A LONGITUDINAL STUDY OF THE COGNITIVE AND AFFECTIVE DEVELOPMENT OF CEGEP STUDENTS

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ABSTRACT

The role of CEGEP in Quebec society was intended to be one of developing the intellectual abilities of young adults. The actual effect of CEGEP on students however, has not been documented. The purpose of this study, therefore, was to identify the cognitive and affective abilities of CEGEP students at the beginning and end of CEGEP and to measure the change in these abilities. The cognitive development of CEGEP students was assessed by examining the three broad areas of development most focused on at the college level: reading, writing and critical thinking skills. Affective development was studied by examining the values of CEGEP students in relation to moral reasoning, their attitudes toward knowledge and learning, and ego development. It was hypothesized that assessing these cognitive and affective abilities at the beginning and end of CEGEP would establish what the colleges can accomplish, and would promote a more thorough understanding of the students they serve.

This research studied the effect of time in CEGEP (independent variable) on cognitive and affective development (the dependent variables). The research design was an interrupted time-series done on male and female students in three programs: Science, Social Science and Commerce. This design permitted the study of the effect of time in CEGEP (the treatment) by comparing measures of performance taken before CEGEP with measures taken at spaced intervals during and after CEGEP. The sample consisted of 334 students who entered CEGEP in 1985 in Science, Social Science and Commerce programs They were selected at random and administered a survey of cognitive and affective measures as part of the college's assessment procedure. The sample consisted of 195 female and 139 male subjects. Of the original 334 subjects, 158 (47%) completed the study.

Overall findings confirm that upon entry to CEGEP, a sizable proportion of the student population do not possess the reading, writing and critical thinking skills required to complete college tasks successfully. However, findings also suggest that cognitive and affective abilities increase while attending CEGEP.

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INTRODUCTION

The role of CEGEP (Collèges d'enseignement général et professionnel) in Quebec society was to be the development of intellectual abilities in young adults (Magnuson, 1980). CEGEPs were created to provide secondary-school graduates with access to general training aimed at developing a critical sense, the ability to analyze and synthesize, and creativity. The actual effect of CEGEP on students, however, has not been documented. A good deal of uncertainty remains about what the colleges do, how they follow from the programs of study of secondary schools, and how they prepare students for university studies (Henchey & Burgess, 1987).

One way of answering the question of the effect of CEGEP education is to determine which areas of intellectual development are affected by the CEGEP experience. Do students improve their vocabulary and level of comprehension? Do they change in their ability to think critically? Do they mature in their decisions about moral issues and attitudes toward knowledge and learning?

A widely held assumption among educators is that most students change cognitively and affectively as a result of attending college. Several researchers of college outcomes, including Astin (1977) in his book Four critical years, Feldman & Newcomb (1969) in their book The impact of college on college students, and Perry (1970) and Winter, McClelland & Stewart (1981) in their studies on the effects of a liberal arts education, have suggested that intellectual development during the college years is demonstrable. What these cognitive and affective changes are, however, is not clear.

Another assumption is that students come to college prepared to perform college tasks with efficiency and commitment. Teachers expect their students to be capable of independent thinking, to interact in situations demanding clear and rational thought, and to combine that thought with communicative techniques (McKinnon, 1978). Students are expected to read critically, write clearly and think logically. However, studies show that

fifty percent of the entering student population do not possess these complex abilities (Higgins-Trenke & Gaite, 1971; McKinnon, 1978; Ross, 1973; Torkia Lagace, 1981).

The assumptions that students arrive equipped to deal with college and that they continue to develop cognitively and affectively while attending college create frustration for both teachers and students. Teachers complain that students cannot think; students become overwhelmed with what appear to be unrealistic teacher expectations.

Cognitive developmental theorists do not separate social from intellectual development. Cognitive and affective development are seen as parallel components of the structural changes which take place during development. The cognitive and affective abilities acquired by students have not to date been recognized or measured. The purpose of this study, therefore, is to identify the cognitive and affective abilities of CEGEP students at the beginning and end of CEGEP and to measure the change in these abilities. To study cognitive development in CEGEP students, their reading, writing and critical thinking skills were examined, since these are the skills of major import at this level of development. To study the affective development of CEGEP students, their moral reasoning, attitudes toward knowledge and learning, and ego development were examined.

Cognitive Development

For cognitive developmental theorists, mature thought emerges through a process of development that is neither direct biological maturation nor direct learning, but rather a re-organization of psychological structures resulting from the interaction between the organism and the environment (Kohlberg & Mayer, 1972). Cognitions are assumed to be structures or systems of internal relations. These structures are rules that are used to process information or connect events. Changes in these cognitive structures or changes in thinking (cognitive development) come about through experience. The environment creates a disharmony forcing individuals to change or accommodate their existing cognitive structures or way of thinking (Inhelder & Piaget, 1958). CEGEP could be expected to provide such an environment.

Cognitive development is defined as the recall or recognition of knowledge and the development of intellectual skills (Bloom et al., 1956). According to Bloom, the development of intellectual skills means that learners can utilize information and techniques from their previous experience to bear on new problems and situations. This requires some analysis or understanding of the new situation; it requires a background of knowledge or methods which can be readily utilized; and it also requires facility in discerning the appropriate relations between previous experience and the new situation.

In the taxonomy of educational objectives, intellectual skills are categorized in terms of increasingly complex behaviors, that is, knowledge, comprehension, application, analysis, synthesis and evaluation. **Knowledge** encompasses the facts, the data, the content or body of material to be mastered. **Comprehension** consists of behaviors such as choosing relevant information, identifying critical relations, recognizing assumptions and ordering information in importance. **Application** requires the use of knowledge and comprehension to solve new problems. It consists of such behaviors as discovering new relationships, categorizing information, combining parts to form a whole or developing a course of action. **Analysis**, according to the taxonomy, consists of identifying elements,

making relationships between them explicit, and recognizing the organizational principles which hold the material together. **Synthesis** is defined as putting together elements and parts to form a whole not clearly there before, so it adds new organization to the steps of analysis. **Evaluation** involves the use of criteria as well as standards, for appraising the extent to which ideas, works, solutions, methods and materials are accurate, effective, economical, or satisfying.

Reading

Comprehension has been the focus of research in reading. College reading tasks demand that students have the ability to select relevant information, note relationships, recognize assumptions and organizing principles, draw conclusions, and judge the validity of arguments (Herber, 1978). These comprehension or higher-level intellectual skills must interact with decoding skills, word knowledge and prior knowledge in order for the college student to comprehend information at both a literal and interpretive level. For example, the ability to identify the main idea is a fundamental skill of reading comprehension (Williams, 1984); it requires that the reader differentiate the main idea from supporting or literal ideas. During this process of selection, the reader converts sentences to propositions, then integrates those propositions until a macrostructure that represents the text is formed (Kintsch & van Dijk, 1978; van Dijk, 1980). The reader thus employs comprehension or high level intellectual skills.

Research in reading has been focusing on understanding the internal processes involved in reading, that is, what the reader does while reading. Reading comprehension is viewed not only as a process of getting meaning from text, but as an interactive process whereby the reader brings meaning to a text (LaBerge & Samuels, 1974; Ruddell & Speaker, 1985; Rumelhart, 1985; Samuels, 1977, 1980). The theory of reading as an interactive process proposes that reading is influenced both by specific vocabulary or knowledge of word meanings and by general background knowledge of the subject matter.

Reading is also influenced by the student's metacognitive status, that is, the degree of control students have over their learning activities (Baker & Brown, 1984). The ability to reflect on one's own cognitive processes, to be aware of one's own activities while reading, is a late-developing skill with important implications for the college student's effectiveness as an active learner. Research on metacognition makes it clear that cognitive skills for comprehending and studying text can be taught (Brown, 1982; Brown & Day, 1983; Palinscar & Brown, 1984).

Writing

Cognitive psychologists explain the process of writing in terms of imposing structures on text (Flower, 1979; Hayes & Flower, 1980; Scardamalia, Bereiter & Goelman, 1982). The successful writer imposes structure on text and uses it to increase organization and coherence in the same way that the successful reader imposes structure on text and uses it to increase comprehension. This *formal text structure* is a form of abstract prior knowledge which assists the writer in the construction of text (Mandler & Johnson, 1977; Stein & Glenn, 1979; Thorndyke, 1977; van Dijk, 1980). If a piece of writing is not organized it is difficult to follow and comprehend; therefore, a macrostructure representing the text cannot be formed.

Reading and writing are interrelated complex mental processes. The conscious use of formal text structures in writing and macrostructures in reading are required for competence in each. Therefore, a well-developed vocabulary, the utilization of background knowledge and the ability to monitor one's cognitive processes while learning are basic abilities that college students must possess if they are to comprehend expository text and produce clear, coherent expository essays.

Critical Thinking

Reading and writing are, in turn, influenced by the ability to think critically. Critical thinking has been discussed in terms of the ability to reason logically (Brookfield,

1987; Hallet, 1984; and Ruggiero, 1975); the ability to independently find and question assumptions (Scriven, 1976); and the ability to think abstractly, to analyze and to evaluate (Donald, 1985; Ennis, 1962; Hullfish & Smith, 1961). Of particular importance to college educators, studies of the thinking skills expected in different disciplines suggest that different fields of study focus on different aspects of the critical thinking process (Donald, 1986; Meyers, 1987). For example, in physics courses, professors focussed on inferential skills, while English professors considered interpretation to be most important.

The development of cognitive structures is necessary for critical thinking. If cognitive structures are viewed as components of larger disciplinary perspectives for problem solving and analysis, when students are taught to think critically they are being helped to alter or replace their cognitive structures. Teaching critical thinking involves the intentional creation of an atmosphere of disequilibrium, so that students can change, rework, or reconstruct their thinking processes (Meyer, 1986).

Stages of Development

According to developmental theory, development occurrs through a sequence of stages, with each stage encompassing the previous stage, in which there are changes in how the individual experiences and reasons about the world (Delworth, 1980; Inhelder & Piaget, 1958). The concept of stages, therefore, is central to the theories on which this research is based (Inhelder & Piaget, 1958, 1972; Kohlberg, 1969; Loevinger, 1976; Perry, 1970; Rest, 1979a).

Inhelder and Piaget (1958) describe four stages of cognitive development, but for understanding the college population the last two, concrete operations and formal operations, are most important. Concrete thinkers are capable of logical thought only in areas where they can be given specific examples or direct experience. They are not yet ready to hypothesize or think in abstract terms. In contrast, formal thinkers can hypothesize or think in the abstract and evaluate many sides of an issue. According to

Piaget, the highest level of thinking, formal operations, is reached by adolescence. Recent research, however, has begun to raise doubts concerning this last aspect of Piaget's theory (Arlin, 1975; Perry, 1970; Schaie, 1977/78). Flavell (1977), a well-known interpreter of Piaget's work, suggests that in contrast to childhood changes in cognitive development which are more biologically based, adult changes in cognitive development are brought about by experience. Bloom (1964) stated that the most rapid changes occur when a powerful environment is brought to bear on a person during a period of high growth rate. Adolescence, wrought with rapid physical, social and psychological changes, is such a period. CEGEP could be expected to provide the environment for such developmental experiences.

Affective Development

Affective development is described as a process that ranges from simple attention to selected phenomena, to complex but internally consistent ways of behaving (Krathwohl et al., 1964). These ways of behaving are influenced by an individual's attitudes, perceptions, motivations and conscience. Like cognitive development, affective development is categorized in terms of increasingly complex behaviors. The categories of affective development are receiving, responding, valuing, conceptualizing and organization. **Receiving** forms the base; an individual must be aware of stimuli and, at least, passively attend to it. **Responding** represents the individual's willingness to attend to the stimuli. **Valuing** represents placing an importance on the activity so that individuals voluntarily respond and possibly become committed to it. As the process continues, the values are **conceptualized** and **organized** into a value system which ultimately characterizes a way of life.

Moral Development

One way education influences an individual's value system or character is by developing moral reasoning. Moral reasoning concerns how a person defines one or another course of action in a situation as morally right (Schlaefle, Rest & Thoma, 1985). Kohlberg (1969) describes the successive transformations which characterize moral development in three main stages: preconventional, conventional and postconventional. The preconventional individual is egocentric. Authority is respected because of age, size and power. There is little concern for the welfare of others. The conventional individual enjoys approval and conforms in order to sustain relationships, groups, communities and societies. The postconventional individual is aware that most values and rules are relative to the group and follows self-chosen ethical principles that are universal in application.

The work of Piaget (1932, 1965) and Kohlberg is interrelated and shares basic assumptions. Piaget and Kohlberg agree that moral reasoning is based on cognitive

structures and not upon learning specific moral rules. For both, the central concept of morality is justice. The central problem of morality is to determine the legitimate claims of people in a situation and to prioritize and balance those claims according to principles that impartial, rational people would accept as governing principles for cooperative interaction (Rest, 1983). Kohlberg's highest stage of moral reasoning relies on the adolescent's capacity for formal operational thought as described by Piaget (1972). The individual progresses from concrete to formal logic which constitutes a reconstruction of social and moral understanding. Therefore, the stages of development proposed by each constitute a hierarchy where each stage represents a more encompassing perspective on society.

According to Rest (1983), moral development continues for adolescents and adults as long as the adult remains in school. These results support the hierarchical nature of Kohlberg's theory and suggest that moral development continues into the adult years particularly if adults continue in higher educational programs. If higher education is a significant variable that fosters moral judgment, it would follow that educators will find Kohlberg's (1969, 1973) theory helpful in understanding students' moral development.

Attitudes toward Knowledge and Learning

If higher education produces changes in students' cognitive style and moral reasoning, it is also likely to produce change in other aspects of personality as well. The research of Perry (1970) on ethical development and Loevinger (1976) on ego development, supports the claim that colleges are settings that can promote basic personality change and fundamentally alter the structures in which an individual thinks, feels and acts (Weathersby, 1981).

Perry proposes four principal positions of development: dualism, multiplicity, relativism and commitment. These stages represent different attitudes towards knowledge and learning. Dualistic students view the world and knowledge in absolute terms; things are either right or wrong. In education, authority is represented by the teacher who knows

the correct information and what the teacher says is accepted as truth. Students moving toward the second stage, multiplicity, begin to recognize the authorities' contrasting viewpoints but see contrasts as the authorities' way of making students think independently and discover the right answer on their own. Students in the third stage, relativism, are becoming aware that there are no right or wrong answers. They recognize the need to perceive, analyze and evaluate. Students at the final stage, commitment, have developed their own approach to living and learning. Decisions regarding career, marriage, education or politics are made based on a personal philosophy.

In contrast to other stage theorists who view stages as upward and sequential, Perry states that individuals can move across his stages more than once. For this reason, he avoids the term *stages* and prefers *positions*. For Perry, individuals may be at different positions in different areas of their intellectual life. For example, at the beginning of the learning process, students must master a certain amount of technical vocabulary and data. They may not be ready to think critically about the subject. If students move to a new discipline, they may revert back to an earlier stage where they once again want right answers (Elrick, 1985).

Ego Development

The components of cognitive, moral, ethical and interpersonal development are incorporated in a global capacity called ego development (Loevinger, 1976). Ego development is the functioning of the self and the involvement of the individual in self-realization. The ego comes into being as a result of the individual's interactions with the real world. Loevinger views ego development as both a normal developmental sequence and a dimension of individual differences in any given age cohort. Each individual has an outlook, a way of looking at the world which causes him or her to react uniquely to experiences and problems. The ego thus functions as the central organizing process in human development.

Loevinger's developmental model has six major stages and three transitional levels relevant to the age group of this study: impulsive, self-protective, a transitional level between self-protective and conformist, conformist, transition between conformist and conscientious (Self-Aware Stage), conscientious, individualistic, autonomous, and integrated levels.

Impulsive individuals lack cognitive complexity and tend to divide the world into good or bad. Self-Protective individuals also have an inadequate conception of the complexities of the world. In addition they are opportunistic, fear being caught and externalize blame. The next level is a transitional level between the Self-Protective and the Conformist stages. This transitional level is characterized by a willingness to obey and to conform to social norms without question. At the next stage, the Conformist Stage, the individual continues to be concerned about external rules. The concern, however, is motivated by a fear of rejection. Conformists fear disapproval and are primarily concerned with appearance, material things, reputation, social acceptance and belonging. A conformist lives in a simple world where everything is always right or wrong for everyone.

