer: Impulses from where?  
 Student 3: From the central nervous system?  
 Interviewer: OK. So if I ask you what causes the blood to flow through the body?  
 Student 3: Then that would.

Interviewer: But then shouldn't you say all those things. Because if you just say the heart, you'd leave all those other bits out. Or don't you think so?

Student 3: Yes.

In response to the question "What causes blood to flow?" the student provides a single answer "The pump of the heart". As in the previous example the student displays a blurredness in his understanding of the part-whole relationship of the heart to the rest of the body and by doing this brings into question his understanding of systems and how systems operate in the body. The student was then given cues to the fact that his answer was inadequate (he was asked "what causes the heart to pump"). Again he gives only one answer, and instead of realizing that a single answer was insufficient, the student keeps giving single responses to the interviewer's questions.

In Table 15 below is a diagram which the student had previously learnt for an examination and which had been shown to him to learn and to reproduce. The diagram shown to him was as follows:

TABLE 15: TEXTBOOK DIAGRAM

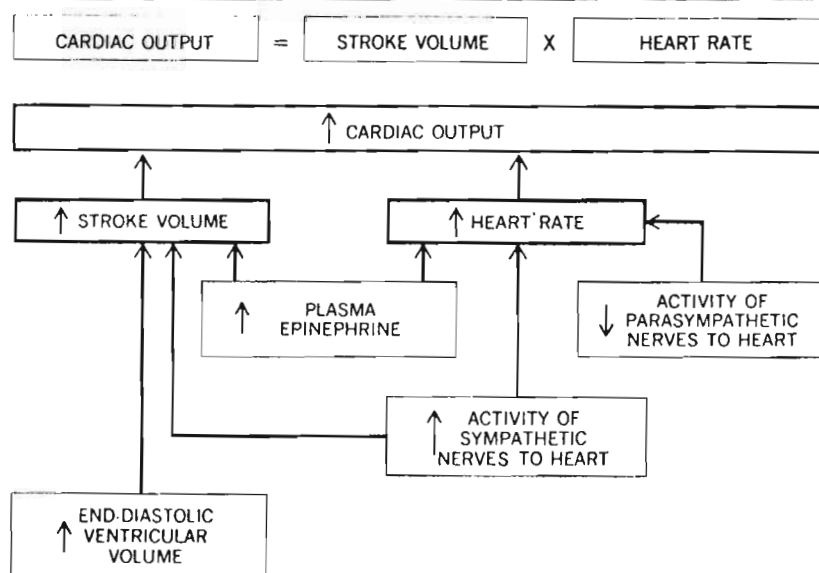
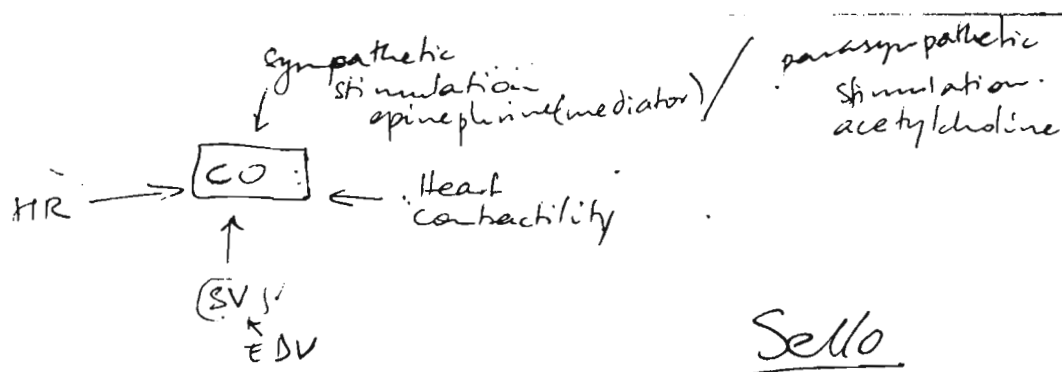


FIGURE 11-37. Major factors determining cardiac output. (This is an amalgamation of Figs. 11-31 and 11-36.)

(Vander et al (1986) p. 331.

After studying the diagram for some time the diagram was removed from his view and he was asked to reproduce the diagram. The result was the diagram in Table 16 below:

TABLE 16: BLURRED AND SWEEPING PERCEPTIONS



Given the importance of this diagram to the student's understanding of cardiac output and given an "homogenized rote learning" history it is surprising that the student did not reproduce the diagram exactly as it was laid out in the book.

The student's reproduction from memory of the diagram on Cardiac Output represents cognitive manifestations typical of a cognitive style characteristic of "Blurred and Sweeping" perception. A comparison of the original diagram with the diagram produced by the student indicates the following important differences:

- i) There was a distinct hierarchy of factors in the original diagram - at the highest level was "cardiac output", at the second level with direct impact on cardiac output were "stroke volume and Heart rate" and at a third level with only indirect input on Cardiac output through Stroke volume and/or Heart rate were all the other factors. In the student's diagram he has Cardiac output placed correctly as the central factor but makes no distinction between the second and third

levels within the diagram. This lack of hierarchy within the student's diagram shows a distinct poverty of details typical of a perceptual style that sweeps indiscriminately across stimuli.

- ii) The student includes in his diagram "heart contractility" which is absent from the diagram in the textbook and fails to include plasma epinephrine as a separate factor. This inclusion of incorrect details and the absence of other details indicates, on the part of the student, a further factor in a "Blurred and Sweeping" cognitive style, namely an inability to deal effectively with the perceived stimulus and a poor quality of sharpness.
- iii) In the textbook diagram there are two factors, namely Plasma Epinephrine" and the "activity of sympathetic nerves to the heart" which impact on both Stroke Volume and Heart Rate (as indicated by the arrows). This dual impact by Plasma Epinephrine and activity of sympathetic nerves to the heart on both Stroke Volume and Heart Rate is not indicated in the student's diagram, once again highlighting the poverty of details inherent in the student's diagram.
- iv) The textbook diagram includes little arrows pointing upwards or downwards in the box surrounding each of the factors. The importance of the arrow is that it indicates the direction of influence of that factor on its superordinate factor (that is, whether that factor will bring about an increase/decrease or slowing down/speeding up on the affected factor.) The importance of the arrows are that they enable the learner to differentiate between the different influences that one factor can have on another. The absence of these small arrows from the student's diagram indicates that the student has an incomplete understanding of the data which in turn

hinders the ability to distinguish between the effects of factors.

