Curriculum Coherence and Student Success

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English
Chemistry
Humanities
Physics
Psychology
Social Science: Methodology
Biology
Mathematics

Their ability to transform the concept of curriculum coherence into a process of collegiality, collaboration and community, makes a project of this magnitude necessary and worthwhile.

Dianne Bateman
Stephen Taylor
Elizabeth Janik
Ann Logan

This work is dedicated to

Gail Sowerby
1951 - 2006

A teacher
A colleague
A friend

When Gail realized she had limited time left, this research remained one of her priorities. Gail believed in its underlying values and its importance to the future of teaching and student learning.

Her intellect, integrity and her laughter are truly missed.

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ORGANIZATION OF THIS REPORT

This report is intentionally organized to allow the reader to understand why this research was undertaken, how it proceeded and what was learned by reading the first four chapters: *The Introduction, Literature Review, Methodology and Conclusion*. Chapters five through twelve explain how the process evolved and what results were achieved in the eight departments that participated: English, Chemistry, Humanities, Physics, Psychology, Social Science Methodology, Biology and Mathematics. Having read the first four chapters, any one of the departmental chapters can be read as a separate report.

CHAPTER 1

INTRODUCTION

Dropout from higher education is a constant concern of college educators. Besides its budgetary effects which can threaten the very existence of an institution, its social and educational implications are far reaching (Astin, 1993; Braxton, 1999; Tinto, 1993). The *Education Indicators: 2001 Edition* reported that in a cohort of 100 students in Quebec, 71 will obtain a high school diploma before the age of 20, but only 39 of these students will go on to obtain a college-level degree.[1] The Quebec government tried to address this problem by asking that each college develop a *Student Success Plan* to achieve pre-ordained graduation rates. Although their intentions were admirable and accompanied by generous funding, an emphasis on "success" and "graduation rates" risks negating the progress made towards building a college system that is based on a program approach with a competency-based curriculum. In addition, while the efforts to increase student success at many institutions have been necessary and worthwhile, the absence of an educational process that validates the kinds of learning students are being asked to be successful at, while simultaneously taking into account the cognitive and affective abilities students have when they enter Cegep, can render the achievement of the pre-ordained graduation rates meaningless. The purpose of this research project, therefore, was to bridge the gap between these two contrasting imperatives. It initiated and documented a process that combines outcomes assessment measures with an in-depth analysis of instructional objectives and the classroom assessments designed to measure the achievement of them. Our overall goal was to increase the chances of student success, while guaranteeing the quality of student learning.

A basic premise underlying this research project is that student retention is a consequence of student success and that the most important characteristic of an institution that leads to persistence (success and satisfaction) is the quality of learning that its students experience. In other words, students persist when they are experiencing meaningful learning and personal growth that they can relate to their current and future development. Most studies on student success and retention focus on personal characteristics of the students such as social economic background, attitudes, motivation, study habits and previous academic achievement. This has been the focus of PAREA funded research in the past (Barbeau, 1994; Barbeau, et al., 1997; Gagnon, et al., 1993; Larose & Roy, 1993; Terrill & Ducharme, 1994; Thivierge & Carbonneau, 1998). However, one crucial dimension has been missing from the general trend in such research, that is, the role of curriculum which includes the methods used to measure the learning of that curriculum. Quality student learning, or the lack of it, lies within the curriculum that is planned for them. Ultimately, the faculty is collectively responsible for the quality of that curriculum.[2]

1 Ministère de l'Éducation, Education Indicators: 2001 Edition, [on line], Québec, 2001. <http: www.meq.gouv.qc.ca/stat/indic01/indic01A/ia2001.pdf>.

2 Curriculum is defined as "a college's - or program's - [or department's] mission, purpose, or collective expression of what is important for students to learn" (Stark & Lowther, 1986). Methods used to assess student learning are central to the curriculum.

Prior to the Cegep Reform, the responsibility for designing the curriculum and stating instructional goals fell, for the most part, to the individual departments within a college, and to the teachers who staffed those departments. Coherence or alignment within the curriculum could only occur to the degree that members of a department felt that establishing agreed-upon learning goals and methods of assessment for individual courses, and across multiple sections of the same course, was important. Measuring learning outcomes across the college was seldom discussed or attempted. It was assumed that departmental work on curriculum, hiring, scheduling, budget allocation, teaching and the evaluation of student learning were producing the desired outcomes.

The educational reform of the Cegep system, which began in the early nineties, inaugurated competency-based education within a program approach. Ministerial objectives and standards (the goals of learning) were assigned for each course, in each department, within each program. Although faculty are contractually obligated to respect these objectives and standards, their usefulness and underlying philosophical assumptions are still being debated on many campuses (Bateman, 2002 a,b,c; Sowerby & Bateman, 2001). There is no way of knowing to what degree they have been understood, intellectually endorsed and integrated into classroom practice.

Using graduation rates as the primary indicator of student success devalues the importance of establishing what students have learned (Simard, 2001). It promotes the message that quantity (the number of students who graduate) is more important than quality (the subject matter knowledge and intellectual abilities they graduate with). As a result, many faculty members view the pressure to meet preordained success rates (commonly referred as targets) as proof that “the Ministry of Education wants teachers to lower standards and pass everyone” (common response to *Faculty Questionnaire on Student Success*, Champlain St-Lambert, May 2001). It can be seen as a bureaucratic requirement devoid of substance, rather than as an opportunity to make systematic, explicit, and public, the agreed upon goals of learning and the assessments used to measure, monitor, and document that learning.

Despite the hesitation surrounding the benefits of a competency-based education, most college educators understand that, theoretically, an authentic competency-based model does not put restrictions on ‘how long’ it might take to ‘genuinely’ achieve the required competencies at a satisfactory level. Therefore, the new challenge of ensuring that students complete their DEC in a prescribed amount of time can be perceived by faculty as colliding with competency-based learning (i.e. higher order thinking skills, intellectual abilities) and, subsequently, devalues the kinds of complex, permanent learning required today (Donald, 2002; Taylor, 1990). One way to ensure that the current emphasis on “student success” does not lead to the lowering of standards is to find a way to guarantee that the assessments used to measure the achievement of the curriculum are directly connected to the goals of instruction.

The broad objective of this research, therefore, was to design a model of institutional development that is grounded scientifically, by using research on student outcomes to drive curriculum and program development. Because disciplinary differences exist in how knowledge is acquired and measured (Donald, 1995, 2002; Taylor, 1990, 1994), this research sought to document formal discipline-specific curriculum validation processes that will become part of the culture of each department and accepted as standard procedures that, when followed, validate the grading practices being used across the college to measure student learning.