People moving toward the Conscientious Stage, Self-Aware individuals, are beginning to see multiple possibilities and that rules may have exceptions. At the Conscientious Stage, people begin to develop conceptual complexity. In contrast to Self-Protective persons who obey rules because they fear getting caught, and Conformists who obey rules because the social group demands it, people at the Conscientious Stage evaluate and choose the rules for themselves. Priorities, long-term goals and ideals become more real. A sense of responsibility develops which enables people at this level to accept the consequences of their own actions. At the Autonomous Stage individuals take charge of their lives and can cope with intra- and interpersonal conflict. The final stage, the Integrated Stage, is characterized by a cherishing of individuality and a developing of one's own personal style.

Does the CEGEP experience foster ego development? According to Loevinger, the majority of people in our society are Conformists, therefore, the transition to higher stages appears to be a developmental milestone. She suggests that the introspective behavior exhibited by American students during the first two years of college precludes movement toward the higher stages of ego development. In most of North America, the first two years of college serve 18 and 19 year olds. CEGEP serves 16 and 17 year olds. CEGEP teachers often expect students to be intellectually and psychologically prepared to perform college-level tasks with efficiency and commitment. Is this a fair expectation when the importance of education is usually not realized until a more advanced stage of ego development? Assessment of ego development in CEGEP students, therefore, is crucial if realistic entry and exit expectations are to be established.

METHOD

Research Design

The research design was chosen to study the effect of time in CEGEP (independent variable) on cognitive and affective development (the dependent variables). The research design was an interrupted time-series done on male and female students in three programs: Science, Social Science and Commerce. The effect of time in CEGEP was measured by comparing performance before CEGEP with performance at spaced intervals during and after CEGEP. The design was an interrupted time-series design because there were periods during the experiment when the treatment was not in effect, in this case, during the summer months (see Figure 1). It was assumed that no change in cognitive and affective development would occur during the non-treatment period.

A time-series design is designed to limit threats to internal validity, which in this study could be expected to include maturation, testing, instrumentation, selection and mortality. Maturation is a threat to the validity of the study when an observed effect might be due to the subjects' growing older and wiser, and not due to the treatment. Testing is a significant factor when a subject is exposed to a test more than once. Performance may be enhanced or worsened because of previous testing; items may be remembered at later testing sessions or the subject may become bored or careless. Instrumentation is a threat when an effect is due to differences in the scales used in the testing instruments at different levels, or to human raters becoming more experienced observers (Cook & Campbell, 1979). Selection poses a threat when an observed effect is due to an inherent difference in the experimental group. Mortality, or loss of subjects, is a threat, particularly in longitudinal studies.

	May 85	Sept 85	May 86	Sept 86	May 87
		4 mos.	8 mos.	4 mos	8 mos.
Exp. Group					
	O (n=334)	O (n=39)	X O (n=271)	O (n=30)	X O (n=158)
Control Group 1 (practice)			O (n=87)		
Control Group 2 (practice)					O (n=39)
Control Group 3 (selection)			O (n=68)		

Fig. 1. Design of the Research Project

To increase internal validity, certain features were added to the research design. To control for testing effects, a random sample of students who began CEGEP in September of 1985, but who had not taken all of the tests at that time, were tested in May 1986 (Control Group 1). A second group of students who also began CEGEP in 1985 but had not taken the tests were administered the measures in May 1987 (Control Group 2). In other words, Control Group 1 and Control Group 2 were comprised of students who had been in CEGEP for the same amount of time as the Experimental Group, but completed the measures once.

If the treatment variable, time in CEGEP, was responsible for an observable change in cognitive and affective development, the same score should be demonstrated by both experimental and control groups. If the experimental group had higher mean scores than the control group at the time of the parallel observations, then testing effects would

have to be supposed. If both groups displayed similar scores, testing effects could be ruled out.

To control for instrumentation, alternate forms of the standardized tests were used when available and human raters were selected who were willing to commit themselves to the research project until its completion. To control for selection and to determine that the entering class of 1985 was not inherently different from previous or subsequent entering classes, a random sample of students entering Champlain in 1986 were administered the entire set of tests (Control Group 3). To control for mortality, the study was begun with a large sample (N=334), approximately one third of the entering population, with the expectation that this number would decrease during the two year period. To determine if the final experimental group was representative, pretest results of those completing the study were compared with pretest results of those who did not complete the study.

Subjects

Experimental Group

One-half of the students (n=453) who entered Champlain Regional College in 1985 were selected at random and administered a survey of cognitive and affective measures as part of the college's assessment procedure. The students in this sample who were registered in Science, Social Science and Commerce programs (n=334) became the experimental group for this study. The experimental group consisted of 195 female and 139 male subjects ranging in age from 15 to 19. Most students (91%) were 17 year olds (58%), and 16 year olds (33%).

Table 1 Ages of Students in Experimental Group

AGE	FREQUENCY	PERCENT
15	5	1.5
16	111	33.2
17	192	57.5
18	25	7.5
19+	1	.3
	334	100.0

The sample represented the proportion of the college population in Science, Social Science and Commerce (Table 2). The greatest number of students overall in the Fall of 1985 were in Social Science (30%), followed by Science (26%), and Commerce (22%) (Admissions Report, Fall, 1985, p.15).

Table 2 - Proportion of Students in Experimental Group Compared to the College Population

PROGRAM	EXPERIMENTAL GROUP	PERCENT	TOTAL % in CEGEP
Science	105	25.0	25.9
Social Science	125	29.8	29.5
Commerce	104	24.8	21.6

Control Groups 1 & 2

Most 1985 incoming students (N=905) took part in the college's placement procedure, but 452 of these students did not write the complete set of cognitive and affective measures. This group became the population from which Control Group samples were selected for effects of testing. In May 1986 and again in May 1987 a sample was randomly selected from this group and administered the complete set of tests. As noted in the research design, the role of these two control groups was to control for effects of testing. Each of these samples wrote the complete set of tests once. Students who participated in 1986 became Control Group 1; students who participated in 1987 became Control Group 2.

Control Group 1 (N=87) consisted of 39 male and 48 female subjects ranging in age from 16 to 19. Control Group 2 (N=39) consisted of 16 male and 23 female subjects ranging in age from 17 to 19.

Control Group 3

To control for selection and to establish that the students of 1985 were not inherently different from subsequent entering classes, 68 students were selected at random from the incoming students of September 1986. The sample consisted of 40 female and 28 male subjects ranging in age from 15 to 19. These students completed the set of cognitive and affective measures as well as the college's placement procedure.

Table 3 - Program of Students in Control Groups

	Control 1 (practice)	Control 2 (practice)	Control 3 (selection)
Science	29	11	14
Social Science	29	16	31
Commerce	29	12	23
Total N	87	39	68

Table 4 - Generic Age of Students in Control Groups

	Control 1 (practice)	Control 2 (practice)	Control 3 (selection)
15			2
16	3		26
17	33	1	33
18	50	15	5
19	1	23	2
Total N	87	39	68

Completers and Non-Completers

Completers were students who completed the study, that is, they participated in May 1985, May 1986 and May 1987 (n=158). Non-Completers were students who participated in the study once or twice.

Instruments

Measuring instruments were chosen to tap the intellectual skills, as defined by researchers, which are needed for success at the post-secondary level (Donald, 1985; Mentkowski & Strait, 1983). Measuring instruments (Table 5) were selected or designed to test reading, writing and critical thinking (cognitive development), moral development, attitudes towards knowledge and learning and ego development (affective development). Academic achievement was also measured.

Table 5 - Measures Used in the Study

Measure	Test
Cognitive Development	
Reading	**Nelson Denny Reading Test (Forms E & F)**
Writing	**English Department Writing Placement Test**
Critical Thinking	**Watson-Glaser Critical Thinking Appraisal**
Affective Development	
Moral Development	**Defining Issues Test**
Attitude Toward Knowledge & Learning	**Research Questionnaire Paragraph Sample**
Ego Development	**Loevinger Sentence Completion**
Academic Achievement	**High School Average Term Average**

Reading

The Nelson Denny Reading Test was used to measure reading ability (vocabulary and comprehension). This test was chosen for three reasons: 1) the theoretical base on which it was constructed closely matches the definition of reading presented in the literature, 2) it was re-standardized in 1981 and therefore was up to date, and 3) it provides

norms for the two-year college population. The Nelson Denny Reading Test measures both vocabulary development and comprehension. The Vocabulary section consists of 100 items, each with five answer choices, and has a time limit of 15 minutes. The Comprehension section contains reading passages and 36 questions, each with five answer choices. Eighteen of the comprehension questions are primarily literal items and 18 are interpretive items. The literal items require that the reader grasp specific details and facts, whereas the interpretative items require that the reader note relationships, draw conclusions, make generalizations and deductions, determine the writer's purpose, and identify the main idea. In addition, comprehension passages reflect a variety of subject-matter fields so that the test does not favor students in any one discipline. The Nelson Denny Tests were computer scored but scores were converted to standard scores by hand.

Writing

The Writing Placement Test developed by the English Department at the college was used to measure writing ability. The test consists of two sample essays. Students are given 30 minutes to compose each one. Each essay was read and scored by two members of the English Department and ranked on a scale of 1-3. *Students who receive a score of three* are considered to be literate; they exhibit an extensive vocabulary and understanding of the structure of a paragraph and the structure of an essay. Their sentences also contain no major grammatical problems. *Students who receive a tscore of two* demonstrate basic writing skills and a good conventional vocabulary. However, their paragraphs and essays lack a clear structure, that is, they might know that a thesis statement and supporting examples are necessary for a strong argumentative essay but they do not provide them in their writing. Their sentences may exhibit major grammatical problems such as fragments and run-ons. *Students who receive a score of one* have a weak vocabulary. Their paragraphs and essays are devoid of any clear structure and their sentences are riddled with major grammatical problems. These students might be described as somewhat illiterate.

Sometimes, students who receive a *score of one* are second language students. These students present major problems with syntax, idiom and vocabulary.

Critical Thinking

The Watson-Glaser Critical Thinking Appraisal (Watson & Glaser, 1964) was used to measure several components of critical thinking. It consists of five subtests: Inference, Recognition of Assumptions, Deduction, Interpretation and Evaluation of Arguments. Each subtest consists of 16 items. The Inference subtest determines whether the subject can discriminate among degrees of truth or falsity of inferences drawn from given data. Recognition of Assumptions requires that the subject recognize stated assumptions or presuppositions in given statements or assertions. Deduction requires that the subject determine whether certain conclusions necessarily follow from information in given statements or premises. Interpretation demands the weighing of evidence and deciding if generalizations or conclusions based on the given data are warranted. Evaluation of Arguments requires that the subject distinguish between arguments that are strong and those that are weak or irrelevant to a particular question.

Moral Development

The Defining Issues Test, (DIT), developed by J. Rest (1979a,1979b), was used as a measure of moral development. Rest's instrument is based on Kohlberg's theory of moral development and assumes that moral judgment can be assessed by determining a student's preference for and comprehension of moral judgments made by others. The DIT presents a series of story dilemmas which require an ethical decision. Following each dilemma are 12 statements, each statement representing a particular stage of moral development. Subjects are asked to rate each statement using one of these ratings: great importance, much importance, some importance, little importance and no importance. After the subject assigns importance to the 12 reasons given for resolving the particular moral dilemma, they are asked to choose the four most important reasons and rank order

them. In this study the short version of the DIT (three stories as opposed to six) was used. The DIT was scored by a self-trained rater from outside the college.

Attitude Toward Knowledge

A questionnaire based on Perry's theory of intellectual development was developed and pilot tested before the study in March of 1985 (Bateman & Donald, 1986). The questionnaire consisted of 16 items, 4 items each on Perry's stages of intellectual development: dualism, multiplicity, relativity and commitment. Students were asked to respond on a 5-point Likert Scale to what extent they agreed or disagreed that the items described the way they felt about knowledge and learning. The pilot study showed that rather than four stages of development, there are two discriminable levels or positions that students take toward knowledge. The first is that knowledge consists of facts and data, and that professors should supply them (dualism). The second is that knowledge is a quest in which students have responsibility for their own learning, and are expected to be able to judge the validity of arguments and to identify and defend their own point of view (advanced level).

Attitude Toward Learning

One of the two essays included in the placement testing procedure for the incoming students of 1985 was entitled *How I Learn Best*. This title was assigned in order to get a qualitative measure of students' attitudes toward knowledge and learning. This essay title was assigned to the experimental group in 1986 and 1987. It was scored on each occasion by two members of the English Department according to the scale used for placement testing (see p. 20)

Ego Development

To measure ego development, Loevinger's Sentence Completion Test (Loevinger, Wessler & Redmore, 1970) was used. This is a production task consisting of 36 sentence stems which students are asked to complete. There is no time limit. Responses are coded according to the level of ego development they reflect. The "total protocol rating" was calculated by two trained raters from outside the college. Inter-rater reliability was .76.

Academic Achievement

High school averages, first term averages and final cumulative averages (BCU) were used as measures of academic achievement. High school averages were obtained from the initial questionnaire. First term averages and final cumulative averages were obtained from student records in the college.

Procedure

Three major observations (May 1985, May 1986, and May, 1987) and two secondary observations, (September 1985 and September 1986) were used to obtain data.

First Major Observation: May, 1985

All applicants to Champlain Regional College take an English Placement Test consisting of a reading test and a writing test as part of standard entry procedures. The results of these tests are used to place students in different kinds or levels of English courses. When the entering students of 1985 were informed about their placement test, they were also informed that their class would be taking part in a longitudinal study designed to examine CEGEP students' intellectual development. This entire population was randomly divided into two groups and each student received a letter assigning him or her to either a morning or afternoon testing session (Appendix A). Students who attended the morning session (n=453) were the source of the Experimental Group. Students in three major programs (Science, Social Science and Commerce) of eight programs in the college constituted the Experimental Group (n=334). They wrote the English placement tests and all measures needed for the longitudinal study. The afternoon group (n=452) wrote the English placement tests and two pseudo-tests to keep the total testing time similar. Two samples from this afternoon group were used as the two control groups for practice effects. A trained team of five faculty members and ten student helpers assisted in administering and collating the protocols.

Second Major Observation: May 1986

The second major observation involved the participation of the Experimental Group, Control Group 1 for practice effects and Control Group 3 for selection. In April, 1986, all students in the experimental group (n=334), were sent a letter asking them to participate in the second testing session (Appendix B). Students were offered three alternative dates to come in for testing. Although having three testing sessions could

introduce a degree of error, it was considered more important to have the most complete data set possible. Two-hundred and seventy students agreed to participate.

At this point in time, students in the Experimental Group and candidates for Control Group 1 had been exposed to CEGEP for approximately one year. Since the Experimental Group had already written the survey once, to control for testing effects, 100 students were randomly selected from among the 1985 entrants who had not yet written tests other than the placement tests. Candidates for Control Group 1 received the same letter as the Experimental Group but were assigned to different classrooms. Eighty-seven students agreed to participate. This was the only time that these subjects would be tested. If there were no practice effects, the results of this group would not be less then the results of the experimental group.

Finally, in order to rule out differences between the entering class of 1985 and other years, 68 students were randomly selected from the incoming class of 1986 and were given the complete set of cognitive and affective measures. These students completed the tests in May of 1986 as part of the college's standard assessment procedure and subsequently became Control Group 3.

A trained team of 5 faculty members, 10 student assistants and two graduate student assistants from McGill University helped collect the May 1986 data.

Third Major Observation: May 1987

The third major observation involved the participation of the Experimental Group and Control Group 2 for testing effects. In April, 1987, all remaining students in the experimental group (n=270), were sent a letter asking them to participate in the final testing session (Appendix D). One-hundred and fifty-eight students agreed to participate. By this time, both the Experimental and Control groups had been exposed to CEGEP for two years. Since the Experimental Group had already written the tests twice, to control for testing effects, 100 students were randomly selected from the 1985 entrants who had not

yet written the tests and were asked to participate in the study. Thirty-nine students agreed to serve as Control Group 2. This was the only time that these subjects would be tested. If there were no testing effects, the results of this group would not be less than the results of the experimental group.