Because of the combination of a poverty of details, poor quality of sharpness and the incompleteness of data necessary for proper distinction and description which are all in evidence in the student's representation of cardiac output, this supports the overall "Blurred and Sweeping" perceptual style. For Feuerstein this in turn is indicative of a lack of an intrinsic need to seek purpose in stimuli, to perceive stimuli accurately and to vary the time invested according to the nature of the stimuli.

#### 7.4 IMPAIRED NEED FOR PRECISION

Feuerstein suggests two manifestations of the impaired need for precision in the learning styles of culturally different learners.

- i) Missing data: the student does not take care to gather all the data available and cannot, therefore, use the information when he has to produce an answer. Imprecision is manifested in a partial gathering and transmission of data.
- ii) Distorted data: Data are gathered in a way which only loosely approximates the original data and a qualitative distortion occurs. Feuerstein claims that the need for precision establishes itself through interaction with and feedback from other people on the accuracy of communication in line with Vygotsky's notion that

"the very structure of individual functioning derives from and reflects the structure of social functioning" (Rogoff and Wertsch, 1984).

This need for precision becomes internalized and thereby is established as a general need within the student for precision in communications. Poor learners have an impaired need for

precision, and imprecision may also be a result of "deficiencies" in other cognitive functions.

Feuerstein states that the impaired need for precision is attributable to a lack of awareness on the part of the learner that additional data are required to produce a complete response to a question. The need for precision is established in the learner through a variety of strategies in the interactional process including such factors as feedback on the efficiency of communication:

"Feedback on communication gaps produced by imprecision will produce in the individual a need to gather all the data and express them in such a way that his partner is able to understand and react accordingly" (Feuerstein, 1979, p. 87).

In the interactional process, the need for precision becomes less dependent on explicit instruction and is manifested as an internalized intrinsic need. Feuerstein uses the example of children correctly counting the dots and correctly perceiving relationships on the Bender Gestalt test and the children then proceed to copy the designs with fewer dots and without indicating relationships. In Feuerstein's clinical judgement the problem lay not with inaccurate perceptions but with a lack in the need to answer accurately. In the example below in Table 17, the student attempted to explicate details of the parasympathetic and sympathetic nervous systems and in doing so recalled from memory the details of these nervous systems. In attempting this description the student manifests an example of what Feuerstein has called "missing data".

TABLE 17: IMPAIRED NEED FOR PRECISION

---

Student 3: And then. Like I said sympathetic and parasympathetic added to more or less explain the nervous system itself like the differences between sympathetic and parasympathetic, ah, nervous system like sympathetic nervous system is involved with the fight/flight and I can't remember the third one but it has to do with emotions and what what like, you know, when you are frightened, its the sympathetic nervous system that is involved, dilating your pupils, increasing the heartbeat.

Interviewer: To prepare you for flight?

Student 3: For flight.

Interviewer: Um. Um.

Student 3: Then parasympathetic is sort of relaxing, you don't have to apply more energy.

---

The section of the transcript above is a classic example of "missing data": the student can remember that there are three points relating to the sympathetic nervous system but only recalls two of them despite the fact that he knows there are three points. In addition to this, his description of the parasympathetic nervous system is vague and is certainly very far from the textbook description of the parasympathetic functions of the nervous system, indicating a poverty of details.

In the example which follows in Table 18 the student was describing one way in which he committed things to memory, that of using mnemonics. He had stated that he had used mnemonics particularly in studying Anatomy and he gives an example of mnemonics for the bones of the hand in the Table below.

TABLE 18: IMPAIRED NEED FOR PRECISION

---

Interviewer: Oh, so what were your mnemonics for the bones of the hand?

Student 3: It's, ah, "she likes to play try to catch".

Interviewer: She likes to play try to catch, and then?

Student 3: "To catch her".

- Interviewer: Oh, ja. Ok, do you do that only for things like bones, or are there other things that you do it for?
- Student 3: There are other things.
- Interviewer: Like?
- Student 3: You see the arrangement of structures and medio-structural.
- Interviewer: How do you remember that? What is the rhyme? The mnemonic? Who taught you about mnemonics?
- Student 3: Well, maybe ah, things such as books and ah, but mnemonics I, they don't seem to work.
- Interviewer: You mean you remember the mnemonic and you can't remember what it stands for? Or what?
- Student 3: Ya. Sometimes I'll remember what it stands for but I just forget maybe that this one is for this and that one's for that.

The student explicitly states that he forgets certain parts when attempting to write down a previously learnt mnemonic, which is a clear indication of his inability to gather data and use the information when producing an answer on a straight recall task. That the student remembers some parts of a mnemonic and forgets others is typical of a reasoning style hampered by a lack of retention of information and by the distortion of data which Feuerstein cites as indicative of a lack of need for precision.

In the example given above the student clearly had acquired a learning strategy which was only partly successful. He had, however, succumbed to the notion of continuing to use mnemonics and thus confined himself to a cognitive style which limited him to being only partly successful in his recall of information for examinations.

Craig (1988c) quotes similar examples of the impaired need for precision where African students were given a lecture in Psychology and the notes taken by students were compared to the lecturer's notes. Craig (1988c) found that notes were taken down in "waves" and the notes often omitted crucial information by virtue of the cognitive processing of the verbal information being limited by the "peaks" and "troughs" inherent in the perception by

the learner of the verbal input. In the same way as the study skill of "mnemonics" became counterproductive to the learning of this medical student, so Craig (1988a) found that the "study skill" of presenting an essay with an introduction, body and conclusion may be counterproductive. Craig (1988a) made the following claim from an analysis of the English essays of students at the University of Natal:

"The good students sometimes violate this form (e.g. introduction, body, conclusion) in order to present a point of view more creatively, and the bad students are often almost so 'blinded' by this form and what it seems to demand, that the issue at stake or that which underlies the examiner's question gets lost" (p. 5).

The above-mentioned are two examples of the way in study skills such as "How to write an essay" or "mnemonics" may actually impede the development of successful, meta-cognitive strategies by creating a fixed learning response to new material.