Approaching "student success" from this perspective placed the assessment of student learning at the center of Champlain St-Lambert's "student success" initiative. We specifically sought to determine what kind of learning represents "student success" in each participating department and in each course that was studied. This meant that we had to find a way to determine if there was a common understanding about what the learning outcomes (goals of instruction) were within each course and across multiple sections of the same course. We wanted to know if the assessment tasks used to measure student performance represented the achievement of the specified learning outcomes. At the same time we wanted to identify educational processes that would enable and motivate faculty to assert their collective responsibility for the integrity and coherence of the curriculum they deliver, while building in the capacity to continually improve teaching and learning.

The importance of this research project lies in its contribution to the knowledge base on how assessment practices can be used to improve and monitor the quality of students' learning. At the same time, the process that it intentionally initiated, supported and documented offers a framework to the collegial community that demonstrates how teachers and institutions can develop a model of curriculum coherence that simultaneously ensures and increases the quality of student learning.

CHAPTER 2

LITERATURE REVIEW

Higher education is in an era of change. Recent reports emanating from Canada (Smith, 1996), Great Britain (JISC, 1995) and the United States (US Department of Education, 2006) suggest that these changes are being provoked by four issues that need to be continually confronted, monitored, and improved if colleges and universities are going to maintain their importance in society and enjoy public support. These four issues include: accessibility, affordability, accountability and quality. The Cegep system in Quebec has successfully dealt with two of these issues; Cegeps are accessible and affordable. They are open to anyone with a high school diploma and funded by the provincial government. Like its European and American counterparts, however, it struggles with issues of accountability and quality.

In a recent attempt to improve quality and make Cegeps become more accountable to the public, the Ministry of Education challenged each college to develop a *Student Success Plan* designed to intentionally increase graduation rates and shorten the extended time it takes to complete a pre-university or professional DEC (a fair number of students need an additional term to complete their program of study). Many Cegep teachers responded to this challenge in a negative way, hearing it as a demand to lower standards and pass more students. Some colleges responded by adding new programs and positions in student learning centers to support students outside of class and handle the increased demand.

At Champlain St-Lambert Cégep, the faculty and administration acknowledge the importance of increasing student success and providing centers that support their learning but reject the view that graduation rates and preordained targets account for the quality of student learning. Champlain St-Lambert Cégep chose to address the challenge of increasing student success by focusing on the academic tasks that students were being asked to master within their respective classes (Doyle, 1983). Efforts focused on finding a way to ensure that ministerial objectives were aligned with departmental standards, curricula and assessments within a course, across multiple sections of the same course, and between courses within the same program. The goal was to create a process that would allow for the constant monitoring of and accounting for the quality of our students' learning. This would be achieved by collecting data on student performance and analyzing the assessment tasks used to measure this performance. The data was fed back into departments to inform curriculum decision making aimed at redesigning assessment methods to make them more coherent with course and program objectives. It was posited that the achievement of an aligned or coherent curriculum at the course and departmental level would increase student success because it would decrease inequities in assessment practices and increase opportunities for all students to learn.

Curriculum Coherence: A possible solution to a complex problem

The need for alignment among curriculum, instruction and assessment is a fundamental principle of educational practice. In a coherent or aligned curriculum, all components in the teaching system, the curriculum and its intended outcomes, the teaching methods, the learning activities, the assessment tasks and resources to support learning are aligned. When these conditions have been created, the learner finds it difficult to escape without learning (Biggs, 1999). It has been reported that when assessments are aligned with instructional objectives, student learning (i.e. success) can be increased as much as two standard deviations (Cohen, 1987). The literature also suggests that faculty who clearly understand the intricate connection between instructional goals and student assessment can both communicate their expectations to students and measure student learning in ways that foster student success without lowering standards (Crooks, 1988; Walvoord & Anderson, 1998; Wiggins, 1993). Creating a coherent curriculum appears to be a simple, straightforward solution to a complex problem that should be easy to design and implement. The literature also suggests, however, that curriculum alignment in higher education is not the norm (Biggs, 1999, 1996; Cohen, 1987; Ramsden, 1992; Pellegrino, 2006).

Although attempts have been made to examine coherence at the state (Cohen, 1995), institutional (Cowan, George & Pinheiro-Torres, 2004), program (Newmann, et al., 2001) and policy levels (Spillane & Jennings, 1997), a documented process for achieving curriculum coherence does not exist. There is little empirical research on the nature of coherence in practice (McDonald, 2005), nor has there been any research on how departments and programs develop coherence (Hammerness, 2007). Pellegrino (2006) suggests that the lack of a central theory about the nature of learning and knowing in a given domain of knowledge and expertise makes it difficult to coordinate curriculum, instruction and assessment.

Anderson (2002) describes curriculum alignment as having a strong link between objectives and assessments, between objectives and instructional activities and materials, and between assessments and instructional activities and materials. In other words, content validity, content coverage, and opportunity to learn are all included within the more general concept of “curriculum alignment.” Our initial conception of coherence was based on this traditional definition which views coherence as an achievable, objective outcome, that is, the internal alignment of standards, curricula and assessments (Biggs, 1999, 2001; Ramsden, 1992).

As the research project progressed, however, it became clear that this simple view ignored the political, and subjective realities operating within an academic department which can easily interfere with a task that requires compromise, collaboration and a conceptual change about how academic departments might work together on issues of curricular structure, pedagogical alternatives, and student assessment. The dynamic process that enfolded during the four years documented in this research report demanded nothing less than a paradigm shift in the way curriculum decisions were made and implemented. Groups of teachers who were used to operating independently were suddenly being asked to become collectively accountable to each other in terms of making and implementing curriculum decisions regarding content, standards and assessments that were in the best interest of the students they served. The process served to remind these teachers that they were also accountable to ministerial objectives that were assigned to each course. How to negotiate the fit between external ministerial demands and the department's own goals and identity was the underlying challenge that sometimes made the achievement of curriculum coherence appear to be an unrealistic goal. The PAREA research team turned to the literature on transformational learning (Mezirow, 2000), organizational change (Argyris, 1991; Argyris & Schon, 1978; Senge, 1992), school reform (Fullan, 1993; 2001) and assessment as learning (Mentkowski, 2000) to inform the strategies they initiated and explain the patterns of interaction that effective departments were exhibiting. Our results support research which suggests that institutions of higher learning can no longer afford to operate in familiar ways (Guskin, 1996; Levine, 1997), and will have to undertake significant change or transformation if they are to authentically increase retention and graduation rates while simultaneously maintaining the quality of student learning.