Secondary Observations: September 1985 and September 1986

In accordance with a time-series design, a secondary observation took place during the first two weeks of the fall semester in 1986 and 1987. The purpose of these observations was to establish if any changes occurred during the summer in cognitive and affective development. It would be expected that any changes would be random or non-significant. For each observation, a small sample of students was randomly selected from the Experimental Group and asked to participate. Thirty-nine students participated in September 1985 and 30 students participated in September 1986. Each sample represented 10% of the Experimental Group. The tests were administered during a two-hour period by the researcher and one assistant.

Maintaining the Sample

A major threat to any longitudinal study is mortality. During the two year study, the Administration of Champlain College took special measures to encourage full participation. At the time of the secondary observation in the fall of 1986, the subjects in the Experimental Group had taken the tests twice. A random subsample of them were now being asked to take them an extra time. It was decided that a reward in recognition of their service to research and to the college was appropriate. Accordingly, the Administration gave them first day registration appointments for the Winter 1987 semester. Thirty students agreed to participate which represented 11% of the Experimental Group.

For the second major observation, May 1986, a letter was initally sent to all members of the Experimental Group and the randomly selected members of Control Group 1 strongly encouraging them to participate (Appendix B). Some of the students reacted

negatively to this letter, by stating that they should not be required to write the tests. After verbal explanations of the importance of the project had been given by the Academic Dean, the secretary of the Learning Center and the academic advisors, a second letter reinforcing the importance of the research and the college's commitment to it was sent (Appendix C). This letter had a positive effect on the students, and as a result, two hundred and seventy one subjects participated In May 1986, the experimental group had 271 of the original 334 subjects, representing a loss of 63 (5%) students, half of whom were not intending to return to the college.

In order to encourage participation in the final data collection in May 1987, students were offered three alternative testing dates, private appointments when necessary and a chance to win a lottery, one of six gift certificates of $50.00. The number of lottery chances each student had was determined by how many times they had participated in the study. Therefore a student who had completed the study and had also taken part in one of the September testings had four chances to win. The lottery helped maintain a positive attitude toward the study. The project was completed by 162 students. Thus, in order to maintain a sufficient sample and limit the introduction of bias through longitudinal mortality, the college Administration took steps at three different times to ensure student participation in the study.

Analysis of Data

Three general methods of analysis were followed. The raw scores for each student who participated in all three major observations were compared with those of students who did not complete the study in order to determine if baseline scores of completers and noncompleters were different. To determine if there were differences between males and females and differences among programs, analysis of variance and post hoc orthogonal comparisons were used. For each observation, all remaining subjects in the experimental group were included in the analysis. To study change over time, multivariate repeated measure analyses of variance were used. This part of the analysis was done on those students who remained in the same program from the time they entered CEGEP and for whom complete data was available. Since each specific measurement required its own method of analysis, more detailed methods of analysis preceed each section of the results.

Testing Effects

The Nelson-Denny Reading Test and the Watson-Glaser Critical Thinking Appraisal were two tests which might be sensitive to testing effects. Control Group 1 and Control Group 2 were used to control for the effects of testing. In May 1986, Control Group 1 wrote Form E of the Nelson Denny Reading Test and in May 1987, Control Group 2 wrote Form F. At each of these two observations, Control Groups 1 and 2 had vocabulary and comprehension scores that were not significantly different from the Experimental Group. In 1986, the average standard score in vocabulary was 308 for the Experimental Group and 311 for Control Group 1. The average standard score in comprehension was 301 for the Experimental Group and 300 for Control Group 1. In 1987, the average standard score in vocabulary was 312 for the Experimental Group and 314 for Control Group 2; the average standard score in comprehension was 312 for both the Experimental Group and Control Group 2. In May 1986, Control Group 1 wrote Form A of the Watson-Glaser Critical Thinking Appraisal; in May 1987, Control Group 2 wrote Form B. In 1986, Control

Group 1 had an average total critical thinking score that was exactly the same as the Experimental Group (51) and in 1986, Control Group 2 had an average total critical thinking score that was two points higher than the Experimental Group (54 compared to 52). This difference was not significant. Therefore, testing effects on the Nelson-Denny Reading Test and the Watson-Glaser Critical Thinking Appraisal were not found

Selection Effects

To control for selection , a random sample of students entering Champlain in 1986 (Control Group 3) were administered the set of tests given to the Experimental Group the year before. Results are given for the two tests of achievement, the Nelson-Denny Reading Test and the Watson-Glaser Critical Thinking Appraisal. Students who began CEGEP in 1986 scored lower in vocabulary and comprehension than students who began CEGEP in 1985, but the reading ability of both cohorts fell in the average range when compared with other students at the same grade level. The average range in vocabulary and comprehension on the Nelson-Denny Reading Test is between the 27th percentile and the 74th percentile. The Experimental Group had an average vocabulary standard score of 303 and an average comprehension standard score of 301. These scores placed the Experimental Group in the 65th percentile in vocabulary and the 54th percentile in comprehension. Control Group 3 had an average vocabulary standard score of 299 which placed them in the 53rd percentile and an average comprehension standard score of 294 which placed them in the 38th percentile.

The mean total critical thinking score for the Experimental Group upon entry to CEGEP was 47.64. The mean total critical thinking score for Control Group 3 upon entry to CEGEP was 49.26. This difference was not significant. Therefore, there were no selection effects; the students who entered Champlain College in 1985 were not inherently different in reading ability or critical thinking skills when compared to other entering classes.

RESULTS

Cognitive Development

Reading

To get the results on reading, the Nelson-Denny Reading Test was analyzed for vocabulary, comprehension and a combined vocabulary and comprehension reading score. Form F was used for the first observation (May, 1985), Form E for the second observation (May, 1986) and Form F for the third observation (May, 1987). Each student's vocabulary and comprehension raw scores were converted into standard scores and percentiles according to the Nelson-Denny norms for students at the end of grade 11, 12 and 13 respectively. Nelson-Denny normalized standard scores have a mean of 300 and a standard deviation of 15. The average standard score for each group was used to arrive at an average percentile rank for each group and to examine differences between groups.

For each major observation, results for vocabulary and comprehension were computed 1) for the entire experimental group 2) for males and females separately, and 3) for each program. Analyses of variance were used to determine if there were differences between males and females, and differences between programs. When significant differences were found between programs, post hoc comparisons were used to determine which pairs of programs were significantly different.

Change in vocabulary and comprehension was measured by using the standard scores for each observation of students who remained in the same program during the two year period of this study and who completed the 1985, 1986 and 1987 administration of the Nelson Denny Reading Test (n=133). A repeated measure MANOVA using program as the between-subjects factor and time (3 observations) as the within-subjects factor was carried out. For each observation, a MANOVA entering vocabulary and comprehension as dependent variables and sex and program as independent variables was performed in order to examine the relationship between vocabulary and comprehension.

Completing versus Non-completing Students

Upon entry to CEGEP, the average vocabulary standard score of students who completed the study (M=305.10) was significantly higher ($F=5.49, p < .02$) than the average standard score of students who did not complete the study (M=302.11). There was no difference, however, between their average comprehension scores. If vocabulary is accepted as a general measure of cognitive complexity or ability (Bormuth, 1966; Coleman, 1971; Davis, 1944; 1968; Thorndike, 1973; Thurstone, 1946), then these results suggest that completing students were more capable than non-completing students, but the results are mixed since comprehension did not differ.

Vocabulary

The average vocabulary percentile for students entering CEGEP was 65. Males and females did not differ in any of the three years. Science students consistently had significantly higher vocabulary scores when compared with students in Social Science and Commerce. Science students entered CEGEP with an average vocabulary standard score of 306, which placed them in the 73rd percentile, that is, the vocabulary of Science students was equal to or higher than 73 percent of their grade peers. In contrast, the average standard score of entering Social Science and Commerce students was 302 which placed them in the 63rd percentile. At the end of two years, Science students had an average standard score of 315 which placed them in the 75th percentile. Social Science and Commerce students finished CEGEP with an average vocabulary standard score of 310 which placed them in the 64th percentile. Therefore, it is seen that the significant lead of Science students was maintained throughout the two years of CEGEP. Tables 6, 7 and 8 present baseline vocabulary results for each of the three major observations.

Table 6 - Vocabulary Results - May 1985

Group	N	Mean	SD	Min/Max	%ile
Males	139	304.71	11.27.	283/331	67
Females	194	303.10	11.87	275/333	65
Science	105	306.33	12.74	275/332	73
Social Sci.	124	302.63	10.93	283/332	63
Commerce	104	302.55	10.94	277/326	63
Total	333	303.77	11.63	275/333	65

Table 7 - Vocabulary Results - May 1986

Group	N	Mean	SD	Min/Max	%ile
Males	122	308.81	11.89	272/337	70
Females	146	307.40	11.51	276/334	67
Science	92	311.12	12.65	287/337	77
Social Sci.	93	305.60	10.97	276/329	63
Commerce	83	307.36	10.69	272/331	67
Total	268	308.04	11.69	272/329	70
Missing	3				

Table 8 - Vocabulary Results - May 1987

Group	N	Mean	SD	Min/Max	%ile
Males	59	313.88	10.16	291/338	69
Females	81	310.85	10.84	282/334	64
Science	38	315.95	11.06	289/334	75
Social Sci.	55	310.60	10.41	282/338	64
Commerce	47	310.83	9.97	291/328	64
Total	158	312.13	10.63	282/338	68
Missing	18				

Sex and Program Differences

The vocabulary results in relation to sex and program were relatively consistent for each observation, and significant differences were not observed between males and females as seen in Table 9. However, significant differences were found to exist between programs in all three major observations (Table 10). Multiple planned comparisons between students in Science, Social Science and Commerce indicated that Science students consistently had significantly higher vocabulary scores when compared with students in Social Science and Commerce. Social Science and Commerce students did not differ from each other.

Table 9 - Summary of Anova between Males & Females in Vocabulary

Observation	Sex	N	Mean	F Prob.
1985	M	139	304.71	.2122
	F	194	303.10	
1986	M	122	308.81	.3248
	F	146	307.40	
1987	M	59	313.88	.0960
	F	81	310.85	

Table 10 - Summary of Anova between Programs in Vocabulary

Obs	Program	N	Mean	F Prob.
1985	Science	105	306.33	.0238*
	Soc. Sci.	124	302.63	
	Commerce	104	302.55	
1986	Science	92	311.12	.0044**
	Soc. Sci.	93	305.60	
	Commerce	83	307.36	
1987	Science	38	315.95	.0332*
	Soc. Sci.	55	310.60	
	Commerce	47	310.83	

*$p < .05$ **$p < .01$

Changes in Vocabulary over Time

Vocabulary is a measure of cognitive complexity and was used to measure cognitive development. For this part of the analysis, only the scores of those students who remained in the same program during CEGEP and for whom complete data was available (n=115) were examined (Table 11). Science students in this group (n=36) began CEGEP with an average standard score of 309 and completed CEGEP with an average standard score of 316. Social Science students (n=43) began CEGEP with an average standard score of 303 and completed CEGEP with an average standard score of 309. Thus, Social Science students ended CEGEP with scores that Science students began with. Students in Commerce (n=36) began CEGEP with a lower average standard score of 302 but completed CEGEP in the middle with an average standard score of 311.

Table 11 - SS Means and Standard Deviations of Vocabulary Scores in each Program for 1985, 1986 and 1987

Program	Obs	Mean	SD
Science (n=36)	1985	309.11	11.44
	1986	313.44	11.97
	1987	316.50	10.34
Soc. Sci. (n=43)	1985	303.07	10.43
	1986	306.05	10.91
	1987	310.09	9.99
Commerce (n=36)	1985	302.86	11.74
	1986	308.92	11.90
	1987	311.53	9.88
Entire Sample (n=115)	1985	304.90	11.43
	1986	309.26	11.86
	1987	312.55	10.35

A two-way (Program x Time) repeated measure MANOVA on vocabulary scores yielded a significant trend over time, but there was no difference in the trend when program was analyzed separetely, nor was there a program by time interaction. There was a highly significant upward linear trend ($p < .001$). This means that in all three programs, vocabulary increased during the 2-year period of this study.

Table 12 - MANOVA Results - Effect of 'TIME' on Vocabulary

	SS	DF	MS	F	SIG.
Time	3407.37	2	1703.68	75.19	.001***
Prog by Time	95.18	4	23.79	1.05	.382
Within Cells	5075.58	224	22.66		

***$p < .001$

Comprehension

The average comprehension percentile for students entering CEGEP was 54, which was significantly lower than that of Science students who had an average percentile of 62. Social Science students had an average comprehension percentile of 50, whereas Commerce students had an average percentile rank of 57.

Science Students had significantly higher comprehension scores when compared with students in Social Science, but were not significantly different when compared with students in Commerce. Science students entered CEGEP with an average comprehension standard score of 303; they completed CEGEP with an average standard score of 315. These results placed Science students in the 62nd percentile at the beginning of CEGEP and the 82nd percentile at the end of CEGEP. Social Science students began CEGEP with an average comprehension standard score of 299; they completed CEGEP with an average standard score of 307. These results place them in the 50th and 58th percentiles respectively. Commerce students entered CEGEP with an average comprehension standard score of 301; they completed CEGEP with an average standard score of 312. These results placed Commerce students in the 57th percentile at the beginning of CEGEP and the 71st percentile at the end of CEGEP. Tables 13, 14, and 15 present baseline comprehension results for 1985, 1986 and 1987, by sex and program.

Table 13 Comprehension Results - May 1985

Group	N	Mean	SD	Min/Max	%ile
Males	139	301.39	12.99	269/338	54
Females	194	301.05	11.99	269/333	54
Science	105	303.22	13.60	272/338	62
Social Sci.	124	299.15	12.02	269/328	50
Commerce	104	301.58	11.26	272/328	57
Total	333	301.19	12.40	269/338	54

Table 14 Comprehension Results - May 1986

Group	N	Mean	SD	Min/Max	%ile
Males	122	301.03	13.00	272/337	48
Females	146	301.92	12.91	270/338	50
Science	92	304.45	12.82	275/333	54
Social Sci.	93	298.47	10.97	278/333	40
Commerce	83	301.70	14.40	267/338	50
Total	271	301.51	12.94	267/338	50
Missing	3				

Table 15 Comprehension Results - May 1987

Group	N	Mean	SD	Min/Max	%ile
Males	59	311.58	12.19	279/338	73
Females	81	311.44	11.43	281/338	71
Science	38	315.74	10.30	296/338	77
Social Sci.	55	307.53	12.35	279/338	58
Commerce	47	312.72	10.73	294/338	71
Total	158	311.50	11.72	279/338	73
Missing	18				

Sex and Program Differences

There was no significant difference between males and females in comprehension (Table 16). However, significant differences were found between programs at each of the three major observations (Table 17). Multiple comparisons between programs indicated that students in Science had significantly higher comprehension scores when compared with students in Social Science but were not significantly different when compared with students in Commerce. Students in Social Science did not differ significantly from students in Commerce. These results were confirmed by the Newman-Keuls and Scheffe procedures.

Table 16 - Summary of Anova between Males & Females in Comprehension

Observation	Sex	N	Mean	F Prob.
1985	M	139	301.39	.8043
	F	194	301.05	
1986	M	124	301.02	.5723
	F	147	301.93	
1987	M	65	311.58	.9479
	F	93	310.85	

Table 17 - Summary of Anova between Programs in Comprehension

Obs	Program	N	Mean	F Prob.
1985	Science	105	303.22.	0427*
	Soc. Sci.	124	299.15	
	Commerce	104	301.58	
1986	Science	92	304.45.	0069**
	Soc. Sci.	93	298.47	
	Commerce	83	301.70	
1987	Science	38	315.73	.0023**
	Soc. Sci.	55	307.53	
	Commerce	47	312.72	

*p<.05 **p<.01

Changes in Comprehension over Time

Comprehension was also used to measure cognitive development. Science (n=36) students began CEGEP with an average standard score of 305 and completed CEGEP with an average standard score of 315 (Table 18). Social Science students (n=43) began CEGEP with an average standard score of 297 and completed CEGEP with an average standard score of 305. Students in Commerce (n=36) began CEGEP with an average standard score of 303 and completed CEGEP with an average standard score of 313. A two-way (Program x Time) repeated measure MANOVA on comprehension scores yielded a significant trend over time, but there was no difference in the trend for program analyzed

separately, nor was there a program by time interaction. There was a significant upward linear trend ($p < .001$). This means that for students in all three programs, comprehension increased during the 2-year period of this study.