#### 7.5 EGOCENTRIC COMMUNICATION MODALITIES

Feuerstein (1980) describes egocentric communication modalities in the following way:

"Egocentric communication modalities refers to an impairment of communication output as a consequence of the way in which an individual regards his partner with whom he is involved in a transaction. Egocentric communication is a function of a lack of differentiation, which does not allow the individual to see his partner as different from himself. This differentiation is a necessary condition for making communication explicit by producing all the evidence necessary for the listener's comprehension of the information conveyed to him. In many cases, the child

limits his communication in terms of detail, precision, and argumentation because of the attitude "How can he think differently than I do?" or "How is it possible that he doesn't know what I know?" This type of undifferentiated approach to another is even more accentuated when the interaction is between a child and a teacher or examiner. The child is not willing to accept the idea of being examined and limits his responses to the necessary minimum because it is clear to him that his are well known to his partner and, therefore, futile to communicate." (pp 99-100).

The extracts which are presented below in Table 16 came from students with an seven months background in Physiology and were attempts by students to communicate previously acquired knowledge of Physiology to the non-Physiologist interviewers. Note particularly the use by the subject of the words "you know" as "catch-all" categories for omitted details, and "what what" where he cannot recall the words.

TABLE 19: EGOCENTRIC COMMUNICATION

EXAMPLE 1

---

Student 3: Or what. Like some other things, Negroes **what what** like we are doing spleen, what what and the negroes and what what. It's a bit different in the causal development because of the type of food they eat and what what and that is why.

---

EXAMPLE 2

---

Student 3: So. But initially, I think at the beginning of the year I was having a problem with ah, ah, you **know** the proprioceptive pathways and touch and temperature pathways taken by nerves, **you know**, through the spinal cord until it enters the brain.

---

In the examples presented above in Table 19, the communication of information on Physiology, the words "what what" and "you know" were used in the sense of presuming that the interviewer had a full understanding of what was being discussed, and details are simply left out of the discussion. The omission of details and their replacement by "you know" was used on this occasion due to a lack of need to produce all the evidence necessary for communication because of a lack of differentiations between student and interviewer on the part of the student. In the absence of some of the evidence for a comprehensive communication, the communication became meaningless, to two non-experts in the subject.

In one sense, expecting students to recall information as they would for examinations highlights a paradox of the learning teaching dialectic: a student is expected to present thorough and precise details in an easily comprehensible format to a lecturer who already has a full understanding of the subject matter. The very nature of egocentric communication modalities lays the weaker student open to not providing full and adequate descriptions because of the presumption that the lecturer already knows the details. This paradox would, in turn, exacerbate the lack of differentiation which does not allow the individual to see his/her partner as different from himself/herself. In the absence of what Feuerstein calls the "necessary condition" for making communication explicit (i.e. the ability to differentiate between self and partner), the learner will not produce all the evidence necessary to fully convey the information required for full understanding on the part of the listener.

In Table 20 below the student was discussing reasons why fellow students achieved poor results in tests and examinations.

TABLE 20: EGOCENTRIC COMMUNICATION

---

Student 1: Like the times we find that we don't pass, not that we got low marks because we didn't understand everything, but we just assumed that this person knows, which is exactly what he wants, he wants to get from you to see that you know it.

Interviewer: Ya. Ya.

---

The paradox mentioned above in the learning-teaching dialectic is directly addressed by the student when he states that the students assumed that the examiner knew all the details and because of this assumption the students presumed a pre-understanding on the part of the examiner. This presumption led to inadequate explication of the topic being examined, which in turn, (because what was being tested was the ability to fully explicate the concepts) led to "low marks".

#### 7.6 IMPULSIVITY

Feuerstein makes the claim that poor learners demonstrate impulsive and unplanned exploratory behaviour when confronted with new learning situations. Poor learners are unable to select appropriate cues whose attributes make them relevant for the solution of a particular learning task confronting them. Feuerstein puts forward three types of impulsivity demonstrated by poor learners and suggests that all three types of impulsivity are not the result of an incapacity in attending to stimuli but are rather as a result of untrained exploratory behaviour. The first type of impulsivity refers to the interference of the "biological rhythm of the individual" with the selection of perceptual cues.

The second type of impulsivity displays itself where the solution to a problem requires a "motoric act" requiring both rapidity and precision. Poor learners fail to balance the two antagonistic trends of activation and inhibition where a task demands both rapidity and precision. Feuerstein suggests that poor learners grapple with balancing activation and inhibition and this manifests itself in an unco-ordinated vacillation between acceleration and inhibition. The third type of impulsivity, namely that of epistemic impulsivity is the type which will be shown to be in clearest evidence in the cognitive manifestation of medical students. This epistemic impulsivity refers to a cognitive dimension of the behaviour of learners and is attributable to

"a lack of awareness on the part of the child that certain dimensions, other than those he has already considered, will have to be used to reach the final solution" (Feuerstein 1979, p. 78).

Feuerstein states that the major determinant of impulsivity is conceptual and that the impulsive exploratory behaviour is linked to the limited awareness of the need for additional data to produce the proper answer. To illustrate this, Feuerstein cites the example of a Russian boy who was slow in responding when selecting the correct answer on Raven Progressive Matrices tasks. Feuerstein (1979) makes the following clinical judgement in this case:

"It was clear that what determined the premature cessation of his exploratory behavior was not a lack of attending, nor a lack of control, nor the inability of the perceptual process, often observed in impulsive children. Rather, his response reflected his lack of awareness that in order to solve the problem properly

there were dimensions to be considered in addition to those that he had already taken into account" (Feuerstein 1979, p. 79).

In Table 21 below the student was given a paragraph from a Physiology textbook to read and summarize. The student responded to this task by writing down each sentence virtually verbatim but in shorthand rather than attempting to crystallize the main points in the paragraph.

TABLE 21: EPISTEMIC IMPULSIVITY

---

(The interviewer was discussing the student's summary with the student).

Interviewer: OK. Now what you did there is you wrote every sentence down, you didn't write down just one point. (Interviewer pointed to the student's summary). You took every sentence and you just used a little bit of shorthand, so you rewrote this paragraph there. Is that what you do?

Student 3: Yes.