Understanding organizational change

As previously stated, educational practice at the college level has a long tradition of faculty members functioning autonomously. Teachers have enjoyed an independent existence where they are seldom held accountable to the students or to each other for following institutional and departmental curriculum decisions and policies. Perhaps the building of a coherent curriculum has seldom been attempted because it demands a radical change away from this way of operating. The transformation required asks each teacher to examine the curriculum they teach and assess individually then collectively, with a view towards making any adjustments the department deems necessary. At the organizational level, this transformational change results from individual and group reflection which includes conversation and consensus building (Argyis & Schon, 1978; Senge, 1992). This can require intense social interaction, an interaction that some faculty members are not willing to engage in. In a real sense, teaching becomes public, a state of being supported in the literature on higher education (Boyer, 1990; Shulman, 1993), but less supported on college and university campuses.

Models for quality in higher education stress the importance of transforming the learners, in this case, the teachers, and "enhancing them through adding value to their capability, ultimately empowering them" (Srikanthan & Dalrymple, 2004, p. 70). This transformation needs to be prompted with a critical incident if one is referring to personal transformation (Mezirov, 2000) or creating a sense of urgency (Kotter, 1996; Senge, 2001) if the change involves an organization. This crisis or sense of urgency provides a reason for those involved to examine their beliefs and personal theories about what is causing the crisis. Collaborating and analyzing together what they are doing, then reaching a consensus about whether or not to change department practices empowers the faculty as they become the primary curriculum decision makers (Wenger, 1998). Having people collectively think differently and develop new meanings and beliefs about what their role and responsibility is to their colleagues and the students they serve, is an aspect of transformational change referred to in organizations as sense-making (Weick, 1995). A process for helping an academic department make sense of the relationships among their curriculum, instruction and assessments has not been established.

Another condition required for change is a visible commitment from senior management - in our case - college administrators and department chairpersons - confirming the value being given to the process that is unfolding. A unique kind of leadership is also needed (Ramsden, 1998). Fullan (2001) points out that the leadership required goes beyond having the ability to organize people to solve problems one knows how to address. The leadership has to be willing and able to confront a problem that has never been successfully addressed.

The relationship between curriculum coherence & classroom assessment

The literature on educational change suggests that educators learn to use the same strategies that effective organizations use, that is collect valid data, analyze it and constantly test the inferences drawn from the data. The data used in study focused on gathering information on what students were learning by examining how students were being assessed.

Current thinking about student learning places assessment at the center of the learning process. In fact, it is what actually drives the curriculum and behaviour of both students and teachers (Biggs, 1999). It is viewed as the most powerful aspect of the curriculum because through it teachers communicate to students what is important to learn and how they should go about learning it. Teachers might argue that curriculum objectives are at the center of student learning, but students think differently, “From our students’ point of view, assessment always defines the actual curriculum” (Ramsden, 1992, p.87). In a poorly aligned system, the assessments do not reflect the instructional objectives. This is why in the current debate about poor educational outcomes and the need for educational renewal, assessment is seen as both the problem (when done poorly) and solution (when done well) (Crooks, 1988; Donald, 1997; Resnick & Resnick, 1991). Viewed from this perspective, the assessment task determines the quality of the learning.

For example, prior to the reforms, there was no consensus on what the ideal exit competencies of a Cegep student should be. As a result, the curriculum within Cegeps and between Cegeps could vary tremendously. Today, the Ministry of Education has addressed this problem by declaring Ministerial Objectives and Standards for each discipline within each program. However, whether or not students can be certified as having achieved these objectives largely depends on the validity of the assessments used to measure them (Crooks, 1988; Wiggins, 1993). For example, the Ministerial Objectives for a course might call for higher-order thinking skills; however, if the assessment tasks used in the course do not demand the use of these thinking skills, it cannot be claimed that the students have acquired and/or developed them.

A further complication occurs when multiple sections of the same course use noticeably different methods to evaluate student learning. This calls into question what the 'grades' actually represent (their validity), and can result in unfair assessment practices where student failure has more to do with inappropriate assessments then to a failure to comprehend and apply new knowledge. Unsuitable assessments raise issues surrounding equity and have serious negative impacts on student success. They can limit learning, stop learning, damage classroom dynamics, destroy confidence, and decrease commitment to a discipline. Students who are asked to complete assessment tasks that they have not been academically prepared to accomplish are more likely to fail, take longer to complete their studies, and in some cases, leave the college. It is important to note that these assessments have even greater consequence in the first year when students are trying to adjust to the social and academic demands of college life (Tinto, 1993).

It follows, then, that student grades can be used with confidence to measure the achievement of the desired learning outcomes if it can be demonstrated that the assessments being used are valid, that is, that they are directly connected to the goals of instruction. When this occurs, meaningful learning increases for all students, which should impact on their motivation, their success, and their retention and graduation rates.

From this perspective, meaningful learning emerges from assessment practices that encourage deep rather than surface approaches to learning (Biggs, 1991; Crooks, 1988; Entwistle & Tait 1990; Ramsden, 1992; Walvoord & Anderson, 1998). Appropriate assessment can confirm learning, increase learning, diagnose misunderstandings, enhance independence and responsibility, and encourage interest in and commitment to the discipline. Teaching is deemed effective when the learning activities and assessment tasks support the curriculum objectives. In addition, it has been argued that formative and summative assessments designed to measure high standards for student achievement will increase the chances of having students reach those standards, resulting in a more fruitful educational climate, more equitable opportunities to learn (McDonnell, 1995; Muthen, et al., 1995), and more equitable educational outcomes (Crooks, 1988; Resnick & Resnick, 1991; Walvoord & Anderson, 1998; Wiggins, 1993).

A validated assessment system is essential because in it the teachers make clear what students are to learn, how best they might learn it, and what evidence will be required to document their learning. It is at this juncture in the teaching and learning process that subject matter, teacher, and learner converge, where student success is judged. The validity, appropriateness and fairness of classroom assessments must be established in order to have confidence in the grades that are awarded (Astin, 1991; Banta, et al., 1996; Bateman, 1992; Crooks, 1988; Donald, 2000; Walvoord & Anderson, 1998). How to accomplish this in a systematic way has not been established.

This research project's main objective is to fill this gap. It contributes to educational research by examining the process of creating and maintaining a coherent curriculum. This needs to be done at the course, department, program and institutional level. When the methods used to measure academic achievement are closely aligned with the course and program objectives, meaningful learning increases for all students increasing their motivation and ultimate success.