Table 18 - Mean and Standard Deviation of Comprehension Scores for each Program in 1985, 1986 and 1987

Program	Obs	Mean	SD
Science	1985	305.50	13.59
(n=36)	1986	307.03	12.60
	1987	315.69	9.83
Soc. Sci.	1985	297.88	11.60
(n=43)	1986	297.65	10.16
	1987	305.98	11.66
Commerce	1985	303.97	11.98
(n=36)	1986	305.39	14.41
	1987	313.22	11.27
Total	1985	302.17	12.72
(n=115)	1986	303.01	12.97
	1987	311.29	11.69

Table 19 - MANOVA Results - Effect of 'TIME' on Comprehension

	SS	DF	MS	F	SIG.
Time	5845.08	2	2922.54	53.90	.000***
Prog by Time	59.54	4	14.89	.27	.894
Within Cells	12146.62	224	54.23		

***p <.001

The Relationship Between Vocabulary and Comprehension

It has been argued that vocabulary and comprehension are interrelated subskills of reading and should therefore be analyzed simultaneously. In order to consider the correlation between these skills, a MANOVA entering vocabulary and comprehension as dependent variables and sex and program as independent variables was performed for each observation. Results from these analyses confirmed the separate ANOVA results. No difference was found between males and females but a significant difference was found between programs.

An Averaged F-Test performed on each observation indicated that both vocabulary and comprehension contribute to the difference found between programs, with comprehension being slightly more influential than vocabulary in 1986 and 1987 (Table 20). Thus, students in different programs differ both in vocabulary and comprehension, but comprehension is a greater differentiator in later college years.

Table 20 - Contribution of Vocabulary & Comprehension to Variance

Observation	Variable	Significance
1985	Vocabulary	.04
	Comprehension	.07
1986	Vocabulary	.01
	Comprehension	.004
1987	Vocabulary	.08
	Comprehension	.004

Secondary Observation Results for Vocabulary & Comprehension: September 1985 and September 1986

The purpose of these observations (see p. 27) was to establish if any changes occurred during the summer in reading. In September 1985 the average standard score in vocabulary of the small sample of students (n=39) taken from the Experimental Group was 311 and the average standard score in comprehension was 310. These scores represented an increase of 7 points in vocabulary and 9 points in comprehension. In September 1986 the average standard score in vocabulary of the small sample of students (n=30) taken from the Experimental Group was 312 and the average standard score in comprehension was 308. These scores represented an increase of 4 points in vocabulary and 6 points in comprehension.

The significant increase in the Nelson-Denny reading scores was unexpected and could be the result of randomization. An analysis of variance between the September sample's May 1985 reading scores with the May 1985 reading scores of the remainder of the Experimental Group revealed that the September sample did, in fact, begin CEGEP with significantly higher reading scores than the rest of the population. The Experimental Group began CEGEP with an average standard score in vocabulary of 303 and an average standard score in comprehension of 300. The September 1985 subsample began CEGEP with an average standard score in vocabulary and comprehension of 305. The increase in reading scores could also be the result of testing effects. The students who took part in the secondary observations wrote the same form of the test that they had written the previous May. Their recent exposure to the test may have resulted in an increase in speed and a subsequent increase in the number of items attempted (Stetson, 1982). This hypothesis is supported by the fact that there was no significant increase in their critical thinking scores which were measured by using an untimed test.

Discussion

The vocabulary and comprehension skills of students in Science, Social Science, and Commerce significantly increased while attending CEGEP. There were no significant differences between males and femalesat each observation, but significant differences were found between programs across all three observations.

Science students consistently had significantly higher vocabulary scores than students in Social Science and Commerce. Science students entered CEGEP in the 71st percentile while entering Social Science and Commerce students were in the 63rd percentile. At the end of two years, Science students were in the 75th percentile, while Social Science and Commerce students ended CEGEP in the 64th percentile.

Science Students had significantly higher comprehension scores when compared with students in Social Science, but were not significantly different when compared with students in Commerce. Science students entered CEGEP in the 62nd percentile and ended in the 82nd percentile. Social Science students began CEGEP in the 50th and ended in the 58th percentile, while Commerce students entered CEGEP in the 57th percentile and ended in the 71st percentile.

Traditionally, Science students have entered CEGEP more able and more prepared then other college students to perform college tasks. It is not surprising, then, that Science students entered CEGEP with stronger vocabulary skills than their peers in Social Science and Commerce, and with stronger comprehension skills than their peers in Social Science. The strong relationship between vocabulary and general intelligence is one of the most robust findings in the history of intelligence testing (Anderson & Freebody, 1981). It is also not surprising that the favorable position of Science students, and the relative position of all three programs to each other, remained stable during the two year period of this study.

What was surprising and encouraging were the gains made by all students in comprehension. Although students in all three programs increased their vocabulary and comprehension skills while attending CEGEP, the increase in comprehension was more dramatic. The overall average percentile in vocabulary in 1985 was 65; in 1987 it was 68. The average comprehension percentile in 1985 was 54; in 1987 it was 73. Therefore, the average percentile increase in comprehension was 19% compared to 3% percent in vocabulary.

Comprehension skills, particularly the ability to select important information and the ability to draw inferences is a gradually developing skill. Although children as young as six can often select the main character and sequence events in a simple narrative, the task can become much more difficult if the material is complex (Brown & Smiley, 1977).

It follows that the development of complex reading abilities is possible and probable during the college years. If CEGEP is to create the environment which aids changes in the area of reading, this will involve showing the reader just how complex the reading process is. Students must be taught to clarify the purpose of their reading, identify relevant information, focus attention on major content as opposed to trivia, monitor their progress to determine whether comprehenion is occurring, engage in self-questioning to determine whether goals are being achieved, and take corrective action if comprehension fails.

Until the middle 1970's, the prognosis of worthwhile educational gains from training in reading skills was poor. Recent studies (Brown, 1982; Brown & Day, 1983; Haller, Child & Walberg, 1988; Palinscar & Brown, 1984) refute the earlier findings and conclude that training in comprehending and student's control and understanding of the skills can be successful. The impact of such training will not be felt if it is limited to students who avail themselves of college reading courses or facilities such as Learning Centers. These skills must be taught and reinforced across the entire curriculum.

Writing

The Placement Test used by the English Department was used to measure writing ability. Students were given one hour to compose two sample essays. Each essay was read and scored by two members of the English Department and ranked on a scale of 1-3. Inter-rater reliability was .85. Writing samples were collected in May, 1985 and May 1987. For each major observation, results were computed for the entire experimental group, for males and females separately and for each program. Analysis of variance was used to determine if there were differences between males and females and differences between programs. To measure change in writing skills, a repeated measure MANOVA was carried out on the scores of those students who wrote the writing test in May, 1985 and May 1987 (n=98).

Level of Writing Skill

There were no significant differences found between the writing skills of males and females or among students in Science, Social Science or Commerce. The writing scores for the entire sample suggest that instruction in writing essays was needed for 43% of the students; fifty seven percent were allowed to choose their English course (Table 21).

Table 21 - Level of Writing Ability in Sample - 1985

Writing Level	Frequency	Percent
1 Needs Remedial Work	45	14.0
2 Needs Essay Course	97	29.0
3 Allowed to Choose	192	57.0
Total	334	100.0

Writing errors that resemble those found in second language students and/or remedial writers (level 1) were found in 14% of the sample. The writing of these students

exhibited problems with syntax, idiom and vocabulary. Their paragraphs and essays were devoid of any clear structure and their sentences were riddled with major grammatical problems. These students might be described as somewhat illiterate. Students who needed an essay writing course made up 29% of the sample. These students have basic writing skills and a good conventional vocabulary. However, their paragraphs and essays lacked a clear structure. For example, they might know that a thesis statement and supporting examples are necessary for a strong argumentative essay, but they do not provide them in their writing. Their sentences have some or many of the major grammatical problems such as fragments and run-ons. Finally, 57% of the sample were considered to be literate. These students exhibit an extensive vocabulary and understand the structure of an essay. Their sentences contain very few grammatical problems.

Changes in Writing over Time

A repeated measure MANOVA (Table 22) was used to measure change in writing skills. This part of the analysis was done on students who wrote the writing test in May, 1985 and May, 1987 (n=98). A significant upward linear trend ($p < .006$) in writing skills was found. In 1985, 72 of the 98 subjects needed help with writing tasks. In 1987, 21 of the original 98 subjects still needed writing assistance (Table 23).

Table 22 - Repeated Measure MANOVA - Writing

	SS	DF	MS	F	SIG.
Time	1.84	1	1.84	7.88	.006**
Within Cells	22.66	97	.23		

**p <.01

Table 23 - Writing Results - 1985 versus 1987

(n=98)	1985	1987
1 Remedial Work	11	-
2 Needs Essay Course	61	21
3 Allowed to Choose	26	77
Total	98	98

Discussion

Of the students who entered CEGEP in 1985, 57% did not need help with their writing. They could be said to have the knowledge of the formal text structure needed to produce a coherent, organized piece of expository writing. Forty three percent of the students who entered CEGEP in 1985 needed writing instruction. The writing of these students lacked a clear structure and their sentences exhibited major grammatical problems. The need for writing instruction was not dependent on a student's sex or program of study. However, results on the students for whom pre and post test writing scores were available suggest that, in general, writing skills did improve as a result of attending CEGEP. These results support the hypothesis that a large number of students who enter CEGEP (even our more able students) are not able to perform college writing tasks. The results also demonstrate the need for the continued development of writing skills at the CEGEP level.

Critical Thinking

The Watson Glaser Critical Thinking Appraisal provided a total score and separate subtest scores for each of five subtests: Inference, Recognition of Assumptions, Deduction, Interpretation and Evaluation of Arguments. Each subtest is worth 16 points. Form B was used for the first observation (May, 1985), Form A for the second observation (May, 1986) and Form B for the third observation (May, 1987).

For each major observation, total raw score (number correct out of 80) and subtest results (number correct out of 16) were analyzed separately 1) for the entire experimental group 2) for males and females separately, and 3) for each program. Separate analyses of variance were used to determine if differences existed between males and females and among programs. When significant differences were found between males and females, a separate one-way ANOVA for each subtest was computed for each observation, to determine which critical thinking skill was causing the difference. When significant differences were found among programs, post-hoc comparisons were used to determine which pairs of programs were significantly different.

To identify critical thinking skills causing differences between males and females and among the three programs, a MANOVA was performed entering the five subtests as independent variables with sex and program as factors. This analysis was carried out for each observation. To measure change in critical thinking skills, a three-way (Program x Sex x Time) repeated measure MANOVA was carried out. The total raw score for each observation of students who remained in the same program during the two-year period of the study, and who completed the 1985, 1986 and 1987 administration of the Watson-Glaser Critical Thinking Appriasal (n=133) was used for this part of the analysis.

Completing versus Non-completing Students

Upon entry to CEGEP, the average total score in critical thinking of students who completed the study (M=48.58) was higher [$F(1)=4.89$, $p < .03$] than the average total

score of students who did not complete the study (M=46.51), but this difference was not as great as the differences between the major independent variables. These results support those for vocabulary and suggest that students who completed the study were more capable than those who did not.

Critical Thinking Score

The average total critical thinking score for students entering CEGEP was 47. By the end of the first year this score was 51 and by the end of the second year this score was 52 (Tables 24, 25 and 26).

Table 24 - Watson Glaser Scores - May 1985

Group	N	Mean	SD	Min/Max
Males	139	49.46	8.65	32/73
Females	194	46.35	8.24	24/67
Science	105	50.44	8.68	25/73
Social Sci.	124	45.43	7.92	24/62
Commerce	104	47.42	8.37	24/73
Total	333	47.64		

Table 25 - Watson Glaser Scores - May 1986

Group	N	Mean	SD	Min/Max
Males	118	52.56	7.91	26/72
Females	146	50.86	7.78	32/68
Science	90	54.26	7.36	26/72
Social Sci.	92	49.20	7.20	34/66
Commerce	82	51.45	8.29	31/69
Total	264	51.62	7.87	26/72
Missing	7			

Table 26 - Watson Glaser Scores - May 1987

Group	N	Mean	SD	Min/Max
Males	63	54.30	9.19	34/71
Females	72	50.99	8.85	32/70
Science	37	56.95	9.23	37/71
Social Sci.	53	49.00	8.15	33/67
Commerce	45	53.07	8.60	32/71
Total	135	52.53	9.13	32/71
Missing	23			

Sex Differences

Males consistently scored higher than females on their total critical thinking scores with differences of 3.11 in 1985; 1.70 in 1986; and 3.31 in 1987. The difference between males and females was significant in 1985 [F(1)=11.04, p<.001] and in 1987 [F(1)=4.55, p<.035], and approached significance in 1986 [F(1)=3.06,p. <.08].

Table 27 - Critical Thinking Differences between Males & Females for Each Observation

Observation	Sex	N	Mean	F Prob.
1985	M	138	49.46	.001***
	F	194	46.35	
1986	M	118	52.56	.082
	F	146	50.86	
1987	M	63	54.30	.035*
	F	72	50.99	

*p_<.05 ***p_<.001

Program Differences

Significant differences in critical thinking skills were consistently found among programs, with Science students scoring highest and Social Science students scoring lowest. The differences among programs were significant in 1985 [F(2)=10.35, p <.001], 1986 [F(2)=10.09, p <.001] and 1987 [F(2)=9.41, p <.001]. Post-hoc comparisons indicated that for each observation, Science students had significantly higher critical thinking scores than students in both Social Science and Commerce. In 1987, students in Commerce also had significantly higher critical thinking scores than students in Social Science (p <.05).

Table 28 - Critical Thinking Differences among Programs for each Observation

Obs	Program	N	Mean	F Prob.
1985	Science	105	50.44	.001***
	Soc. Sci.	123	45.43	
	Commerce	104	47.42	
1986	Science	90	54.26	.001***
	Soc. Sci.	92	49.20	
	Commerce	82	51.45	
1987	Science	37	56.95	.0002***
	Soc. Sci.	53	49.00	
	Commerce	45	53.07	

***p<.001

Since there were differences both across sex and program, the question arose as to whether males or females in any particular program were contributing to the variance between programs more than others. To answer this question, a one-way ANOVA for *each program* was computed between males and females for *each observation* (Table 26). Females in Science scored two points lower than males in 1985, were equal to males in 1986 and scored higher than males in 1987; none of these differences was significant. Females in Social Science had lower critical thinking scores than males each year but the difference was significant only in 1985. Females in Commerce also scored lower than

males each year, but the differences were not significant (Table 29). The difference between males and females and between programs seems to be strongly influenced by females in Social Science and moderately influenced by females in Commerce. Females remaining in Science after the first year were as strong or stronger than their male counterparts in critical thinking skills. These results highlight the differential strengths and weaknesses exhibited by students entering CEGEP in Science, Social Science and Commerce.

Table 29 - Means of Total Critical Thinking Scores for Females and Males in each Program for each Observation

		Females		Males	
Program	Obs	n	Mean	n	Mean
Science	1985	50	49.28	55	51.49
	1986	38	54.00	52	54.44
	1987	13	57.23	24	56.79
Soc. Sci.	1985	83	44.31	40	47.75
	1986	62	48.63	30	50.37
	1987	36	48.42	17	50.24
Commerce	1985	61	46.70	43	48.44
	1986	46	51.28	36	51.67
	1987	23	51.48	22	54.73

Contribution of Individual Subtests to Variance

To determine if the differences between males and females and across the three programs were due to specific critical thinking skills, a MANOVA was performed entering the five subtests as independent variables with sex and program as factors.

Of fifteen analyses, four showed differences between males and females with females consistently scoring lower than males. Multivariate results indicated that for the 1985 results, two subtests, Recognition of Assumptions and Interpretation were

significantly different at the .01 level. In 1986, Inference ($p < .05$) and Interpretation ($p < .01$) were significantly different. In 1987, no subtests differed significantly. One-way analysis of variance indicated a similar pattern except for 1987 results, where the effect of sex was significant ($p < .04$) and the subtest, Deduction, was significantly different at the .05 level.