---

What was important in this case was not only the content of the summary which the student produced but his perception of the task of "summarizing" and also how he performed this task. In the natural course of their academic careers students are required to process vast quantities of information (all three students in this study complained of the volume of work in the second year of medicine). At a later stage in this interview the student makes it plain that virtually "rewriting the book" is his way of studying and by doing this the student does little to the perceptual cues by way of "mental work". The aspect of epistemic impulsivity demonstrated in this approach is the unplanned fashion in which the student explores the cues given to him. The data is also treated by the student as a discrete bit of information

isolated from the wider body of knowledge in Physiology and the relationship of this part to the whole (or to systems and sub-systems) is not considered. There is not an awareness in the students approach to learning that there were dimensions outside of the paragraph which needed to be considered. This links with the comment made by Feuerstein on the Russian boy that the problem was that he was unaware that there were other dimensions required in order for him to solve the problem. In neither the case of the Russian boy nor in the case of the medical student in Table 21 is there a lack of attending nor an inability of the perceptual process. The Russian boy failed to begin and complete tasks on the Raven Progressive Matrices because he did not grasp the overall context of the learning situation. In the case of the medical student, he failed to successfully summarize the text because his notion of summarising lacked an understanding of what constituted "summarising".

It was suggested by Feuerstein that conceptual or epistemic impulsivity is particularly evident in tasks where a learning task contains a rich input with a variety of data which has to be derived from a number of different sources before a solution to the problem can be attained. These requirements of a rich input and a wide variety of data from different sources would be typical of a number of learning tasks required of university students. One example of a typical learning task at university level which contains a rich input with a variety of data from a number of different sources would be the writing of an essay where the requirement was to "compare and contrast" two concepts. Students of Physiology may, for example, be required to compare and contrast the roles of the sympathetic and para-sympathetic nervous system. The elements of comparing and contrasting demand the comprehension of two different bodies of data and seek in both the

similarities and differences in the data to be analyzed. Evidence for the existence of epistemic impulsivity is to be found in a probabilistic perceptual response to stimuli (i.e. the learner arbitrarily selects data for the solution to a task). In Table 22 below the student was discussing his own failure to correctly answer a question on oxygen and carbon dioxide pressures in his November 1987 Physiology paper. Just prior to this extract the student had stated that he had not tried to memorize the partial pressures of oxygen and carbon dioxide at various sites and that he had mixed up these values in his answer to the question.

TABLE 22: EPISTEMIC IMPULSIVITY

---

Interviewer: You mixed them up. You couldn't remember, for instance, here they give you 152 and there they give you 100, you couldn't remember where which one comes? (Interviewer pointed to textbook).

Student 3: Yes I could remember everything because I knew the details of these gases in the respiratory sites. (Student pointing to various sites in textbook diagram).

Interviewer: Ya.

Student 3: So I could ....

Interviewer: So you know the percentage of gases in the atmosphere.

Student 3: Yes.

Interviewer: But you couldn't remember the percentage in the respiration sites.

Student 3: Yes.....

Interviewer: I see. OK. And that was because you didn't try and memorize it before?

Student 3: I didn't try to memorize it, just went over it.

Interviewer: Didn't you think they would ask you in the exam, or why didn't you memorize it?

Student 3: I never thought it would come up like this.

Interviewer: Um.

Student 3: I just thought that .....

Interviewer: So if they had just asked you that question, the question number one, "In the atmosphere ...." you would have remembered?

Student 3: Yes.

---

In learning the particular extract from his notes the student had established the percentage of gases in the atmosphere as both the key component to be memorized and as his "cues" for memorizing the concepts. This cue proved to be an arbitrary selection of data as it was inappropriate and failed to mobilize his understanding of the values of gases in the respiration sites. Also the student was locked into memorizing the values rather than coming to an understanding of how the values were established. In contrast with the student in the example above, the student in Table 23 below stated that he had not memorized the values at respiration sites but that he was able to calculate them because he understood the logic behind the different values.

TABLE 23: EPISTEMIC IMPULSIVITY

---

Student 1: I took that percentage and said OK, that percentage of 360 millimeters since it is at sea level and I could find it then for carbon dioxide too.

Interviewer: Um. Um.

Student 1: Now I'm not so sure if the figures I've given you are correct.

Interviewer: Ya. OK. Do you understand the logic? Do you understand the argument?

Student 1: Ya.

---

In Table 24 below the student provides an outline of his understanding of homeostasis. Note how he struggles with coming to terms with the fact that systems in the body are closely interrelated.

TABLE 24: EPISTEMIC IMPULSIVITY

---

Interviewer: Um. And homeostasis, or homeostases. How could you explain that?

Student 2: Homeostasis is the processes that ah, keep the, the

- activities of the body, the internal activities of the body normal.
- Interviewer: Um.
- Student 2: And then the, the receptors in the body.
- Interviewer: Um. Um.
- Student 2: So those things keep, keep the activities of the body, the internal activities of the body normal.
- Interviewer: Um. So in relation to the volume of blood, or the volume of blood in relation to the, to the secretion of that hormone, (pointing to a diagram) does one also attempt, does the body also attempt to achieve some homeostasis?
- Student 2: Ya. It actually, so it must keep a certain normal.
- Interviewer: Ya.
- Student 2: Ya, so if there's ah, if ever there's some abnormality.
- Interviewer: Um.
- Student 2: Then the body can detect that and then pretend, you know, try to make up for that abnormality.
- Interviewer: Um. Um.
- Student 2: So that's some some homeostases.
- Interviewer: OK.
- Student 2: Which keeps the balance.
- Interviewer: So why did you have difficulty with this question?
- Student 2: Actually the problem is ah, they are many factors which affect homeostasis.

The concept of homeostasis is central to the understanding of Physiology. Vander (1986) describes homeostasis as follows:

"We shall define a homeostatic system as a control system which consists of a collection of interconnected cells and which functions to maintain a physical or chemical property of the body relatively constant"

(p. 147).

The student's description is notable for its unsystematic presentation of information about homeostasis. Lack of verbal skills is evident from the student's use of the term "normal". The student correctly makes use of the word "processes" but fails to show that he has a deeper understanding of the word i.e. he

failed to show that he has not just rote learned the word and that he can take it and apply it to novel situations. Absent from the student's description is the idea that there are a number of co-ordinated homeostatic subsystems in which some are super-ordinate and have greater influence than other sub-ordinate systems. Also absent is the understanding of the term "normal": inherent in the student's description is an absolute normal without a grasp of a range of normal values. Further aspects not in evidence in the description are the concepts of inputs and outputs and the influence of the external environment as well as a negative feedback system. All of these concepts are central to an understanding of homeostasis and their absence indicates the unplanned and unsystematic exploratory behaviour of this learner. In Table 25 below the student (after prompting by the interviewer) addresses his own problem of unplanned and unsystematic exploratory behaviour and something of the logic underlying it.