CHAPTER 3

METHODOLOGY

CONTENTS

This action research project used a combination of qualitative and quantitative methods to study the phenomena of curriculum coherence in eight academic departments at Champlain St-Lambert Cégep. It officially began in the fall of 2003 and ended in June 2006. However, the rest of this chapter and the eight chapters that follow will reveal that it had its beginnings in the Student Success era of 2001-2003 and is still ongoing.

The broad objective of this research was to design a model of institutional development that is grounded scientifically, by using research on student outcomes to drive curriculum and program development. Because disciplinary differences exist in how knowledge is acquired and measured (Donald, 1997; Taylor, 1990, 1994), this research sought to establish and document discipline-specific curriculum validation processes that will become accepted as standard procedures that, when followed, inform curriculum decisions and validate the grading practices being used across the college to measure student learning.

A valid curriculum is coherent. Curriculum coherence is the degree to which the intended learning outcomes (instructional objectives), instructional processes (teaching and learning activities) and assessments (formative and summative evaluations of student learning) are aligned or connected. At the course level this means that the instructional objectives, the learning activities and the assessments used to measure the achievement of the intended learning outcomes are intricately related and connected to each other. At the departmental level, this means that when multiple sections of the same course are offered, there is a common understanding of what the instructional objectives mean in terms of student learning, and how the achievement of those objectives will be measured.

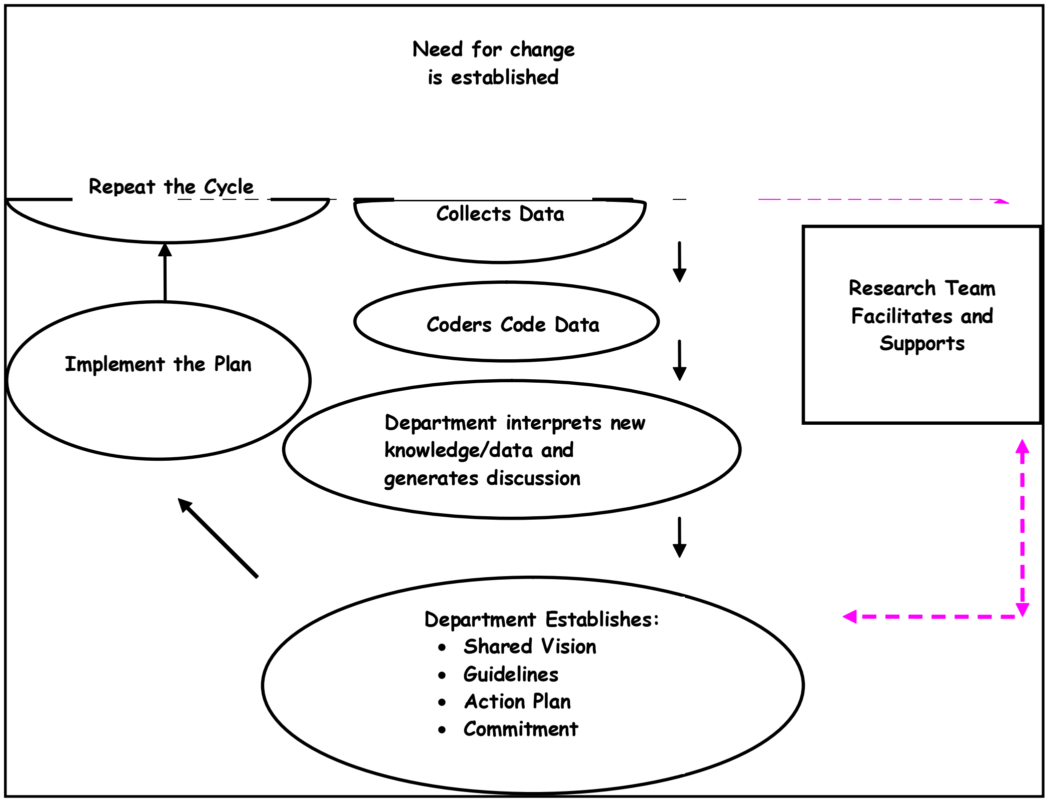
Inherent in this study's underlying objective are nine research projects, with two overarching methodologies. The eight participating departments served as single case studies as they learned how to determine the degree to which individual and multiple sections of a selected course were vertically and horizontally aligned. Approaching each department as a single case study allowed the research team to document the discipline-specific curriculum validation process that each department experienced. While leading and monitoring this process, the researchers simultaneously noted similarities and differences across the eight departments. An analysis of the consequences of the similarities and differences that were observed using a multi-site case study approach allowed for a scientifically grounded model for achieving curriculum coherence to emerge.

The common patterns and conditions necessary for change to occur that were observed across the eight departments serve as the basis for what has become locally known as the *Curriculum Review Process*, a process that can be used to achieve alignment, equity, fairness, and an increase in learning for our students with a corresponding increase in job satisfaction for our teachers. The stages in the *Process* ideally evolve into a continuous, iterative *Cycle* and are depicted in Figure 3.1.

The following pages describe the process that evolved as we initiated, guided and documented its creation.

Figure 3.1

CURRICULUM REVIEW CYCLE



INITIATING A CURRICULUM REVIEW PROCESS: ESTABLISHING A NEED FOR CHANGE

Cegep teachers are seldom informed about how their classes did in relation to the classes of other teachers teaching the same course. This information may be given to department coordinators, but it seldom trickles down to the individual teacher in a format that is simultaneously understandable and thought provoking. In the two years preceding the launching of this research project, the Student Success Committee, which was formed in the fall of 2000 as an adhoc committee of the Academic Council, began to bring student results to every department each term. This information was presented in boxplots which provided a pictorial representation of student results across multiple sections of the same course allowing each teacher to see their own class results in relation to the overall results in their department[1]. First term courses were featured.

[1] At department meetings when this step in the process was in progress, names were removed from the boxplot to maintain confidentiality. However, each teacher received their own file number so they could reflect, in private, about their practice.

When teachers are faced with a wide unevenness of outcomes most feel compelled to understand and explain its origins. For example, Figure 3.2 illustrates how students did across five different sections of Course X at the end of the first term. The first common explanation of the variance in results is that some students stopped attending class before or after the official deadline for withdrawing but never officially withdrew. Consequently, they have to receive a grade for the course, a grade that often reduces the class average. To address this concern, all students who had a grade less than 30% were deleted from the analysis. This step reduced the variance within each class but it did not affect the variance between the multiple sections of the course.