Table 30 - MANOVA - Contribution of Watson Glaser Subtests to Variance for Each Observation - Effect- Sex

	1985 (1,327) D. F. Sig. of F	1986 (1,258) D. F. Sig. of F	1987 (1,129) D. F. Sig. of F
INFER	.106	..050*	.223
RA	.008**	.181	.537
DED	.168	.189	.097
INTER.	.000**	..015*	.736
EVAL .	.588	.293	.575

*p <.05 **p <.01

Table 31 - One-Way ANOVA Results for Subtest Scores between Males and Females for Each Observation

	1985		1986		1987	
	Males (N=138)	Females (N=194)	Males (N=118)	Females (N=146)	Males (N=63)	Females (N=72)
INF	7.39	6.94	8.19	7.42**	8.59	7.79
RA	9.75	8.64**	10.99	11.36	11.52	10.60
DED	9.62	9.23	10.30	9.68	10.73	9.76*
INT	11.49	10.42**	11.92	11.00**	11.92	11.33
EVAL	11.21	11.35	11.16	11.40	11.54	11.50

*p <.05 **p <.01

In three years, two subtests - Interpretation and Evaluation of Arguments made significant contributions to the variance across programs. The subtest, Inference, approached significance in 1985 ($p < .06$) and was significant in 1986 ($p < .000$) and 1987 ($p < .05$). The subtest, Deduction was significant in 1985 ($p < .001$) and 1986 ($p < .01$), but did not reach significance in 1987. The subtest, Recognition of Assumptions, was not significant in any observation. One-way analysis of variance confirmed the multivariate results for each observation (Table 33).

Table 32 - MANOVA - Contribution of Watson Glaser Subtests to Variance for Each Observation - Effect- Program

	1985 (1,327) D. F. Sig. of F	1986 (1,258) D. F. Sig. of F	1987 (1,129) D. F. Sig. of F
INF	.063	.000***	.054*
RA	.662	.128	.138
DED	.000***	.012**	.168
INT	.000***	.001***	.001***
EVAL	.022*	.022*	.029*

*p <.05 **p <.01 ***p <.001

Table 33 - One-Way ANOVA Results for Watson-Glaser Subtest Scores between Programs for Each Observation

Obs.	Science Mean	Social Science Mean	Commerce Mean	F Prob
Inference				
1985	7.57	6.79	7.06	.06
1986	8.47	7.15	7.67***	.000
1987	9.16	7.64	7.95**	.01
Recognition of Assumptions				
1985	9.38	8.96	8.99	.77
1986	11.71	10.97	10.87	.12
1987	11.97	10.30	11.11	.09
Deduction				
1985	10.36	8.64	9.29***	.000
1986	10.60	9.52	9.74**	.01
1987	10.89	9.69	10.21	.08
Interpretation				
1985	11.57	10.16	10.98***	.000
1986	12.08	10.81	11.32***	.001
1987	12.64	10.62	11.91***	.000
Evaluation of Arguments				
1985	11.77	10.93	11.22*	.02
1986	11.37	10.72	11.82*	.02
1987	12.27	10.73	11.82*	.03

*p <.05 **p <.01 ***p <.001

Changes in Critical Thinking Over Time

A three-way (program by sex by time) repeated measures MANOVA was used to measure change in critical thinking skills. This part of the analysis was done on students who did not change programs during CEGEP and who wrote the Watson-Glaser Critical Thinking Appraisal at the three major observations (n=105). Science (n=33) students began CEGEP with an average critical thinking score of 52 and completed CEGEP with an average score of 57. Social Science students (n=39) began CEGEP with an average critical thinking

score of 45 and completed CEGEP with an average score of 49. Students in Commerce (n=33) began CEGEP with an average critical thinking score of 50 and completed CEGEP with an average score of 53.

Thus, Science students on average began CEGEP with higher scores in critical thinking than Social Science and Commerce students. Social Science students ended CEGEP with.a lower average score than the other two groups began with.

Table 34 - Means and Standard Deviations of Total Critical Thinking Scores for Students who did not change Programs

Program	Obs		Mean	SD
Science	1985	33	52.30	7.75
	1986	33	55.24	6.90
	1987	33	57.97	8.53
Soc. Sci.	1985	39	45.17	7.90
	1986	39	51.17	9.61
	1987	39	49.07	7.83
Commerce	1985	33	50.00	6.35
	1986	33	52.33	8.74
	1987	33	53.45	8.65
Entire Sample	1985	105	48.91	7.93
	1986	105	52.81	8.65
	1987	105	53.24	9.15

There was, however, a significant upward linear trend ($p < .001$) in critical thinking skills for all students who stayed in their programs. The analysis indicated a significant main effect for time with no interactions. Therefore, students who remained in the same program throughout their CEGEP experience increased their critical thinking skills during their two years at CEGEP. If these results are generalized to the larger population, the conclusion can be drawn that regardless of sex or program, students increase their critical thinking skills while attending CEGEP.

Table 35 - MANOVA Results -Effect of TIME on Critical Thinking

	SS	DF	MS	F	Sig.
Time	679.82	2	339.9	18.87	.000***
Sex by Time	33.65	2	16.83	.44	.645
Prog by Time	231.88	4	57.97	1.51	.200
Sex by P by T.	240.08	4	60.02	1.57	.185
Within Cells	7589.42	198	38.33		

***p <.001

Secondary Observations: September 1985 and September 1986

The purpose of these observations (see p. 27) was to establish if any changes occurred during the summer in critical thinking. In September 1985 the average total critical thinking score of the small sample of students (n=39) taken from the Experimental Group was two points higher (49 compared to 47) than and the average total critical thinking score achieved by the Experimental Group the previous May. In September 1986 the average total critical thinking score of the small sample of students (n=30) taken from the Experimental Group was exactly the same as the average total critical thinking score achieved the previous May (51). Therefore, no significant gains were made in critical thinking ability during the summer months.

Discussion

Results suggest that students' ability to think critically is related to their sex and program of study. Male students in Social Science and Commerce seem to have more advanced critical thinking skills than female students, particularly when information must be inferred or interpreted. Differences between males and females in Science, however, were *not* found. Male and female Science students exhibited more advanced critical thinking skills when compared with students in Commerce and Social Science. They were better able to distinguish between arguments that are strong and arguments that are weak, they could better determine whether generalizations based on given data were warranted, or whether certain conclusions necessarily followed from given information.

During the two year period of CEGEP, the difference in critical thinking between males and females remained although approximately equal gains (4.84 for males; 4.64 for females) were made. Program differences increased, however. Science students maintained a significant lead throughout CEGEP, with a gain of 6.91 over the two years. Commerce students increased their critical thinking skills by 5.65, while Social Science students increased their critical thinking skills by 3.67.

All students, regardless of sex or program, increased their critical thinking skills while attending CEGEP, but the differences found between programs highlight the strengths and weaknesses of students in Science, Social Science and Commerce. Science students enter CEGEP more equipped to deal with intellectual tasks: they are more able to select, infer, interpret and evaluate information. Students in Social Science and Commerce, and in particular, female students in Social Science and Commerce, enter CEGEP less well equipped to deal with the intellectual demands of their programs.

Affective Development

Moral Development

Before proceeding with the analysis of the Defining Issuses Test (DIT), the DIT scores of subjects who participated in the three major observations were compared to those who did not fully participate in order to evaluate the equivalency of scores for completers and noncompleters. There was no significant difference in the 1985 principled morality score (P score) between students who completed the study and those who did not. Therefore, the DIT results in relation to sex and program can be generalized across the CEGEP population for that year.

The three-dilemma version of the DIT was administered to 333 entering students in 1985. Of these, 271 re-wrote the DIT in 1986 and 158 re-wrote the DIT in 1987. For each observation, a consistency check on the DIT scores was carried out using the procedure described by Rest (1979b). Only the scores from subjects who passed the consistency check were included in each analysis; 191 (57%), 151 (56%) and 87 (55%) successfully completed the DIT in 1985, 1986 and 1987 respectively.

For each observation, raw scores of students' stage of moral development and the P score were computed for each group to create a *group stage profile*. Results were analyzed separately 1) for the entire experimental group, 2) for males and females and 3) for each program. Analyses of variance were used to determine if there were differences between males and females and differences between programs. Post-hoc comparisons were then used to determine which pairs of programs were significantly different.

To evaluate change in moral development, a repeated measure MANOVA using program and sex as between-subject factors and time (3 observations) as the repeated measure was computed. The participants whose scores were examined were the 61 students who did not change programs during CEGEP and who successfully wrote the DIT at each major observation.

Level of Moral Development

When the students' 1987 moral development scores were compared to their scores obtained upon entry to CEGEP (1985), using a repeated measure MANOVA, there was a significant increase in principled-level thinking (P score). Not only had social contract thinking increased, (Stage 5A, 6.57 in 1985 versus 7.92 in 1987), but there was an accompanying decrease in the lower level, conformance to authority (Stage 3, 7.92 in 1985 versus 6.06 in 1987) (see p. 7). However, throughout the two year period of this study, most students chose a "law and order" approach for solving moral dilemmas (Stage 4). At this stage correct behavior consists of doing one's duty, showing respect for authority, and maintaining the given social order for its own sake.

Table 36 - Comparison of DIT Scores from 1985 to 1987

	1985 (n=191)		1986 (n=151)		1987 (n=87)	
Stage	M	SD	M	SD	M	SD
2	2.87	2.23	2.87	3.82	2.28	2.22
3	7.92	6.11	7.22	7.94	6.06	3.69
4	9.77	5.15	9.66	4.11	9.89	4.33
5A	6.57	6.25	7.39	3.94	7.92	4.03
5B	1.76	7.28	1.11	1.48	1.10	1.61
6	1.36	3.43	1.01	1.52	1.12	1.66
Pscore	8.13	4.59	9.26	4.99	10.46	5.97

Sex Differences in Moral Judgement

There was no significant difference between males and females in moral reasoning. In general, both males and females decreased in conventional-level thinking (Stages 2, 3, and 4) and increased in principled-level thinking (Stages 5A, 5B and 6). In 1985, the average P score was 8.62 for females and 7.44 for males. In 1986, the average P score was 9.91 for females and 8.58 for males. In 1987 females had an average P score of 10.39 while males had an average P score of 10.54.

Table 37 - Comparison of DIT Scores from 1985 to 1987 for Males and Females

	1985		1986		1987	
	Males (n=80)	Females (n=111)	Males (n=74)	Females (n=77)	Males (n=41)	Females (n=46)
2	2.70	2.99	2.18	2.75	2.19	2.35
3	7.81	7.99	7.90	6.56	6.65	5.54
4	9.87	9.70	9.44	9.87	9.63	10.13
5A	5.87	7.06	7.16	7.51	7.97	7.87
5B	.70	2.53	.82	1.37	1.00	1.19
6	.98	1.68	.94	1.07	1.12	1.33
P%	7.44	8.62	8.58	9.91	10.54	10.39

Program Differences in Moral Development

Significant differences in moral reasoning were found between programs in 1985 [F(2)=4.51, p <.01] and 1986 [F(2)=9.89, p <.001]. There was no significant difference between programs in 1987.

Post-hoc comparisons in 1985 indicated that students in Science (M=8.87) had significantly higher principled morality scores when compared with students in Social Science (M=6.79) but did not differ significantly from students in Commerce. Separate one-way ANOVA's between each program and the stages of moral development suggested that Stage 4 was most influential in causing the variance between programs [F(2)=4.27, p <.01]. Social Science students(M=11.24) had a greater tendency to choose Stage 4 solutions to moral dilemmas than Science students (M=9.10). At this stage students believe that laws should be upheld except in extreme cases where they conflict with other fixed social duties. Rules are followed to avoid a breakdown in the system.

Post-hoc comparisons in 1986 indicated that Science students (M=11.46) had significantly higher principled morality scores than students in *both* Social Science (M=8.25) and Commerce (M=7.65). Separate one-way ANOVA's between each program and the stages of moral development suggested that Stage 5A was most influential in

causing the variance between programs [F(2)=6.17, p <.003]. Science students had a greater tendency to choose Stage 5A, that is, social contract solutions to moral dilemmas (M=8.73), than their peers in Social Science (M=6.76) and Commerce (M=6.26). At this stage, students become aware that people hold a variety of values and opinions, and that most values and rules are relative to their group. By the third observation in 1987, differences between programs had disappeared.

Table 38 - DIT Scores from 1985 to 1987 for Science Students

	1985 (n=69)		1986 (n=56)		1987 (n=32)	
Stage	M	SD	M	SD	M	SD
2	2.62	2.19	2.30	2.43	2.58	2.47
3	7.79	4.79	6.39	6.95	5.89	3.42
4	9.10	4.39	8.80	3.64	10.19	4.69
5A	7.69	8.89	8.73	4.03	7.65	4.59
5B	2.30	10.81	1.45	1.61	.92	2.15
6	1.74	4.91	1.29	1.73	1.30	1.59
P%	8.87	5.00	11.46	4.96	10.58	7.65

Table 39 - DIT Scores from 1985 to 1987 for Social Science Students

	1985 (n=66)		1986 (n=49)		1987 (n=32)	
Stage	M	SD	M	SD	M	SD
2	3.06	2.31	3.86	5.72	2.31	2.22
3	8.61	8.62	8.22	11.01	5.91	4.04
4	11.24	6.54	11.12	3.87	10.75	4.29
5A	5.44	4.47	6.76	3.59	7.38	3.28
5B	1.18	2.76	.96	1.37	.97	1.38
6	1.15	2.66	.88	1.47	1.13	1.52
P%	6.79	3.53	8.25	4.58	9.66	4.99

Table 40 - DIT Scores from 1985 to 1987 for Commerce Students

	1985 (n=56)		1986 (n=46)		1987 (n=26)	
Stage	M	SD	M	SD	M	SD
2	2.95	2.19	2.50	2.21	1.96	.38
3	7.25	3.42	7.15	4.46	6.41	3.63
4	8.88	3.62	10.22	4.76	8.69	3.87
5A	6.50	3.86	6.26	3.74	8.76	4.24
5B	1.79	5.36	.85	1.36	1.41	1.57
6	1.16	1.46	.80	1.24	1.07	1.39
P%	8.66	4.88	7.65	4.58	11.24	5.45

Changes in Moral Reasoning over Time

A three-way (program by sex by time) repeated measures MANOVA was used to measure change in moral reasoning skills in the 61 students who did not change programs during CEGEP and who wrote the Defining Issues Test each year. Among this group there were no differences due to sex or program. Scores increased significantly over time ($p < .001$). Science (n=22) students began CEGEP with an average P score of 8.02 and completed CEGEP with an average P score of 10.23. Social Science students (n=24) began CEGEP with an average P score of 5.71 and completed CEGEP with an average P score of 9.54, whereas Commerce students (n=15) began with an average P score of 9.80 and finished with an average score of 12.80. Lowest variation in level occurred among Social Science students; greatest among Commerce students.

Similar results were found when students who changed programs were combined with students who did not (n=87). Therefore, it can be concluded that male and female students in Science, Social Science, and Commerce increased their moral reasoning during their two years at CEGEP.

Table 41 - Effect of Time on Moral Development

	SS	DF	MS	F	Sig.
Time	190.34	2	95.17	6.45	.002**
Sex by Time	38.40	2	19.20	1.30	.277
Prog by Time	8.94	4	2.24	.15	.962
Sex by P by T.	15.00	4	3.75	.25	.907
Within Cells	1624.04	110	14.76		

**p <.01

Table 42 - Means and Standard Deviations of Principled Morality Scores for Students who did not change Programs

Program	Obs	Mean	SD
Science	1985	8.02	4.19
(n=22)	1986	8.77	4.83
	1987	10.23	6.31
Soc. Sci.	1985	5.71	3.41
(n=24)	1986	7.96	4.19
	1987	9.54	4.92
Commerce	1985	9.80	5.06
(n=15)	1986	11.80	5.10
	1987	12.80	6.03
Entire Sample	1985	7.56	4.39
(n=61)	1986	9.19	4.83
	1987	10.59	5.78

Secondary Observations: September 1985 and September 1986

There were no significant gains made in moral development during the summer months. In September 1985 the average P score of the small sample of students (n=39) taken from the Experimental Group was 7.76 while the average P score achieved by the entire Experimental Group the previous May was 8.13. In September 1986 the average P

score of the small sample of students (n=30) taken from the Experimental Group was 8.94 while the average P score achieved the previous May was 9.26. Neither of these differences was significant.