TABLE 25: EPISTEMIC IMPULSIVITY

---

Interviewer: So in the end the best you can do is to, when you sit there with the exam question, just write down what you remember. You can't even think about that, you just let it come out.

Student 2: Ya. If you can't isolate points then sometimes you just think by writing down every thing that, you know, I will gain some marks on all those.

Interviewer: Um. Ya. And that is what is very frustrating if one, if one writes an exam and you write down every thing you remember and the marks come back and you got 40% or 20%. Because then you think you put so much into the paper and it didn't get you marks?

---

In this Table the Interviewer and the student were discussing the answering of questions in an examination. This extract follows on from the statement by the student that he tends to write down all the facts he knows about a topic rather than structuring his

answer. If a learner is impulsive in learning new information (i.e. does not explore and come to know the topic in a systematic, planned fashion) then the consequence of this would be an inability to "isolate points" (by "isolating points" the student is specifically referring to the epistemic ability to structure knowledge according to importance, relevance etc). Evidence for this comes both from exams where the student writes down everything he knows about a topic rather than answering the exam question and in the attempts to learn whole chunks of information instead of seeking out the main points. This extract also indicates the captivity of the student to text referred to elsewhere.

#### 7.7 Overview of Results

1. Feuerstein suggests that a considerable degree of overlap exists amongst the categories. This current research concurred with Feuerstein on this point and found that one specific category, the Episodic Grasp of Reality was a superordinate category in the cognitive functioning of medical students with a constellation of subordinate categories around it.
2. As anticipated, not all of Feuerstein's categories were to be found in this study due to the age difference between the population used in this research and the age of Feuerstein's subjects. The fact that not all of Feuerstein's categories were in evidence was also due to the limited nature of the tasks, namely performance on tasks related only to academic studies at a tertiary level.
3. The medical students in the study were in the process of adaptation to the cognitive demands of the university tasks. Despite the fact that the medical students were a "schooled"

population (having each spent twelve or more years in schools) the medical students demonstrated cognitive characteristics which were at odds with the cognitive demands of tasks typical of university studies. These cognitive characteristics bore resemblance to characteristics found by other researchers in "unschooled" populations. It is suggested that the apartheid model of education must answer for the disempowering nature of apartheid education. It must also be stated that the medical students in this study demonstrated varying degrees of disjunction between their own cognitive abilities and the demands of typical tasks at university.

4. From the preliminary survey it became clear that certain of Feuerstein's categories would be more in evidence than others. It was predicted from the large number of comments about the volume of work in the second year that categories such as "Blurred and Sweeping perceptions" would typically be found in the cognitive manifestations of the students.

CHAPTER 8DISCUSSION

That Feuerstein's categories which he established from the cognitive difficulties of learners dislocated from their own cultures can be transported from one category of learner in Israel to another category of learner in a Medical School at the University of Natal in South Africa is a finding which is supported in this current research, but it is not the key finding. Nor is it important that "part of the problem" of the high failure rate of Black Medical Students and the learning difficulties of these medical students in the second year can be located in the cognitions of the Black medical students. On the basis of previous research in the same tradition (namely the research of Mindry, Kok and Beinhardt) which instantiated Feuerstein's categories, the two findings mentioned above could have been predicted.

The disjunction between the cognitive abilities which medical students bring to the learning task and the nature of the demands of the learning task provided the shifting faces of reality referred to by Craig (1985) in the following quote:

"Shifting faces of reality are evident to an outsider or an observer in the discrepancies between individual and social forms. These discrepancies may arise when actors from one socio-historical tradition engage in tasks or activities that are embedded in different socio-historical contexts. It is also desirable to reveal the source of change because, in a theoretical account of the

phenomena, it is paramount to explain rather than merely describe the phenomena under study." (Craig, 1985 p. 316)..

The current project takes seriously the uniqueness of the moments in time/opportunities for surprise which revealed themselves in the data. Every medical student brought with them an eco-cultural learning history peculiar to themselves. What is reflected in the data is not a static notion of cognition that permanently locks a Black medical student into an eco-cultural learning history but rather that the "slice of life" represented in the data is a moment in a process of upheaval, conflict and adaptation. The upheaval and conflict come from the inadequacy of previously tried and tested learning recipes for in the novel learning context of the Medical School. The process of adaptation comes partly from the driving force of cognitive development, cognitive disequilibrium (cf. Piaget). In addition to Piaget's intrinsic generative mechanisms are the social processes which underlie the development of cognitions, Vygotsky's model which addresses the historical development of mind in social action and communication. For Vygotsky, the interpsychological cognitive processes created by the mediated learning experiences of the learner bring about development/change in the intrapsychological cognitive processes. These mediated learning experiences (interpsychological processes) directly impact on the process of adaptation experienced by medical students when coming to terms with an unfamiliar reality.

On the face of it the results which were reported merely reflect the difficulties that learners from one culture experiences when confronted with the unfamiliar tasks of another culture. The explication of these difficulties is neither unique nor surprising: that Black medical students experience great

difficulty in coming to terms with the Westernized form of the acquisition of knowledge says nothing new. It was essential, however, to take into consideration what Craig (1988e) calls the cognitive constraints to change. To go beyond the face value of the results, what is required is the focus on the process of adaptation, that Black medical students can and do successfully adapt to the cognitive demands of tasks at a university level. The pass rate of Black medical students at the University of Natal bears sufficient testimony to the fact that large numbers of Black students come to master the cognitive demands of academic tasks. Furthermore, this mastery occurs seemingly without any direct cognitive intervention on the part of the Medical School. Thus the "ordinary" learning transactions within the Medical School provide a sufficient basis for the successful cognitive socialization and transformation of some students. For other students it is not enough.

The consequences of this "not enoughness", what has elsewhere in this research been called "a weakness in the Learning-Teaching dialectic", are the exclusions and the large number of students who are required to repeat the second year of study. If we accept Piaget's statement that all human beings are capable of achieving logico-mathematical thought (the highest form of cognition) then it must be accepted that these consequences of a weakness in the Learning-Teaching dialectic can be addressed. Similar conclusions may be reached from the reported work on Feuerstein's Instrumental Enrichment Programme whereby culturally uprooted adolescents were given mediated learning experiences which took them from their specific eco-cultural learning histories to successful adaptation to novel "other culture" tasks. These mediated learning experiences essentially explicated Vygotsky's concept of a Zone of Proximal Development.