An alternative explanation for low student achievement is that the class is populated with students who are not prepared to do college work; that is, the teacher believes that they had a weak group. This explanation might be affirmed or rejected by comparing the outcome grades with the students' overall high school averages (Figure 3.3). In other words, student results are compared to the high school average that was used by the college to admit those students. In this case, an explanation that students in class 60 and 61 were academically weak would be rejected.

Figure 3.2

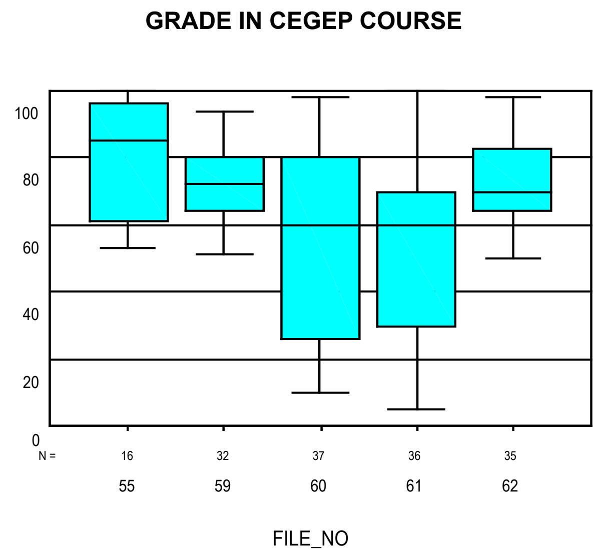
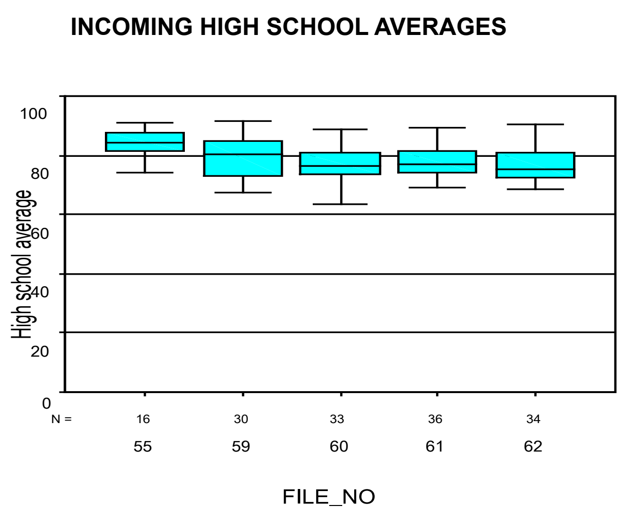
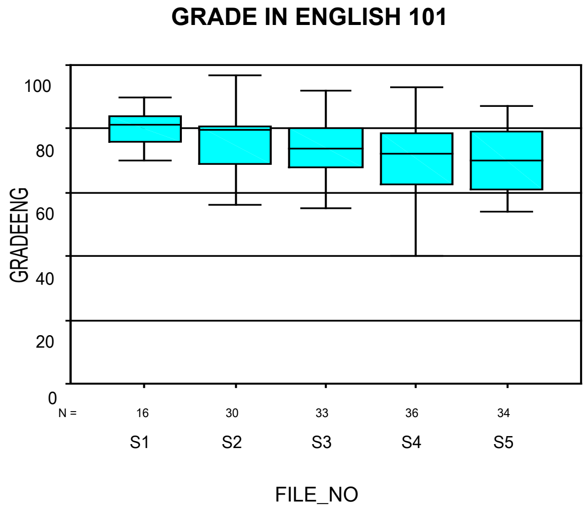


Figure 3.3



If the reliability of the high school grade was questioned (which happened frequently) we made a second comparison with the grades achieved in our first English course, Introduction to Literature and Composition (Figure 3.4). This course focuses on reading, writing and thinking analytically at the college level. The English department has worked diligently for over 10 years to keep this course coherent across multiple sections that function at three different levels. Each student, regardless of whether they are in level A (standard), B (needs extra help) or C (remedial) writes a common final essay, worth 30%, that is marked 'blind' by members of the department. Consequently, student outcomes in this course are known to be reliable, and as a result, more closely resemble the distribution of incoming high school averages. The distribution in Figure 3.3 closely resembles the distribution in Figure 3.4. This validation of incoming high school grades, calls into question the assumption of any teacher of Course X who argues that their class was weak. It leaves the department with a variance among sections to be examined and explained.

Figure 3.4



Departments that exhibited large differences in student outcomes between multiple sections of the same course were encouraged to examine the coherence within their curriculum. At that time, most departments did not know how to proceed in a systematic way, nor could the Student Success Committee offer guidance as a documented process for achieving coherence did not exist (Honig, 2004; Fullan, 2001). However, these visits began to create an awareness of this complex problem.

Team Reflection: Establishing a need for change

Initiating a need to examine a problem is known to be a difficult but necessary step in any process that is attempting to create change (Kotter, 1996; Mezirow, 1991). The PAREA Research Team was conscious of the importance of this fundamental step as it intentionally set out to convince faculty that there was a need to examine student success in relation to the assessment tasks that they were asking students to do to prove that they had learned, that is, that they had been successful. By analyzing these assessment tasks according to the knowledge and cognitive processes that they demanded, one could (1) determine if the tasks were appropriate, (2) if they were aligned with the goals of the course, and (3) if there was coherence or equity across multiple sections of the same course.

Looking back, we believe, that the box plots presented by the Student Success Committee at the semi-annual visits to each department, provoked a desire to understand the factors that contribute to the variance in student grades across sections and served as a catalys for initiating a cycle of change that we were able to pursue with the awarding of the PAREA Grant. Illustrating student results in this manner allowed departments to determine collectively if, in fact, there was a problem worth examining. The box plots served as the 'disorienting incident' required by Mezirow's (2000) model of transformative learning and supports the literature which states that for organizational learning to occur and collaborative inquiry to proceed there must be an important question that the group wants to answer (Senge, 2000; Yorks & Marsick, 2000). Being faced with these results served as the catalyst that was needed to prompt a desire to examine what students were being asked to be successful at, especially across multiple sections of the same course. In many ways it cast doubt on the validity of the grades that were being awarded which infringed on each teacher's sense of moral purpose and integrity. It served as a difficult but necessary step in prompted the process of curriculum realignment that followed.