Discussion

Overall, both male and female students in Science, Social Science and Commerce decreased in conventional-level thinking and increased in principled-level thinking during the two years they attended CEGEP. No sex differences were found. This latter finding does not support the research suggesting that there are sex differences in moral development (Gilligan, 1982; Kitchener, et. al., 1984; Kohlberg & Kramer, 1969; Rest, 1976; Walker, 1984).

Significant differences were found between programs in 1985 and 1986. In 1985, Science students had significantly higher principled morality scores when compared with students in Social Science. Social Science students had a greater tendency than Science students to believe that laws should be upheld except in extreme cases where they conflict with other fixed social duties (Stage 4). In 1986 Science students had significantly higher principled morality scores than students in *both* Social Science and Commerce. More Science students held that people hold a variety of values and opinions, and that most values and rules are relative to one's group (Stage 5A). The fact that Stage 4 was the main contributor to the variance in 1985 and Stage 5A was the main contributor in 1986, seems to support the hypothesis that the development of moral reasoning is sequential in nature. However, the overall tendency of all students was to favor Stage 4.

Attitude Toward Knowledge

To examine students' attitudes toward knowledge, a questionnaire based on Perry's theory of intellectual development (Table 43) was developed and pilot-tested in March 1985 (Bateman & Donald, 1987). Although the results of the pilot test suggested that only two levels of intellectual development could be discriminated, dualism and advanced, in this analysis attention was paid to all four positions to examine Perry's theory. The questionnaire measured the stages of intellectual development as put forward by Perry: dualism, multiplicity, relativity and commitment. Level of intellectual development was measured by items (4 statements each) describing the four stages. Students were asked to respond on a 5-point Likert Scale (lower scores indicate disagreement; higher scores indicate agreement) to what extent they agreed or disagreed that the items described the way they felt about knowledge and learning.

The questionnaire was administered at each major observation. A two-way ANOVA with sex and program as factors was carried out on each item. With the exception of Item 13, which had a program effect in 1986, and Item 15 which had a program effect in 1987, no significant differences between sex or program were found. Therefore, the results for all students who completed the study were combined (n=214). The percentage of student agreement with each item was calculated to determine the overall tendency of students to prefer specific levels of intellectual development. To measure change over time, a repeated measure MANOVA was carried out for each item.

Student Responses

The majority of students did not tend to agree with items representing dualism, but did tend to agree with items representing the more advanced levels of intellectual development (Table 44). Overall agreement with dualism items ranged from 11 to 55 percent, while agreement with multiplicity, relativity and commitment items ranged from 31 to 91 percent.

Table 43 - Questionnaire Items on Perry's Stages of Intellectual Development

D1	When it comes to knowledge, facts are facts: that's basic. The student's business is to master the facts as the professor gives them.
D2	Knowledge is being able to figure out the right answer.
M3	Teachers present different points of view because they want us to think independently - to learn to find the answer for ourselves.
C4	The professor is not a giver of knowledge. The professor is a guide and a model for our own independent learning. The responsibility for learning or mastering a subject is the student's.
R5	You can't analyze, consider and balance things forever; sooner or later you have to decide and act.
C6	Knowledge is being able to defend a position with solid argumentation, even though others might disagree.
C7	Learning is challenging when we must look at all the ideas and from these decide where we stand.
D8	Knowledge is being able to recall facts and data.
R9	Opinions are only as good as the evidence supporting them.
R10	As long as students develop and support their answers they should not be penalized, even if their view differs from that of the professor.
M11	In areas where experts disagree, everyone has a right to his or her own opinion.
R12	Knowledgeable persons use what they know to judge ideas, data and values.
C13	Knowledgeable persons have identified their own point of view, recognize that it is their own and act according to it.
D14	If teachers stuck more to the facts and did less theorizing, students would get more out of their classes.
M15	The successful student has figured out what the teacher wants.
M16	Everyone has a right to his or her own opinion. There is no such thing as right or wrong.

Table 44 - Percentage of Student Agreement with each Item

Item	1985	1986	1987	
D1	55.6	40.2	33.5	p <.001
D2	42.1	31.8	29.2	p <.03
D8	41.6	32.2	37.3	
D14	11.2	12.7	13.6	
M3	88.8	84.1	85.9	p <.05
M11	83.2	78.0	72.8	p <.01
M15	31.3	49.3	51.1	p <.001
M16	57.0	49.3	43.7	p.<.001
R5	83.2	84.6	83.2	
R9	54.7	64.8	67.6	
R10	91.1	89.7	88.6	
R12	80.4	82.1	83.7	
C4	85.5	79.9	74.6	p <.05
C6	72.8	72.0	76.8	
C7	84.1	78.9	81.1	
C13	77.6	70.3	70.1	p <.05

D=Dualism R=Relativity
M=Multiplicity C=Commitment

Dualism

According to Perry, students at the dualistic stage of intellectual development possess a simple set of assumptions about the nature of knowledge. Their outlook is one in which the world of knowledge, conduct and values is divided into good versus bad and right versus wrong. Knowledge is viewed as an accumulation of facts, a 'right' answer is always possible and the teacher always knows the right answer. Items 1, 2, and 8 represent this outlook.

If intellectual development, as defined by Perry, is a consequence of attending CEGEP, one would expect a decrease in the level of agreement to items representing

dualism. Results confirm this hypothesis. Upon entry to CEGEP, 55% of the students agreed with Item 1 and 42% agreed with Item 2. After two years in CEGEP, the level of agreement to Items 1 and 2 had significantly decreased ($p < .001$) to 33% and 29% respectively. There was no change in response to Item 8.

Item 14, also classified as a dualistic item, describes the teacher's role in the classroom and suggests that less theorizing and more fact giving would be beneficial. The majority of students - 63% in 1985, 61% in 1986 and 57% in 1987 - consistently disagreed with this item suggesting that students view knowledge as much more than simply fact gathering.

Multiplicity

According to Perry students at the multiplistic stage of intellectual development are beginning to accept a plurality of "answers" or points of view. The authority (teacher) is still seen as the possessor of knowledge who is now trying to teach students how to think or how to find the answer. Therefore, the pluralism is not yet recognized as real or legitimate. The uncertainties are viewed as temporary; they are working on them to get to the truth. However, even good teachers admit that they do not know all the answers. Therefore, in a world where there are so many uncertainties, the multiplistic student believes that everyone has a right to his or her own opinion.

Items 3 and 15 refer to the role of the teacher in the acquisition of knowledge. Item 3 represents the multiplistic idea that a 'right' answer is always possible and that the only reason the teacher presents different points of view is to encourage the students to find the 'right' answer for themselves. There was strong agreement to this item before (88.8%), during (84.1%) and at the end of CEGEP (85.9%). Item 15 suggests that the successful student has figured out "what the teacher wants." There was a significant increase ($p < .001$) in the percentage of agreement to this item between 1985 and 1987. Upon entry to

CEGEP, 31% of the students agreed with this item. By 1987, the level of agreement had risen to 51%.

Items 11 and 16 represent the multiplistic belief that everyone has a right to his or her own opinion, with the implication that no judgement among opinions can be made. Item 11 refers to areas where experts disagree. There was strong agreement (83%) to this item in 1985. Although there was a significant decrease ($p < .01$) in the level of agreement to Item 11 by 1987 (72%), the fact that most of the students continued to agree with this item suggests that CEGEP students are beginning to recognize the important relationship between facts and opinions but are reluctant to give up the belief that having an opinion automatically makes it a valid one. This trend is supported by the response to item 16 which suggests that everyone has the right to his or her own opinion and that consequently there is no such thing as right or wrong. In 1985, 57% of the students agreed with this item; by 1987, the level of agreement had significantly ($p < .001$) decreased to 43%.

Relativity

In Perry's schema, as the student moves towards relativity their approach changes from trying to figure out *what* the teacher wants to trying to think the *way* the teacher wants. The transition from focusing on "what" to "how" develops a way of thinking that can be shared by both teacher and student. The realization that having an opinion does not automatically make it right, and that some opinions can be better supported than others, enables students to recognize that opinions are only as good as the evidence supporting them. A strong argument is based not on the quantity of work and "facts" but on the quality of the relationships drawn between data and interpretations. Perry (1981) refers to this phenomenon as the capacity for meta-thought, that is, the capacity to compare different ways of thinking.

The level of agreement to Items 5, 10 and 12 ranged from 80% in 1985, to 91% in 1987. There was no significant change in the level of agreement to these items during the

two-year period of the study. The high level of agreement with these items might make one conclude that CEGEP students are more relativistic in their attitude toward knowledge and learning. The response to item 9, however, suggests that movement towards relativity is not complete. Item 9 states that opinions are only as good as the evidence supporting them. As students move through college, one would expect an increase in the level of agreement to this item. Although the level of agreement to Item 9 rose from 54% in 1985 to 67% in 1987, this increase was not significant. The response to Item 9 is similar to the response to multiplicity Items 11 and 16 and further supports the hypothesis that CEGEP students are reluctant to give up the notion that any opinion is right and should not be judged by others.

Commitment

Students who have reached the final stage in Perry's developmental scheme have identified their own point of view, recognize that it is their own, and act according to it. Commitment then, refers to affirmations: in all the plurality of the relativistic world - truths, relationships, purposes, activities, and cares, in all their contexts - one affirms what is one's own. Commitments require the courage of responsibility, and presuppose the acceptance of human limits, including the limits of reason (Perry, 1970).

The majority of students tended to agree with items representing commitment (Items 4, 6, 7 and 13). Although there was a significant decrease ($p < .05$) in the level of agreement to Items 4 and 13 between 1985 and 1987, overall agreement remained high, ranging from 70 to 85 percent.

Differences Among Programs

Based on Perry's developmental schema, one might hypothesize that students moving away from multiplicity and more toward relativistic thinking are developing an awareness that having an opinion does not automatically make it valid and that some opinions are more worthy because of the evidence supporting them. These students should agree with Item 9, which supports the need for evidence, but disagree with Item 11, which

gives everyone the right to his or her own opinion. Science students responded in this fashion (lower scores indicate disagreement; higher scores indicate agreement - Table 45) In contrast, Social Science students agreed more strongly with Item 11 than with Item 9. They were more in agreement with the idea that everyone has the right to his or her own opinion than with the need to support opinion with evidence. The difference between these two programs was significant for Item 9 in 1986 and for Item 11 in 1987.

These results suggest that Science students have attitudes toward knowledge and learning that are at a higher level of intellectual development when compared with Social Science students. It can be inferred that Science students bring structure to their relative world by recognizing the need for evidence. When evidence is provided, valid judgements can be made. In contrast, Social Science students seem to prefer the state of multiplicity where every opinion is equally valid.

Table 45 - Response of Science versus Social Science students to Items 9 and 11

Item 9	Opinions need evidence	
	Science	Social Science
1985	2.51 (yes)	2.35 (no)
1986	2.69 (yes)	2.35 (no) p<.05
1987	2.68 (yes)	2.49 (no)
Item 11	**Everyone has the right to his or her own opinion.**	
	Science	Social Science
1985	2.76 (no)	2.87 (yes)
1986	2.64 (no)	2.76 (yes)
1987	2.49 (no)	2.81 (yes) p<.02

Discussion

The majority of students did not agree with items representing the lowest stage (dualism) but did agree with items consistent with more advanced stages according to Perry's scheme. The majority of students disagreed upon entry to CEGEP and continued to disagree with the statements which equated knowledge and learning to a mere accumulation of facts and data (Items 1 & 2). Therefore, students at the beginning of CEGEP do not appear to be dualistic.

The significant decrease over the two years in the level of agreement with the two main items representing dualism was complemented by a consistently high level of agreement with the multiplistic belief that a right answer is always possible and that the teacher presents different points of view so that the students can find 'the answer' for themselves. In addition, there was an increase in the level of agreement with Item 15, which states that the successful student has 'figured out what the teacher wants.' Upon entry to CEGEP, 31% of the students agreed with this statement. By 1987, the level of agreement to this item had risen to 51%! Such responses should concern CEGEP teachers. The strong agreement with item 3 and the increased agreement with Item 15 suggest that although students reject a dualistic view of knowledge and learning, teaching methods and evaluation procedures may encourage the dualistic notion that a right answer is always possible and that 'success' is dependent on figuring out what the teacher wants.

There was an overall tendency for students to agree with all commitment items and most relativity items. However, the response to relativity Item 9 and multiplicity Items 11 and 16 suggests that, in general, CEGEP students appear to be multiplistic in their attitudes toward knowledge and learning. Items 11 and 16 represent the multiplistic belief that everyone has a right to his or her own opinion, with the implication that no judgement among opinions can be made. Although the level of agreement to Item 11 decreased to 72%, that level of agreement suggests that CEGEP students are beginning to recognize the important relationship between facts and opinions but are reluctant to give up the belief that

having an opinion makes it a valid one. Item 16 suggests that everyone has the right to his or her own opinion and that consequently there is no such thing as right or wrong. In 1985, 57% of the students agreed with this item; by 1987, the level of agreement had significantly ($p < .001$) decreased to 43%. A shift away from this attitude would have been supported by an increase in the level of agreement with item 9, which states that opinions are only as good as the evidence supporting them. This occurred to a small extent: in 1985, 54% agreed; in 1987, 67% agreed.

Although most students appear to be multiplistic in their attitudes toward knowledge and learning, there is evidence among science students of movement toward relativistic thinking. Science students were more in agreement with the idea that an opinion is only valid if it is supported with evidence than with the idea that everyone has the right to his or her own opinion. In contrast, Social Science students were more in agreement with the individual's right to an opinion than with the need for evidence. While these results suggest that Science students operate at a higher level of intellectual development when compared with Social Science students, they may be more a reflection of the structure of inquiry inherent in each discipline.

Ego Development

To measure ego development, Loevinger's Sentence Completion Test (SCT) of 36 sentence stems which students are asked to complete (Loevinger, Wessler & Redmore, 1970) was used. The incoming scores of subjects who participated in all three observations were compared to the incoming scores of subjects who did not complete the study in order to determine if students who completed the study were different in ego development when they entered CEGEP. The average stage of ego development of students who completed the study (M=4.05) was not significantly different upon entry from the average stage of ego development of students who did not complete the study (M=3.95). Therefore, the following SCT results can be generalized across the CEGEP population entering that year.

For each major observation, SCT scores were analyzed 1) for the entire experimental group, 2) for males and females separately, and 3) for each program. Analysis of variance was used to determine if there were differences between males and females and differences among programs. To measure change in ego development, a repeated measure MANOVA, using sex as the between-subject factor and time (3 observations) as the repeated measure, was carried out. The total raw score for each observation of students who remained in the same program during the two-year period of the study, and who completed the 1985, 1986 and 1987 administration of the SCT (n=133), was used for this part of the analysis.

Level of Ego Development

The mean level of ego development for beginning CEGEP students and students at the end of their first year of CEGEP was the Conformist Stage. In 1985, 77% of the entering students were at or below the Conformist Stage of ego development. In 1986, 71% of these students remained at these levels. In 1987, however, only 40% of these students remained at these levels. During the two years of CEGEP, there was an increase in the percentage of students, at higher levels of ego development: 23% in 1985, 29% in 1986 and 60% in 1987 had ego levels above the Conformist Stage.