Change and the ability to change is a further central facet to the findings of this current research. Craig makes a statement with which the results of this research concur: the instructional process must not just create the conflict but must also provide the resources to surmount the conflict. To meet this requirement means meeting the demands for an enabling theory-praxis placed on Academic Support Programmes, demands which were elucidated in the quest for theory. Briefly, the requirements for an enabling theory-praxis were as follows:

1. It had to be an explicit process-oriented theory of cognition.
2. It had to be a transformational theory which focussed on the Learning-Teaching dialectic.
3. It had to address the cognitive constraints placed on change.

What emerged from this research was a number of possible meta-cognitive strategies instantiated within a specific learning-teaching context. The word "possible" is used to indicate that the data-base was derived from engagement in tasks typical of a specific, culture-bound situation for the acquisition of knowledge. The data-base was, therefore, of a very different order to the actual replies and questionnaires which provided the basis for the data-base. What emerges in the data-base is a dialectic between what the individual brings to the task (cognitive abilities) and the cognitive demands of the task. Because the students were in the process of adaptation to an unfamiliar reality, this research provided an opportunity to "visit" the transformation of mind in society. In a certain sense this research took for granted the "academic tasks" and the teaching context by depending on the research of authors such as Craig (1988c) who focussed on an analysis of the cognitive demands of the university tasks. Further research into the Learning-

Teaching dialectic would demand the explication of the contentless cognitive processes demanded of "expert" students by the content, context and process of learning Physiology. These "contentless cognitive processes" of successful learners were implicit in this current research but must be made explicit in order to elicit mediational operators which would assist in the transformation of the instructional process.

This shift in focus to a dialectic between "experts" developing the cognitive contentless processes demanded by specific university subjects and the "mediational operators" (cf. Craig 1985) which facilitate the mediational process is the next requirement in the research process. This dialectical process would assist in further uncovering the hidden facade of the Learning-teaching dialectic within the Medical School of the University of Natal.

"The time has arrived for universities to contemplate some other reality or set of structures to support their educative function. We need to look beyond common sense and find, or at least attempt, a solution that requires no apology and casts no shame on either students or teachers who ultimately are answerable to each other in equal measure."  
(Craig, 1988a p. 158).

APPENDICESAPPENDIX 1

	African	Asian	Coloured	White	Total
% population	69,2	3,2	10,3	17,3	100,0
students	171 404	7 926	25 513	42 851	247 694
	61378	19 177	16 111	151 028	247 694
	+110 026	-11 251	+9 402	-108 177	
academics	6 156	285	916	1 539	8 869
	408	238	157	8 093	8 896
	+5 748	+47	+759	-6 554	
administrators	6 878	318	1 024	1 720	9 940
	1 123	571	725	7 521	9 940
	+5 755	-253	+299	-5 801	
servants	5 894	273	877	1 474	8 518
	6 031	285	1 868	334	8 518
	-137	-12	-991	+1 140	

(Taken from a talk by Moulder (1988)).

## APPENDIX 2

### Student Population

The Admissions Committee of the University of Natal admitted 80 students to the first year of study in 1987 and there was an equal split between African students and Indian/Coloured students. In 1987 the Admissions Committee admitted a further 55 students to the second year of study. These 55 students were students who had completed their first year of B.Sc with specific subjects (B.Sc 1 subjects) and were, in the main, Indian students. There was a paucity of African applicants to the second year of study with the result that, in 1987, the African population in the Medical School was only 35 per cent of the total Medical School population. This was despite the equal admissions policy in the first year of study. A further factor which reduced the African population at the Medical School was the exclusion of students from the second year of study.

### Selection of Students

Branford (1961) researched the first decade of the existence of the Medical School (1951-1961) as a training institution for medical students. Branford found that, for the period 1951-1961, 33 percent of the first year intake failed to reach the clinical years of study and Branford attributes this directly to the inferior provision of school education. Branford also found that the exclusion rate for students in the fourth to sixth years of study was very low and that, once students reached fourth year they were virtually guaranteed to graduate. Branford's selection findings were that there was a very low correlation between matric Biological Sciences and results in the second year of medicine. The same was true for Physical Sciences whilst no other matric

marks correlated with second year results in Anatomy and Physiology. An interesting observation was that selection in the year 1960 was done purely on the basis of matric marks and that only nine African students gained admittance in direct competition with Indian and Coloured students. In comparison, the Indian and Coloured students in 1987 all had matric aggregates of over 70 percent while the African students accepted in 1987 had matric aggregates ranging from 57 percent to 73 percent with a fairly even spread throughout the range. In 1987 not one African student would have gained admission in direct competition with Indian and Coloured students. In Branford's time matriculation marks, interviews and psychometric testing were used to identify suitable students. Shortly after that the interviews and psychometric testing fell away and Admissions Committee rigidly adhered to the matriculation marks for selection. Currently four subjects, namely Maths, English, Physical Science, and Biology are weighted and combined to provide a selection criterion. Presently the system selects equal numbers of African students and Indian/Coloured students. The weighted aggregate used for selection is the absolute deciding factor for admissions, even to the extent of going to decimal places, despite the publication of data which indicated the inadequacies of matriculation marks for selection. The poor predictive validity of matric marks for academic success at this Medical School has been well documented by Badsha, Blake and Brock-Utne, 1986. Badsha et al (1986) correlated matric results with results in the first and second years at the Medical School for the period 1979 to 1983. They found that the matric aggregate score used in selection of medical students by the University of Natal Medical School accounted for a mere 8 percent of the variance when correlated against Anatomy and Physiology marks. The "best" single predictor of second year results was

Physical Science with a correlation of 0,18 (Anatomy) and 0,25 (Physiology). They performed a Multiple Regression Analysis on the data and found that, at best, the matriculation examination marks could account for only 13 percent of the variance associated with the second year results of African students. Badsha et al (1986) called for the researching of additional criteria for the selection of medical students. Despite these findings, the Medical School continues to use matriculation marks as the sole criterion for selection of medical students.

It must be stated, however, that the students who have been selected by the Medical School in the past have achieved results in the upper quartile of their respective matric education years and are students who have successfully negotiated the minefield of apartheid education. Despite their success within the system, this same apartheid education had however, made the gap between school and university so great that performing well at school has not equipped learners for successful university education.