PARTICIPANTS AND DATA SOURCES

The role of participating departments

Contemporary action research (Kemmis & McTaggert, 2000) requires the active involvement of the 'clients' themselves, in this case, the teachers in the eight participating departments. English, Humanities, Psychology and Chemistry joined the project in the fall of 2003 and became known as the lead departments. In fall 2004 they were joined by Biology, Physics, Mathematics and Methodology. Participation in the project was voluntary but each department that was invited to participate was asked to get their department's full endorsement. The research team met with each respective Department Head and a department representative. In some cases a visit to a department meeting was requested. During these meetings the Research Team outlined the benefits of participating in the study and the associated departmental responsibilities.

As this research focused on first semester courses, teachers from participating departments who taught a first semester course in fall 2003 or fall 2004 submitted their course outline, syllabus, assignments and assessments to the research team. Assessments included both traditional paper and pencil measures such as quizzes, class tests, and exams, as well as performance based tasks such as essays, oral presentations, group work and projects. Anything that contributed to the student's overall grade was collected. By June of 2006, the assessment tasks used across multiple sections of 13 courses were analyzed. This consisted of 115 sections, representing the work of 67 teachers. By the end of the third year of this study a total of 6,192 assessment items had been analyzed. Tables 3.1 and 3.2 summarize this data.

Table 3.1

DATA SOURCES FOR PAREA RESEARCH - F2003 TO W2006

PROGRAM/ DEPARTMENT	COURSES STUDIED	SECTIONS	TEACHERS INVOLVED
Social Science	Intro to Psychology 102 - (F2003) Quantitative Methods - (W2005)	12 11	5 6
Science	Chemistry NYA - (F2003) Chemistry NYB - (W2004) + 1 (F2004) Physics NYA - (F2004) + 1 (W2004) Biology NYA - (F2004)	8 7 6 4	7 7* 6 3
CORE/English	Literary Genres (102) (F2003) Literary Themes (103) (F2003)	12 9	12 9 (16**)
CORE/Humanities	Knowledge and Media -103 - (F2003) Knowledge - All 103 titles (F2004)	10 25	6 11
Mathematics	Calculus1 for Science Calculus1 for Commerce Calculus 1 for IB	7 4 1	4 3 1 (7***)
TOTAL	13	115	67

** Same seven teachers taught NYA & NYB*
*** Five teachers taught both 102 & 103 in the fall 2003 semester*
**** One teacher taught both Cal 1 Science and Cal 1 Commerce*

The role of our subject-matter experts (Coders or SMEs)

Two members from each participating department were elected to collect, prepare and analyze the data, making them co-researchers in this complex project. They were considered to be partners of the principal research team and were given an equal voice in the innovative process. These two subject-matter experts, who became known as the 'coders', agreed to be responsible for the curriculum review process in their department. This meant that they assumed responsibility for the collection, coding, analysis and preliminary interpretation of the data. They agreed to participate in training sessions, collect course materials from their colleagues, analyze all documents and ultimately share their findings and curriculum recommendations with their respective department. Under the direction of the research team they specifically agreed to conduct an in-depth analysis of the degree of alignment within each course and across multiple sections of the same course between: (1) course objectives and the content being taught, (2) course objectives and the content being assessed, and (3) course objectives and the level of cognitive complexity of assignments and assessment tasks.

In order to prepare to carry out their responsibilities, each pair of SMEs (coders) along with their respective department coordinator took part in a training workshop on January, 19, 2004 (lead departments) and January 19, 2005 (2nd year entrants). At these sessions they were introduced to the concept of curriculum coherence, types and formats of tasks, different kinds of knowledge, cognitive complexity and coding procedures. The intention was to build support and understanding for the goals of the study and the proposed route for achieving those goals. SMEs (coders) from the lead departments attended the training session held for departments who joined the project in 2004 and shared their experience.

The role of the principal investigators (PAREA Research Team)

The four principal investigators responsible for this project became known locally as the PAREA Research Team. Their main objective was to fulfill the core goal of action research which is to give participants increasing control over their own situation (Warrican, 2006). Therefore, at times they played the role of distant observers, while at other times they were actively involved in the process. Their main responsibility was to design, support and document the curriculum review process that each of the eight participating departments experienced. They assisted directly with the collection, coding, analysis and interpretation of the data, turning it into trustworthy evidence that would serve as justification for systemic change and inform curriculum decisions. This visible role was crucial but secondary to the implicit leadership role they assumed which demanded that they simultaneously manage and inspire their colleagues. Their personal commitment to the goals of this project maintained a sense of purpose and underscored their interactions with the SMEs, the department coordinators and the teachers whose work was being analyzed. As each department forged their own path through this process, being guided by their own learning as the project progressed, decisions had to be made about the direction that a department should take. These decisions were made through dialog between the SMEs and the PAREA Research Team allowing for collaborative planning and designing of actions aimed at solving the department's unique curriculum alignment issues. Leading these discussions required educational insight, negotiating skill and good will. The example of the PAREA Research Team played a major role in bringing about fundamental shifts of mind individually and collectively.

In order to simultaneously initiate and document the curriculum review process (single-case studies), each of the four principal researchers assumed responsibility for two departments. A working relationship was established with the two subject-matter experts from each of these departments and separate weekly meetings were organized to monitor progress and offer assistance. When possible, the department chairperson attended these meetings. The PAREA Research Team also met weekly to share observations and challenges. This working structure allowed the research team to note the similarities and differences across the departments (multi-site study) and to identify the factors that were contributing to or thwarting the goal of establishing curriculum coherence and alignment.

During the first phase of this project, the four members of the research team designed the training workshops and the tools that the subject-matter experts would use to record the data. Five instruments were designed: (1) Survey of Learning Outcomes Form, (2) Survey of Content Topic, (3) Survey of Assessment Tasks Form, (4) Assessment Task Analysis Codes, and the (5) Coding Form for Task Analysis. In all cases they had to be discipline-specific. The tools made it possible to collect, visualize, analyze and interpret the information that was needed to improve the process of curriculum creation and revision. Samples can be found in the Progress Report submitted in March 2004.

A review of the literature was also conducted to locate subject-matter taxonomies that described the kinds of knowledge and intellectual abilities inherent in each discipline. In the end, Bloom's revised taxonomy of the cognitive domain was presented as a generic taxonomy with which to begin (Anderson & Krathwohl, 2001). However, each coding team was encouraged to create a taxonomy that suited the discourse of their discipline.

When the SMEs were finished coding their department's data, the four main researchers met with the SMEs and went through a preliminary analysis of the data sharing observations, interpretations and questions about the findings. Department coordinators were invited to this preliminary meeting. At this time, additional questions, requiring further analysis, often emerged. When everyone was satisfied with their understanding of what the results indicated, a department meeting was scheduled and the results were presented.