Table 46 - Levels of Ego Development - May 1985

Level of Ego Development	Frequency	Percent	Cum %
Impulsive	8	2.4	2.4
Self-Protective	36	11.0	13.4
Transitional	29	8.8	22.2
Conformist	178	54.3	76.5
Self-Aware	50	15.2	91.7
Conscientious	26	7.9	99.6
Individualistic	1	.3	99.9
Missing	6		
Total	334	100.0	100.0

Table 47 - Levels of Ego Development - May 1986

Level of Ego Development	Frequency	Percent	Cum %
Impulsive	10	3.9	3.9
Self-Protective	18	6.9	10.8
Transitional	8	3.1	13.9
Conformist	146	56.6	70.5
Self-Aware	27	10.5	81.0
Conscientious	47	18.2	99.2
Individualistic	2	.7	99.9
Missing	13		
Total	271	100.0	100.0

Table 48 - Levels of Ego Development - May 1987

Level of Ego Development	Frequency	Percent	Cum %
Impulsive	3	2.6	2.6
Self-Protective	3	2.6	5.2
Transitional	7	6.0	11.2
Conformist	33	28.4	39.6
Self-Aware	37	31.9	71.5
Conscientious	24	20.7	92.2
Individualistic	6	5.2	97.4
Autonomous	3	2.6	100.0
Missing	42		
Total	158	100.0	100.0

Sex and Program Differences in Ego Development

Females consistently scored higher than males in ego development with differences of .20 in 1985, .86 in 1986, and 60 in 1987. The difference between males and females was significant in 1985 [F(1)=3.88, p <.05], in 1986 [F(1)=25.42, p <.001] and in 1987 [F(1)=15.66, p <.003) (see Table 51). Most females (77%) began CEGEP at or *below* the Conformist Stage, but were at or *above* the Self-Aware and Conscientious Stages (74%) by the end of CEGEP (Table 49). Like females, most males began CEGEP at or below the Conformist Stage (76%) but in contrast to the females, only 43% of them moved toward the higher stages of ego development by the end of CEGEP (Table 50). No significant difference in ego development was found among programs in 1985, 1986 or 1987.

Table 49 - Levels of Ego Development - Females (percentages)

Level of Ego Development	1985	1986	1987
Impulsive	2.6		
Self-Protective	7.3	1.4	
Transitional	5.8	1.4	4.6
Conformist	61.3	63.6	21.5
Self-Aware	15.7	13.3	41.5
Conscientious	7.3	19.6	24.6
Individualistic		.7	6.2
Autonomous			1.5
Total	100.0	100.0	100.0

Table 50 - Levels of Ego Development - Males (percentages)

Level of Ego Development	1985	1986	1987
Impulsive	2.2	8.7	5.9
Self-Protective	16.1	13.9	5.9
Transitional	13.1	5.2	7.8
Conformist	44.5	47.8	37.3
Self-Aware	14.6	6.9	19.6
Conscientious	8.8	16.5	15.7
Individualistic	.7	.8	3.9
Autonomous			3.9
Total	100.0	100.0	100.0

Table 51Anova on Ego-Development between Males & Females

Observation	Sex	N	Mean	F Prob.
1985	M	137	3.82	.05*
	F	191	4.02	
1986	M	124	3.64	.001***
	F	143	4.50	
1987	M	51	4.41	.003**
	F	65	5.11	

*p <.05 **p <.01 ***p <.001

Changes in Ego Development Over Time

A three-way (program by sex by time) repeated measure MANOVA was used to measure change in ego development in students who did not change programs during CEGEP and who wrote the SCT each year (N=88). There was a significant upward linear trend (p <.001) in ego development for these students. These results indicate that male and female students in Science, Social Science and Commerce who remained in the same program experienced an increase in ego development during their two years at CEGEP.

Table 52 - Effect of 'TIME' on Ego Development

	SS	DF	MS	F	Sig.
Time	16.50	2	8.25	7.31	.001***
Sex by Time	3.95	2	1.98	1.75	.176
Within Cells	193.99	172	1.13		

***p<.01

Discussion

The majority of students entering CEGEP (77%) were at the Conformist Stage of ego development. The majority of students at the end of their second year of CEGEP (60%) were at the Self-Aware and Conscientious Stages of ego development. Significant differences between males and females in ego development were found at each observation. The difference was most striking at the end of the second year of CEGEP. At this point, 57% of the males were still at or below the Conformist Stage in contrast to 26% of the females. Most students, however, regardless of sex or program, increased their ego development scores while attending CEGEP.

Loevinger's research places the majority of late adolescents and adults at the Conformist or Conscientious Stages, or right between them (the Self-Aware Level). The Self-Aware Level is the modal stopping place for adults in our society. Therefore, movement toward the Self-Aware Level and Conscientious Stage is considered to be a developmental milestone, and often appears to develop in students during the first two years of college. College students in the first two years of college are expected to be 18 and 19 years old, rather than 17 and 18, as CEGEP students are.

One could therefore expect beginning CEGEP students, to be at stages of ego development lower than the Self-Aware Stage. The findings of this present study support this hypothesis. The majority of incoming students (77%) were at stages of ego development below the Self-Aware Level, and most of these students (55%) were at the Conformist Stage. Conformists view the world in absolute terms. Things are either right or wrong. This stage is characterized by cognitive simplicity and a great concern for external rules. Students at the Conformist Stage do not feel responsible for the consequences of their actions. In school this characteristic results in the transfer of blame to others (usually the teacher) if they do not succeed. Conformists view education as a practical necessity where one can get a better job with it than without it.

One would also expect CEGEP students to move toward higher levels of ego development as they progress through school. The findings of this study support this hypothesis. By 1987, 60% of the students were at stages of ego development at or above the Self-Aware level. Self-Aware individuals are beginning to see multiple possibilities and that rules may have exceptions. A growing sense of responsibility enables them to accept the consequences of their actions. Personal success or failure is viewed as a result of their own behavior (not the teacher's). Priorities and long-term goals begin to become more real. Education is viewed less as a concrete entity and more as a goal and asset.

These findings begin to explain the frustrating discrepancy that exists between students' emotional and psychological development and teacher expectations. CEGEP teachers expect students to be intellectually and psychologically prepared to perform college-level tasks with efficiency and commitment. Commitment to educational priorities begins to develop at the Self-Aware and Conscientious Stages of ego development. These stages would be expected of 18 and 19 year olds. CEGEP serves 16 and 17 year olds. It seems, then, that students begin CEGEP at a level of emotional and psychological maturity (the Conformist Stage) that would be expected theoretically. It also seems that many students move toward the higher levels of ego development and begin to develop long-term goals and commitment to education while attending CEGEP. If teachers recognize that most beginning CEGEP students are not mature commited learners due to their age, then frustrations might be lessened.

SUMMARY

The role of CEGEP in Quebec society was intended to be one of developing the intellectual abilities of young adults. The actual effect of CEGEP on students however, has not been documented. While some educators view the CEGEPs as glorified high schools, others view them as mini-universities. One way of examining the effect of a CEGEP education is to determine which areas of intellectual development are affected by the CEGEP experience. The purpose of this study, therefore, was to identify the cognitive and affective abilities of CEGEP students at the beginning and end of CEGEP and to measure the change in these abilities. The cognitive development of CEGEP students was assessed by examining the three broad areas of development most focused on at the college level: reading, writing and critical thinking skills. Affective development was studied by examining the values of CEGEP students in relation to moral reasoning, their attitudes toward knowledge and learning, and ego development. It was hypothesized that assessing these cognitive and affective abilities at the beginning and end of CEGEP would establish what the colleges can accomplish, and would promote a more thorough understanding of the students they serve.

This research studied the effect of time in CEGEP (independent variable) on cognitive and affective development (the dependent variables). The research design was an interrupted time-series done on male and female students in three programs: Science, Social Science and Commerce. This design permitted the study of the effect of time in CEGEP (the treatment) by comparing measures of performance taken before CEGEP with measures taken at spaced intervals during and after CEGEP. The design was an interrupted time-series design because there were periods during the experiment when the treatment was not in effect, in this case, during the summer months. The sample consisted of 334 students who entered CEGEP in 1985 in Science, Social Science and Commerce programs They were selected at random and administered a survey of cognitive and affective measures as

part of the college's assessment procedure. The sample consisted of 195 female and 139 male subjects. Of the original 334 subjects, 158 (47%) completed the study.

Overall findings confirm that upon entry to CEGEP, a sizable proportion of the student population do not possess the reading, writing and critical thinking skills required to complete college tasks successfully. However, findings also suggest that cognitive and affective abilities increase while attending CEGEP.

Cognitive Development

Cognitive development or intellectual competence was assessed by examining vocabulary development, reading comprehension, writing ability and critical thinking skills. The Nelson-Denny Reading Test was used to measure vocabulary and comprehension. The average vocabulary percentile for students entering CEGEP was 65. Science students entered CEGEP with an average vocabulary percentile of 73; Social Science and Commerce students entered with an average percentile of 63. Science students maintained their significant lead in vocabulary before, during and at the end of CEGEP. The average comprehension percentile for students entering CEGEP was 54. Science students had an average comprehension percentile of 62; Social Science students averaged in the 50th percentile and Commerce students averaged in the 57th percentile. Science students had a significantly higher comprehension score when compared with students in Social Science, but were not significantly different from students in Commerce. Thus, it would appear that Science students entered CEGEP with stronger vocabulary than their peers in Social Science and Commerce, and with significantly stronger comprehension skills than their peers in Social Science. The favorable position of Science students, and the relative position of all three programs to each other, remained unchanged during the two year period of this study.

Students in all three programs increased their vocabulary and comprehension skills while attending CEGEP. The increase in comprehension, however, was most dramatic.

Between 1985 and 1987 the average percentile increase in vocabulary was 3% while the average percentile increase in comprehension was 19%.

Students' writing skills were measured by the Placement Test used by the English Department. Writing instruction was needed by 43% of the students who entered CEGEP in 1985. Of these, 14% needed remedial instruction and 29% were required to take an essay writing course. The writing of these students lacked a clear structure and their sentences exhibited major grammatical problems. The need for writing instruction was not influenced by a student's gender or program of study. Results on the students for whom pre-test and post-test writing scores were available suggest that writing skills improve as a result of attending CEGEP.

The Watson-Glaser Critical Thinking Analysis was used to examine critical thinking skills. Similar to the findings in relation to vocabulary and comprehension, the ability to think critically differed according to program of study. Science students exhibited more advanced critical thinking skills than students in Commerce and Social Science. They were better able to distinguish between strong and weak arguments, ascertain whether generalizations based on given data were warranted, and determine whether certain conclusions necessarily followed from given information. Critical thinking was also related to a student's sex. Whereas male students in Social Science and Commerce seemed to have more advanced critical thinking skills than their female counterparts, (particularly when information had to be inferred or interpreted), no differences were found between male and female Science students.

During the two-year period of CEGEP, all groups of students, significantly increased their critical thinking skills. The difference in critical thinking between males and females remained, although approximately equal gains (4.84 for males; 4.64 for females) were made. Program differences increased, however. Science students increased their lead throughout CEGEP, with a gain of 6.91 and, by the end of the second year, Commerce

students increased their critical thinking scores by 5.65, more than students in Social Science who had a two-year gain of 3.67.

Affective Development

Affective development was measured by tests of moral reasoning, attitudes toward knowledge and learning, and ego development. Moral reasoning was assessed by using the Defining Issues Test. Overall, both male and female students in Science, Social Science and Commerce increased in principled-level thinking and decreased in conventional-level thinking during the two years they attended CEGEP. No sex differences were found. Differences across programs were significant in 1985 and 1986, but not in 1987. In 1985, Science students had significantly higher principled morality scores when compared with students in Social Science. Social Science students had a greater tendency to believe that laws should be upheld except in extreme cases where they conflict with other fixed social duties.

Results in 1986 indicated that Science students had significantly higher principled morality scores than students in *both* Social Science and Commerce. Science students had a greater tendency to choose social contract solutions to moral dilemmas, than students in Social Science and Commerce.

Attitudes toward knowledge and learning were measured by a questionnaire based on Perry's theory of four stages of intellectual development: dualism, multiplicity, relativity and commitment. At the lowest stages the student views knowledge as an accumulation of facts and data with a correct answer always possible. At the higher stages, students begin to tolerate a plurality of answers and finally choose their own point of view and act according to it.

The majority of students agreed with items representing the more advanced stages and did not agree with items representing dualism. Overall agreement with dualism items ranged from 11 to 55 percent, while agreement with the higher stages (multiplicity, relativity

and commitment) ranged from 31 to 91 percent. In addition, the majority of students disagreed upon entry to CEGEP and continued to disagree with statements that equated knowledge and learning to a mere accumulation of facts and data. Therefore, students at the beginning of CEGEP do not appear to be dualistic.

There was a consistently high level of agreement with the multiplistic belief that a right answer is always possible and that the teacher presents different points of view so that the student can find 'right' for themselves. In addition, there was an increase in the level of agreement to the statement, 'the successful student has figured out what the teacher wants.' Upon entry to CEGEP, 31% of the students agreed with this statement. By 1987, the level of agreement with this item had risen to 51%. It seems that although students reject a dualistic view towards knowledge and learning, teaching methods and evaluation procedures may be encouraging the dualistic notion that a right answer is always possible and that 'success' is dependent on figuring out what the teacher wants.

There was an overall tendency for students to agree with all commitment items and most relativity items. However, the response to three of the eight items suggests that, in general, CEGEP students are multiplistic in their attitudes toward knowledge and learning, that is, CEGEP students are reluctant to give up the belief that having an opinion automatically makes it a valid one.

Although most students appear to be multiplistic in their attitudes toward knowledge and learning, there was evidence that Science students had moved more toward relativistic thinking. Science students generally agreed more with the idea that an opinion is only valid if it is supported with evidence than with the idea that everyone has the right to his or her own opinion. In contrast, Social Science students were more in agreement with the individual's right to an opinion than with the need for evidence. These results would suggest that Science students have more sophisticated attitudes toward knowledge and learning when compared to their Social Science peers. However, this result may also reflect the different structures of knowledge inherent in each discipline.

A third measure of affective development, ego development, was Loevinger's Sentence Completion Test. Loevinger's research places the majority of late adolescents and adults at the Conformist or Conscientious Stages, or right between them (the Self-Aware Level). The Self-Aware Level is the modal stopping place for adults in our society. Therefore, movement toward the Self-Aware Level and Conscientious Stage is considered to be a developmental milestone, and often appears to develop in students during the first two years of college. College students in the first two years of college tend to be 18 and 19, in CEGEP however, they are 17 and 18. One would therefore expect beginning CEGEP students to be at stages of ego development lower than the Self-Aware Stage. The findings of this study support this hypothesis. The majority of incoming students (77%) were at stages of ego development below the Self-Aware Level. Most of these students (55%) were at the Conformist Stage, viewing the world in absolute terms: things are either right or wrong.

It would also be reasonable to expect CEGEP students to move toward higher levels of ego development as they progress through school. The present findings support this hypothesis. The majority of students at the end of their second year of CEGEP (60%) were at the Self-Aware and Conscientious Stages of ego development, beginning to see multiple possibilities and that rules may have exceptions. Their growing sense of responsibility enables them to accept the consequences of their actions.

Significant differences between males and females in ego development were found at each observation but were most striking at the end of the second year of CEGEP. At this point, 57% of the males were still at or below the Conformist Stage in contrast to 26% of the females. However, most students (regardless of sex or program) increased their ego development while attending CEGEP.

To summarize, significant gains were made by male and female students in Science, Social Science and Commerce in vocabulary, comprehension, writing, critical thinking, moral reasoning, and ego development. Strongest gains overall in CEGEP were in comprehension, critical thinking and ego development.

Male and female students did not differ in vocabulary, comprehension, writing or moral reasoning. Differences between male and female students were found in critical thinking and ego development. Male students in Social Science and Commerce seemed to have more advanced critical thinking skills than female students, particularly when information had to be inferred or interpreted. However, differences between males and females in Science were not found. Females remaining in Science after the first year were as strong or stronger than their male counterparts in critical thinking skills. The most striking difference between males and females was in ego development. At the beginning of CEGEP, 77% of the females and 76% of the males were at or below the Conformist stage of ego development. At the end of the second year of CEGEP, 57% of the males were still at or below the Conformist Stage in contrast to 26% of the females.