APPENDIX 3Academic Performance of Students Over the Past 30 Years

In the years 1957 to 1987 inclusive, the Medical School has had 1753 graduates of whom 598 were African, 1052 were Indian and 103 were Coloured/Chinese. This represents a success rate of over 70 percent. These statistics which highlight the successes also hide the crucial failure of the learning-teaching dialectic in the second year of study. The Anatomy results for the period 1975 to 1986 are shown below.

ANATOMY RESULTS FOR THE YEARS 1975-1986

	Pass	Fail (repeat)	Fail (excluded)	Total
1st attempts	867	342	148	1357
2nd attempts	210		16	
	1077		164	

Whilst it could be argued that this is a fair success rate\*, the two or more years for the 164 exclusions constitutes a long and costly selection process, costly both to the university and to the student concerned. The following recent statistics on the failure rate of students in the second year of study are also disheartening:

1984 : 34% failure rate

1985 : 40% failure rate

1986 : 63% failure rate

(Note that a large proportion of students who fail are given the opportunity to repeat the year and in general, these second year repeats fare well in their repeat year).

On the other side of the coin, more than seventy percent of the students admitted to the faculty successfully completed their

studies, albeit that some take a few years longer. Cognizance must be taken of this relatively high success rate for Black students and reasons for it must be researched.

APPENDIX 4"Bhagat" Sub-Committee 1978

Reasons found for student dissatisfaction:

- a) Students have a fear of being excluded in the second year.
- b) Volume of work presented in second year was daunting.
- c) Lecturers spoke too quickly for the taking of notes.
- d) Students were afraid to ask questions for fear of being ridiculed by lecturers.
- e) Lecture periods were too long (60 minutes).

Their recommendations were as follows:

- a) Students should have had a guaranteed right to repeat second year.
- b) Either second year staff should have reduced the volume of work or there should have been an extension of academic time in the second year.
- c) Reduction in the length of time of lecture periods and installation of air-conditioning in lecture halls.

It is important to note that this commission saw its role as providing feedback from students to the Faculty rather than having a mediating role between staff and students. The Head of Anatomy at the time, Professor Braithwaite, responded to each point in detail. He rejected, amongst others, the reduction in volume of work, the notion of essential and non-essential anatomy, and criticism of teaching staff. He concluded as follows: "... in my opinion this report presents an unbalanced view of the second year of study ...." (Minutes of the Curriculum Committee).

APPENDIX 5Curriculum Committee Debates

During the period 1984-1986 the Curriculum Committee held numerous meetings in which the second year Curriculum was discussed. It essentially provided a forum for discussion between staff and students on "the second year problem". The recent investigations began at a Curriculum Committee on

27 April 1984. The student grievances were stated as:

- a) Lack of co-ordination of tests and lectures between Anatomy and Physiology.
- b) One hour was too long for lectures.
- c) Lack of handouts on lectures.
- d) Lack of clinical relevance in the courses.

In October 1986 the medical students again submitted a detailed list of their grievances to the Curriculum Committee. Briefly, the grievances stated were as follows:

- a) Lack of clinical relevance in Anatomy and Physiology.
- b) Too much information presented in courses.
- c) Students had an excessive fear of failure.
- d) Lack of handouts.

APPENDIX 6The 1987 Commission of Enquiry into the Problems in the Second Year of Study

Recommendations were made as follows:

1. Educational Management

- 1.1 Greater educational accountability of Departments to Faculty Board.
- 1.2 More student involvement in curriculum review.
- 1.3 Improved co-ordination of teaching programme.
- 1.4 Departments to set own objectives in consultation with clinicians and then submit these to faculty board.
- 1.5 Departments to consider future appointments.
- 1.6 Greater emphasis on undergraduate teaching, and recognition of good teachers.

2. Volume and relevance of material taught in Second Year

- 2.1 The volume of material taught must be reduced, with the emphasis on "fundamental principles and methods to promote understanding".
- 2.2 Provide guides regarding depth of knowledge expected.
- 2.3 The courses in Anatomy and Physiology to be completed in Second Year, as at present.
- 2.4 Teach Histology as part of Anatomy course.
- 2.5 Radical reduction in time spent on Anatomy dissection.
- 2.6 Make Physiology teaching relevant by including small-group Problem-Solving exercises.
- 2.7 Consider University of the Witwatersrand's Credit System.

3. Previous education and University selection procedures

- 3.1 Involvement with high school students.
- 3.2 Attend to administration of student selection process.
- 3.3 Research new methods of student selection.

3.4 Consider participation in Science Bridging Year Programme.

3.5 Review present First Year Curriculum.

4. Teaching Methods

4.1 Emphasis on small-group problem-solving rather than didactic teaching.

4.2 Revise Physiology/Biochemistry practicals.

4.3 Excessive time spent on Anatomy dissection to be replaced by demonstrations and small group teaching in applied Anatomy.

4.4 Introduce "Progress Tutorials".

4.5 Revise approach to student assessment.

4.6 Ensure that students perceive relevance of teaching rather than introducing elaborate D.P. requirements to obtain good student participation.

5. Environmental problems

5.1 Provision of suitable accommodation on or near University campus.

5.2 Streamline student bursary provision.

## APPENDIX 7

UNIVERSITY OF NATAL  
Faculty Of MedicineGENERAL INFORMATION QUESTIONNAIRE TO ALL  
2ND YEAR PHYSIOLOGY STUDENTS

The purpose of this investigation is to describe students' perceptions of their learning tasks. All results obtained from this study will be made available to all concerned, that is copies of the project will be placed on reserve in the Medical Library.

Name : \_\_\_\_\_

When were you born? 10/04/68

Where did you live as a child? Durban

Which High School did you attend? Gandhi Desai High School.

Home language English

What marks do you think you will get for the Physiology theory exam? 45 → 55%

What is the most difficult part of studying for exams?

No last week or two - realizing the enormity of the volume - and trying to study everything to the maximum in the short time available.

I did not even during the study last - but the volume was still great

What is the most difficult part in writing exams?

Trying to recall the and so on ... before writing the answers.

2.

How do you go about learning for the exams. Please write down in point form the steps you take in studying for the exams.

① Start studying  $\pm$  6 weeks prior to exam

② Draw up a timetable giving adequate time to the subjects

③  $\pm$  2 weeks - begin revision of work studied.

④  $\pm$  2 days before exam - go over past year papers.

Why do you want to become a medical practitioner?