The Research Team helped the SMEs prepare for this meeting by preparing the power point presentation along with individual teacher reports so that each department member could privately compare their results with the overall departmental results. In the case of Humanities, Physics and Chemistry preliminary workshops were also held to help the department understand the data analysis process and to familiarize them with the coding scheme used by their SMEs. At the official department meeting, however, the SMEs conveyed the results. Whenever possible, all members of the research team attended this meeting as participant observers and to be on hand if any questions arose that the SMEs could not answer.

The role of department coordinators

The PAREA Research Team made every effort to involve department coordinators in every aspect of the project given the importance of leadership in a change process and the important role that department coordinators would play in terms of implementing and sustaining curriculum changes that emerged. All department coordinators participated in the training workshops and assisted the SMEs in data collection. Their involvement was also essential in the discussion of preliminary results that preceded the presentation of final results to the department. At these meetings they often raised questions of clarification that needed to be addressed before the results were officially presented to the department.

Coordinators from five of the eight participating departments organized additional workshops and meetings to further their department's understanding of the process and to engage their department in the collective critical reflection that was needed to promote change. It was frequently observed and noted in discussions regarding the similarities and difference across departments, that if the department head understood and valued the curriculum analysis work that was being conducted by their SMEs, the chances of the *Curriculum Review Process* having lasting effects on the department's curriculum were greatly increased. Their involvement made the academic work required for this project to succeed, a more enjoyable and productive experience for everyone.

The role of student outcomes

The PAREA team was given access to the high school average of all students who participated in the study and to the grades that they received in the courses being examined. They were identified through their student number. This information was always used in an aggregate form, that is, the grades of individual students are not apparent.

Team Reflection: Why use subject-matter experts?

> Previous research indicates that it is essential to have subject-matter experts (SME) analyze discipline-specific assessment tasks and items (Bateman, 1992). These experts have the responsibility of translating each assessment item into a type of knowledge. They also have to determine the level of thinking required by the learner to successfully perform the assessment task. Therefore, someone who has acquired both a solid base of content knowledge and the ability to apply it is needed. Content knowledge includes what Bruner (as cited in Shulman, 1992) called the "structure of knowledge" - the theories, principles, and concepts of a particular discipline. Pedagogical content knowledge is also required (Shulman, 1986, 1987, 1992). This includes knowledge that deals with the teaching process, including the most useful forms of representing and communicating content to students. Therefore, it is necessary that the SME has a deep understanding of the conceptual knowledge in their

discipline and an understanding of the instructional goals of the course and how the course fits into a particular academic program. Ideally, they understand the difference between knowing a subject, teaching a subject and learning a subject.

Equally important is the fact that the results are meant to be seriously considered by the department. Therefore, having someone from their own community of practice conduct the analysis, interpret the results and present the results to them increases internal commitment to the process itself increasing the likelihood that the changes emanating from the study are set in motion and sustained (Fullan, 2001; Wenger, 1998). Electing subject-matter experts from each department also reinforces a premise underlying this research which is that the department owns the problem and has the power to create their own solution. The challenge is to create a safe environment where the participants feel empowered and change can be considered (Srikanthan & Dalrymple, 2005).

PREPARING, CODING AND ANALYZING THE DATA

Procedures

All assessment tasks and items on quizzes, tests and final exams were coded according to type and format of task, kind of knowledge and level of cognitive complexity. The primary instructional objective being measured, the "weight," or mark contribution to the student's overall grade and in all disciplines except English, the main topic being addressed in the assessment item was also identified.

The first step in this process was for the SMEs to take each teacher's assessment documents and number every item that contributed to a student's overall grade. This included performance based assessments such as essays, research papers, oral presentations and assignments, as well as items on quizzes, class tests or final exams. In some cases it was necessary to assign more than one number to a question as it contained sub-questions. The following example from Chemistry illustrates this point.

Sample question:

> Although nitrogen dioxide is a stable compound, there is a tendency for two such molecules to combine to form dinitrogen tetroxide. Why? Draw four resonance structures showing the formal charges.

This question counts as three items. The first item identified is for the question, 'why'; the second item is for drawing the resonance structure; the third item is assigning the formal charges. Table 3.2 shows the number of items analyzed for each discipline in the initial stage of participation in the project.

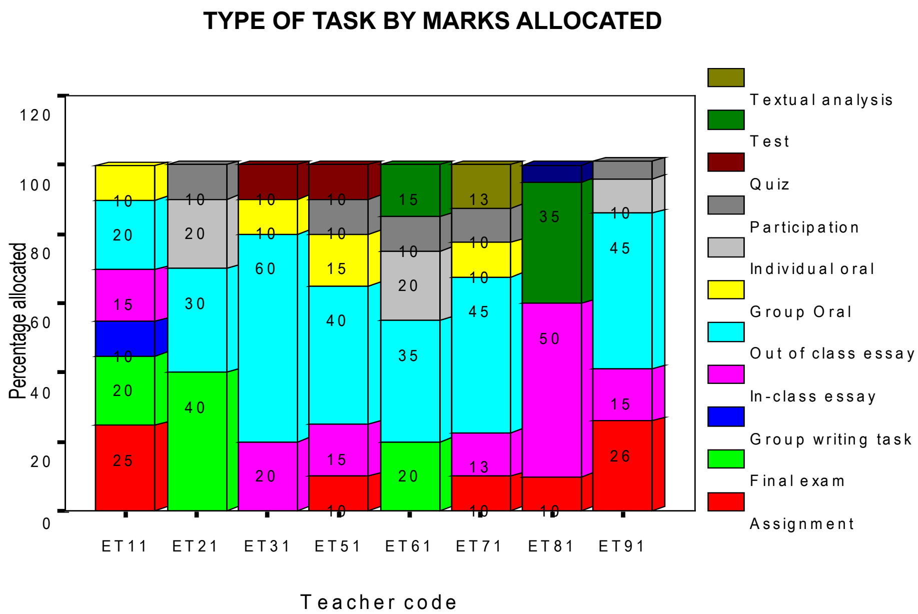
Table 3.2

NUMBER OF ITEMS CODED IN EACH DISCIPLINE (BASELINE FIGURES)

English (n = 285)	Psychology (n = 948)
Physics (n = 672)	Methodology (n = 816)
Chemistry (n = 728)	Humanities (n = 1025)
Biology (n = 681)	Math (n = 1037)