Differences among programs were not found in writing or ego development. Differences among programs were found in vocabulary, comprehension, critical thinking, moral reasoning and in certain attitudes toward knowledge and learning. Science students seemed to be better prepared than Social Science and Commerce students in these areas when they entered CEGEP and maintained their favorable position throughout the two years of CEGEP. Science students had significantly higher vocabulary scores than Social Science and Commerce students, and significantly higher comprehension scores than Social Science students. Science students had significantly higher critical thinking scores than students in both Social Science and Commerce. In 1987, students in Commerce also had significanly higher critical thinking scores than students in Social Science. Science students had significantly higher principled morality scores than Social Science students in 1985 and Social Science and Commerce students in 1986. By the third observation, however, the

differences between programs in moral reasoning had disappeared. Most students appeared to be multiplistic in their attitudes toward knowledge and learning, but there was evidence among science students of movement toward relativistic thinking. Science students were more in agreement with the idea that an opinion is only valid if it is supported with evidence than with the idea that everyone has the right to his or her own opinion. In contrast, Social Science students were more in agreement with the individual's right to an opinion than with the need for evidence. A summary table follows.

Table 53 - Summary of Significant Gains over two years in CEGEP

	ALL	FEMALE	MALE	SCIENCE	SOC.SCI.	COMM
VOCABULARY						
1985	303	303	304	306	302	302
1987	312	310	313	315	310	310
	+9	+7	+9	+9	+8	+8
COMPREHENSION						
1985	301	301	301	303	299	301
1987	311	311	311	315	307	312
	+10	+10	+10	+12	+8	+11
WRITING						
1985	72 needed help with their writing					
1987	21 needed help with their writing					
CRITICAL THINKING						
1985	47	46	49	50	45	47
1987	52	50	54	56	49	53
	+5	+4	+5	+4	+4	+6
MORAL DEVELOPMENT (P Score)						
1985	8	8	7	8	6	8
1987	10	10	10	10	9	11
	+2	+2	+3	+2	+3	+3
EGO DEVELOPMENT (percentage at or below the Conformist Stage)						
1985	77%	77%	76%	-	-	-
198	40%	26%	57%	-	-	-

IMPLICATIONS

This study suggests that the development of complex cognitive and affective abilities is both possible and probable during the college years, but that most students do not begin college with these abilities to any great extent. the results for reading, writing and critical thinking skills suggest that the ability to reflect on one's own cognitive processes is a late-developing skill with important implications for becoming an effective learner. Results also highlight the differences found between students in each program and suggest that different programs require and reinforce different intellectual skills.

The acquisition of comprehension skills, particularly the ability to select important information, and the ability to draw inferences appears to be a gradually developing process, which can become much more difficult if the material is complex If CEGEP is to create the environment which aids individuals to change or accommodate their existing cognitive structure or way of thinking, then students must gain knowledge about their metacognitive processes. In the area of reading, students should be taught to clarify the purpose of their reading, identify relevant information, focus attention on major content as opposed to trivia, monitor their progress to determine whether comprehension is occurring, engage in self-questioning to determine whether goals are being achieved, and take corrective action if comprehension fails.

In the area of writing, this requires that the writer develop a sense of purpose, a sense of audience, and an understanding of writing as a process which involves pre-writing, writing and editing. At the same time, teachers must be prepared to accept the phenomenon of regression as evidence that the student does not yet have the essential aspects of the task under automatic control. Regression means that writing skills tend to regress when writing tasks are cognitively demanding and in an unfamiliar mode. This is often the case with writing tasks in various disciplines. Regression also occurs as a result of the additional burden writing places on newly acquired and, as yet, unstable formal operational thought structures. Teachers at the post-secondary level can, therefore, expect

considerable variation in levels of performance as their students attempt to assimilate unfamiliar concepts into their developing cognitive structures and to change these structures to accommodate the new demands A practical application of such principles to the post-secondary classroom would be to have students engage in group discussion, group projects and oral presentations as well as in exploratory writing assignments and journal keeping (Loerick, 1986).

The differences found between programs in vocabulary, comprehension and critical thinking highlight the strengths and weaknesses of students in Science, Social Science and Commerce programs. Science students seem to enter CEGEP more equipped to deal with the intellectual tasks that they will be called upon to perform. They are more able to select, infer, interpret and evaluate information. Students in Social Science and Commerce, and in particular, female students in Social Science and Commerce, appear to enter CEGEP less well equipped to deal with the intellectual demands of their programs.

The differences found between programs also suggests that different programs require and reinforce different intellectual skills and modes of inquiry. If the cognitive or intellectual skills required of each program are identified, and entering students are evaluated as to their levels of ability in regard to these skills, teachers in each field will more readily be able to create methods that will promote development and success in their courses.

The expectation that students arrive at CEGEP intellectually prepared to perform college tasks is accompanied by an underlying expectation that students are also psychologically and emotionally prepared to perform college tasks with efficiency and commitment. The findings in relation to affective development suggest that although CEGEP students may not be at a level of psychological and emotional maturity that is desired by the faculty, they are at a level of maturity and commitment that is concomitant with their age.

For example, commitment appears in each of these theories at a point that is not characteristic of the entering CEGEP student. The awareness of the relativity of personal

values and opinions does not develop until later in Kohlberg's theory. The awareness of the relativity of knowledge and a commitment to knowledge and learning that reflects one's own personal philosophy does not develop until the two last stages of Perry's theory. The ability to take charge of one's life and develop one's own personal style does not develop until the advanced stages of Loevinger's theory. All of these stages reflect an advanced level of maturity and commitment that is not often reached until adulthood. CEGEP serves primarily 16- and 17-year olds. It is not surprising then, that most entering students chose "law and order" solutions to moral dilemmas, exhibited multiplistic attitudes toward knowledge and learning and were at stages of ego development that are primarily concerned with appearance, reputation, social acceptance and belonging.

The results across measures of moral reasoning, attitudes towards knowledge and learning and, ego development support each other. Moral reasoning that has a 'law and order' orientation toward authority, fixed rules, and an emphasis on maintaining the given social order for its own sake is reminiscent of a multiplistic attitude toward knowledge and learning where a 'right' answer is always possible and a successful student has 'figured out what the teacher wants.' They are both characteristic of a Conformist Stage of ego development where everything is either right or wrong and great concern is placed on following external rules and being socially accepted.

The findings in relation to moral reasoning, attitudes toward knowledge and learning and ego development also illustrate the intricate relationship between cognitive and affective development. Affective development largely depends upon the development of logical reasoning or cognitive development. It has been shown that the majority of entering CEGEP students are at a stage of intellectual and psychological development that is characterized by cognitive simplicity. Priorities and long-term goals have yet to be established. This behavior and mode of thinking is characteristic of concrete thinkers who have not yet reached the stage of formal operations. In order for students to develop an awareness of the relativism of personal values and opinions, become committed to a

personal lifestyle, and begin to seen multiple possibilities, they must be able to reason abstractly, that is, consider all possibilities, form hypotheses, deduce implications form hypotheses, and test them against reality. They must reach and go beyond the stage of formal operations. Only then will students be able to analyze; interpret and judge the validity of arguements. Only then will students be able to make moral decisions based on self-chosen ethical principles, establish their own personal style and act in terms of priorities and long-term goals and ideals.

It has been shown that students begin CEGEP at a level of emotional and psychological maturity that may not be desirable but is generally expected in terms of test results. It has also been shown that students in general move toward a higher level of cognitive and affective development while attending CEGEP. If teachers recognize that most beginning CEGEP students are not mature committed learners, but might become mature learners as a result of attending CEGEP, the gap between teachers' expectations and students' level of development might be lessened.

By creating CEGEP's, Quebec developed an educational system that is unique in North America. Students who are at a critical stage in their development are removed from the high school and placed in an educational setting which can focus on intellectual development and independent learning. Adolescents are at a period in their lives which is wrought with rapid physical, emotional and psychological changes. Priorities, long-term goals and attitudes toward knowledge and learning are beginning to solidify. Cognitive-developmental theorists believe that changes in thinking are interactive with changes in the environment (Bloom, 1964; Inhelder & Piaget, 1958). The environment creates a disharmony forcing individuals to accommodate their existing cognitive structure or way of thinking. The most rapid changes occur when a powerful environment is brought to bear on a person during a period of high growth rate. CEGEP can provide the environment for such developmental experiences. The challenge of the CEGEP teacher is to introduce appropriate problems which will help students develop. The ability to introduce conflict in the form of

academic tasks which are appropriate to the student's stage of development, yet stimulating enough to promote growth, may represent the most important part of the teacher's contribution to the development of students' intellectual abilities.

An instructional system based on lectures and examinations in which the teacher is the transmitter of knowledge and functions as a judge and certifier of the students' mastery, fits the orientation of a Conformist Stage in ego development and a multiplistic attitude toward knowledge and learning. CEGEP teachers should be concerned with the high levels of agreement to the notions that a right answer is always possible and that the successful student is one who has figured out what the teacher wants. Teachers must choose instructional methods that involve active participation and require individuals to make decisions around goals, activities, and standards or methods of evaluation that are more suited to students at the middle and higher stages of intellectual development. These methods are also more likely to create the interpersonal interactions and self-questioning that facilitate development (Weathersby, 1984).

Until the mid 1970's, the prognosis of worthwhile educational gains from cognitive skills training studies was poor. Recent studies refute the earlier findings and conclude that training in the understanding of the cognitive processes can be successful. The impact of such training will not be felt if it is limited to students who avail themselves of college reading courses or facilities such as Learning Centers. These skills must be intentionally taught and reinforced across the entire curriculum.

The main point is that it is the responsibility of the teacher to develop curriculum and create teaching strategies that simultaneously connect with and extend the development of students. Admittedly, this is not an easy task. Faculty roles can range from being authoritative transmitters of knowledge, to role models helping to develop greater mastery of the learning process, to facilitators of personally relevant, transformative learning. In addition, faculty play different roles with different students, and these roles become more complex as the range of developmental stages broadens.

Cognitive and affective development are broad goals of all levels of education which are both difficult to define and difficult to measure. But, if cognitive and affective development are acknowledged as goals of higher education, government officials, administatorts, parents, and CEGEP teachers themselves may begin to recognize the role that teachers can and do play in their development. CEGEPs are ready for renewal and there is an urgency to the task. An increased demand for literacy has created new complexities which are so formidable that teachers must become students of learning in their own classrooms. CEGEP teachers, who are experts in their fields, must also become experts in teaching and learning. Only then they will be able to integrate course content and intellectual skills for their students.

This task requires both faculty development and administrative and government support. Involvement in this process, however, may require released time, reduced loads and collegial decision making. Appropriate curricula and methodologies should be created. CEGEPs must be willing to define educational goals, to assess performance in meeting those goals, and to make the results of those assessments available to the community. In order to accomplish this task, we must (1) make cognitive and affective development an explicit aim of higher education, (2) recognize that while the level of cognitive and affective development in incoming students is not what teachers might like, it is what could be expected, and (3) deliberately provide students with teaching practices that support yet challenge their current ways of thinking and beliefs. In this way, cognitive and affective development can become one of higher education's most significant results.

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APPENDIX A

April 15, 1985

Dear Student:

An important part of the curriculum at Champlain College is designed to improve reading and writing skills in English. The College has established testing procedures designed to make an accurate diagnosis of each individual's ability in these areas. It is the policy of the College that the results of these tests have no bearing on the student's standing for admission, but ALL incoming students are required to take them. The students entering Champlain this year will also participate in research which will give the College information on the intellectual development of our students during their college years. This testing session will include a survey on attitudes towards knowledge and learning. Some students will participate in follow-up studies in their second and third years.

Saturday, May 25, 1985 has been established as the testing date for those who will begin their studies at Champlain, St. Lambert in September 1985. You are requested to appear at the College, 900 Riverside Drive, at 9:00 A.M. on that date. You will be directed to the appropriate classroom.

The testing session will last approximately 3 hours. Once the tests have been corrected, your results will be sent to you. Based on these results, a specific English course may be required for the Fall Semester, 1985.

If you have any questions about the testing procedures, please contact the Admissions Office at 672-6240.

Alex G. Potter
Campus Academic Dean

AGP:rs

Champlain

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APPENDIX B

April 15, 1986

Dear Student:

Last May you participated in Champlain College's research project designed to measure the learning skills of students entering Cegep. It is now time to examine any changes that have taken place in your intellectual development during this first year.

Wednesday 14 May 1986, which is the second study day at the end of term, is the testing date. You are required to appear at the College at 8:50 A.M. on that date. Upon arrival please go to the gym. The testing session will last approximately two hours. If you have an unavoidable time conflict on May 14th, you must notify Maria DiStaulo in the Learning Center of the Library (Extension 214) by May 5th.

Please be aware that you will not be able to pick up your registration package and appointment card for the Returning Students' Registration in June unless you have taken these tests. Furthermore, your registration could be delayed until August or later.

Your continuing participation in this research project is vital to our work. We thank you for your cooperation.

Brian G. O'Boyle
Acting Campus Academic Dean

BOB:rs

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APPENDIX C

May 9, 1986

Dear Student:

You have recently received a letter from me asking you to continue your participation in a research project sponsored by the College. It is apparent that a number of students are concerned about the requirement that they write another test, particularly on that date, and under the conditions described in my letter. I would like to take an additional moment of your time to explain the importance of the test for us. Additionally, I would like to clarify some important details regarding alternative dates.

Through this research project, we are attempting to measure the impact of Cegep education on aspects of intellectual development such as: thinking critically, defining moral issues, and attitudes towards knowledge. The test will be the objective type and will not require the writing of essays, compositions or paragraphs.

In answer to the question: "Of what use is this to me, and why should I bother?", I must agree that there is probably no direct benefit to you. Unfortunately, research often does not provide direct benefits to the subjects of the research. However, there are potentially major ramifications for those students who will come after you, and it is for this reason that we depend heavily on your assistance. Fundamentally, we are attempting to measure whether or not the education we believe we are providing you is in fact accomplishing what we intend. If it is not, then it is imperative that we modify our teaching and our programs.

It is important that you understand the extent of the College's commitment to this research. Total financing for the project will involve over $125,000 and three years of work on the part of the researcher. The College is firmly committed to the research. We are depending on your help to assist us in meeting this commitment.

Wednesday, May 14th, was selected as the most appropriate date for the test since it was felt that most students would still be available. However, if you are unable to write the test on May 14th due to exam preparation, jobs or any other commitments that you have already made, then alternative dates are available. The first of these is SATURDAY, MAY 24th, at 8:45 A.M. when new students will be writing the English placement tests. The second alternative is THURSDAY, JUNE 5th, at any time between 9:00 A.M. and 4:00 P.M. This is when the registration packages will also be distributed. If you are unable to take the test on May 14th, please call Maria in the Learning Center of the Library (Extension 214) to advise her which of these alternate dates is suitable.

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Champlain

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APPENDIX D

April 2, 1987

Dear Student,

Since May 1985, Champlain College has been conducting a research project designed to measure the intellectual development of Cegep students. We are attempting to measure whether or not the Cegep education we are providing is in fact accomplishing what we intend. We are particularly interested in our students' ego development, moral development, critical thinking and attitudes toward knowledge and learning. This research is crucial to our college; if we are not achieving our objective it is imperative that we modify our teaching and programs.

Until now, you have not been asked to participate, however, 442 of your fellow students have and more than once! Now, we need your help! Each time we collect data from students who have been participating in the study, it is crucial that we create a control group. This means that a sample of students write the tests who have never written them before but have been in Cegep for the same amount of time. This will establish that effects we are seeing in the research group are true effects and not the result of their repeatedly taking the tests. These tests are objective and will not require the writing of essays or paragraphs.

As a token of our gratitude for your participation, a LOTTERY will be held during the last week of classes and six $50.00 awards will be distributed. Students in the research group, who have written the tests three times, will have three chances to win. Students in your group, who have written the tests one time, will have one chance to win. Winners will be announced in the last issue of the Hub.

To facilitate your participation in this research project three testing dates have been scheduled:

Wednesday	April	15th	12-2 p.m.
Wednesday	April	29th	12-2 p.m.
Tuesday	May	5th	6-8 p.m.

We must know which testing session you will attend so that we can plan classroom allocations and notify you. Please check the most convenient testing time on the enclosed postcard and send it back immediately. The post-card can be mailed in the pre-paid envelope or dropped off at Student Services. If none of these times is convenient an individual testing session can be arranged by calling Maria in the Learning Center (Ext. 214).

Please accept my sincerest thanks on behalf of the College for your help in this research.

Brian G. O'Boyle
Academic Dean