I enjoy the challenge.

I ~~like~~ like working with people.

It is a most interesting and enjoyable profession.

Thank you for your co-operation.

Dr A P Craig (Report out of Educational Psychology)

Mr D I Bezuidenhout

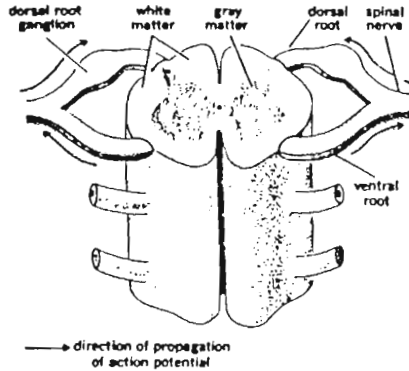


FIGURE 8-8. Section of the spinal cord (ventral view, i.e., from the front).

which forms the outer rim of the cross section in Fig. 8-11. The cortical surface of the cerebrum is highly folded, which increases the area available for cortical neurons without increasing appreciably the volume of the skull. The cortex is the most

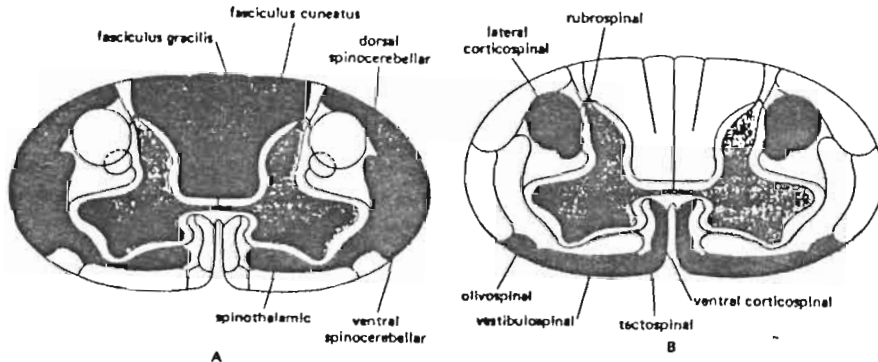


FIGURE 8-9. Major tracts of the spinal cord; tracts are shaded and labeled. (A) Ascending tracts; (B) descending tracts.

complex integrating area of the nervous system and is necessary for the bringing together of basic afferent information into meaningful perceptual images and for the ultimate refinement of control over efferent systems. The cortex is divided into several parts, or lobes (the frontal, parietal, occipital, and temporal lobes, Fig. 8-10). The cortex is an area of gray matter, so called because of the predominance of cell bodies. The subcortical nuclei form other areas of gray matter which lie, as the name suggests, under the surface of the cortex (Fig. 8-11) and contribute to the coordination of muscle movements. In other parts of the forebrain, nerve-fiber tracts predominate, their whitish myelin coating distinguishing them as white matter.

The thalamus, part of the diencephalon (Fig. 8-11), is a relay station and important integrating center for sensory input on its way to the cortex and is also important in motor control. Like the brainstem, it contains a central core that is part of the reticular formation. The hypothalamus, which lies below the thalamus (Fig. 8-11), is a tiny region whose volume is only 5 to 6 cm<sup>3</sup>. Yet it is responsible for the integration of many basic homeostatic mechanisms and behavioral patterns that involve correlation of neural and endocrine functions. In-

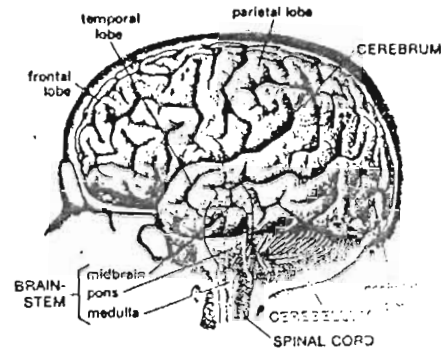


FIGURE 8-10. The three major divisions of the brain: the brainstem, cerebellum, and forebrain. The outer layer of the forebrain (the cerebrum) consists of four lobes, as shown. The diencephalon, which is an extension of the brainstem and lies deep within the brain, is not shown.

deed, the hypothalamus appears to be the single most important control area for the regulation of the internal environment.

The limbic system is not a single brain region but is an interconnected group of brain structures within the forebrain, including portions of frontal-lobe cortex, temporal lobe, thalamus, and hypothalamus, as well as the circuitous neuron pathways connecting these parts (Fig. 8-12). The limbic system is associated with learning and emotional behavior; stimulation of some of the limbic areas leads to behavior interpreted as rewarding or pleasurable, whereas stimulation of other areas of the limbic system is associated with unpleasant feelings. Besides being connected with each other, the parts of the limbic system have connections with many other parts of the central nervous system. For example, it is likely that information from all the different types of receptors can influence activity in the limbic system, whereas activity of the limbic system can result in a wide variety of responses, such as sweating, blushing, heart-rate changes, laughing, and sobbing.

TABLE 8-1. Divisions of the central nervous system

Brain	Cerebrum, cerebral hemispheres, including cerebral cortex and basal ganglia	Forebrain
	Diencephalon, including thalamus and hypothalamus	
	Midbrain	Brainstem
	Pons	
Medulla		

Nerve processes (axons) in the peripheral nervous system, which transmit signals to and from the central nervous system, are grouped into bundles called nerves, whereas the individual axons are called nerve fibers. (There are no "nerves" in the central nervous system; recall that axon bundles there are called tracts or pathways.) The peripheral nervous system consists of 43 pairs of nerves; 12 pairs connect with the brain and are called the cranial nerves, and 31 pairs connect with the spinal cord as the spinal nerves. The spinal nerves have been shown in Fig. 8-7.

Each nerve fiber is surrounded by a type of satellite cell called a Schwann cell. Some of the axons are wrapped in layers of Schwann-cell membrane, and these tightly wrapped membranes form the myelin sheath (see Fig. 8-2). Other fibers are unmyelinated and are simply tucked into invaginations of the Schwann cells (Fig. 8-13).

The individual nerve fibers in a nerve may be processes of either afferent or efferent neurons accordingly they may be classified as belonging to the afferent or the efferent division of the peripheral nervous system (Table 8-2). All of the spinal nerves contain processes of both afferent and efferent neurons, whereas some of the cranial nerves (the optic nerves from the eyes, for example) contain only afferent fibers.

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