Once the data was coded, it was entered into SPSS and summarized graphically. In all cases, the selection of data presentation format was driven by the knowledge that the range of statistical expertise between departments was large and consequently the results should be as visual as possible to make them understandable to all. Stacked bars were selected as the most accessible format, allowing teachers to be compared side by side in terms of the proportion of marks allocated in each of the measured categories (task type, knowledge, level of cognitive complexity, etc.). For example, Figure 3.5 illustrates the variance across sections initially found in English 103 theme courses. Presenting the results in this visual manner highlights the misalignment between different teachers and raises important questions. Is constructing an essay outside of class equal to constructing an essay during class time? Is it appropriate for one teacher to count essay writing for 35% of the student's grade (ET11) while another, (ET31), counts it for 80%? One teacher has a final exam worth 40% (ET21); the majority of teachers do not use a final exam. Given the variance in task type, can we assume that the grades awarded by the teachers of this course represent achievement of the same instructional objectives? Have the students taking this course experienced an equal opportunity to learn and develop the same intellectual abilities?

Figure 3.5



Type and format of task

The first levels of categorization are type and format of task. Type is the first level of categorization that is assigned to each question or task. It is used to distinguish objective tasks from tasks that might be considered to be more subjective. Examples of type of task include: quizzes, class tests, final exams, assignments, group work, in-class essays, out-of-class essays, research papers, lab quizzes, oral presentations and integrative activities. The second level of categorization was format of task. Format refers to how the assessment task or question was arranged or constructed. Examples of different formats include: multiple choice, true-false, short answers, extended responses, essays, research papers, paragraphs, group work, diagrams and calculations. In general, objective tasks, that is, tasks where a right answer exists, such as quizzes and class tests were comprised of different formats. Most performance-based tasks, such as essays, research papers, oral presentations and projects received the same classification in terms of type and format of task.

Discipline-specific taxonomies for assessing levels of cognitive complexity

The revised version of Bloom's taxonomy (Anderson & Krathwohl, 2001) was offered as a generic theoretical framework for identifying the kinds of knowledge and thought processes inherent in each assessment item or task. The revised taxonomy has a separate knowledge dimension which identifies four kinds of knowledge: factual, conceptual, procedural, and metacognitive, and six levels of cognitive complexity with several sub-categories.

The categories and sub-categories are:

(a) "Remember - recognizing, recalling;"
(b) "Understand - interpreting, exemplifying, classifying, summarizing, inferring, comparing, explaining;"
(b) "Apply - executing, implementing;"
(c) "Analyze - differentiating, organizing, attributing;"
(d) "Evaluate - checking, critiquing;" and
(e) "Create - generating, planning, producing" (p. 31).

Anderson and Krathwohl believe that teachers can determine which level they are reaching by identifying the nouns and verbs in their objectives. The noun describes the category of knowledge they are assessing, and the verb defines the category and sub-category of the cognitive domain they have reached. Anderson and Krathwohl noted that teachers can create their assessments by examining the categories covered in classroom instructional objectives. Using this process backwards, the coders analyzed each assessment item according to the knowledge and thinking skill it demanded of the learner.

The Coders were encouraged to adjust the taxonomy in any way needed to capture the thought processes required to master the competencies reflected in their courses. Psychology, Humanities, Biology, Methodology and Math chose to use the revised version of Bloom's taxonomy without any changes. English, Chemistry and Physics made revisions which are summarized in their respective chapters. A unique, discipline-specific taxonomy created by the Physics Department appears in Supporting Document A, in Chapter Eight. These taxonomies provided a vocabulary that was used to discuss curriculum in a new way. They gave labels to the thought processes that teachers try to develop in their students, capturing the thought processes that are inherent in each discipline. They were central in the process of achieving curriculum coherence within and between courses in a specific academic discipline.

Coding could not proceed or be completed until the two department representatives (subject matter experts) were satisfied that the taxonomy they were using captured the kinds of knowledge and cognitive complexity inherent in their discipline's assessment tasks. In most cases, this required practicing with items that were not part of the official data. When a basic level of agreement was reached, each coder would code separately and then meet with their partner and one member of the research team to compare results, resolve disagreements and establish inter-rater reliability.

Coding issues

Several issues emerged during the coding process. In some departments a considerable amount of coding was completed before the SMEs decided that changes to the taxonomy were necessary. These changes were encouraged by the PAREA Research Team despite the fact that it resulted in a recoding of already coded data.

It was also noted by SMEs from several departments that one does not know how certain things are presented during class. If a teacher presents a question in class and goes over the answer and then, subsequently, the question appears on the test or examination, it could be considered to be at a lower level than if students are seeing this item for the first time. There is also the issue of how an item is corrected. For example, in biology, some items can be corrected as either right or wrong, while other assessment items are open to discussion. If some teachers give partial marks for a partially correct answer, while others mark it totally wrong, there will be variations in the students' final marks. The research team acknowledged this limitation and recognized that determining how each topic was addressed in class would be impossible. For the purpose of this study, coders were instructed to code each item as it appeared, according to the taxonomy they had chosen to use.

Reviewing and affirming instructional objectives

A fundamental characteristic of an aligned curriculum is that the assessments used to measure student learning directly connect to the instructional goals of the course. These goals represent the "vision" of the department in terms of how a particular course contributes to the overall development of a student. Therefore, there has to be a common understanding about the types of knowledge and levels of thinking in the discipline that the achievement of the instructional goals demands. Consequently, defining the instructional objectives of a course is required before it can be established that the assessments being used to measure the achievement of those objectives are valid, that is, that they actually measure what they claim to be measuring.

Variation in course objectives across multiple sections of the same course was common. In fact, each department had work to do in this area before the coders could proceed. For some this meant a simple clarification, for others it required a Delphi sorting procedure to reach a meaningful agreement. In skill-oriented courses, such as English and Humanities, the department had to reach a common understanding about the thinking processes or intellectual abilities that characterize the successful student. In content-oriented courses, such as Introduction to Psychology and Chemistry NYA, the subject-matter knowledge or topics to be addressed also had to be established. The need for this important, initial step was confirmed by the departments that joined the project in the second year. In all cases, the general course objectives had to be revisited, realigned and reconfirmed by the entire department before the analysis of assessment tasks could proceed.

Team Reflection: Realigning course objectives; an unexpected but crucial step

> The variation in course objectives found across multiple sections of the same course came as a surprise to the PAREA research team because we assumed that the reforms of the

1990s had solved this problem. The educational reform of the Cegep system inaugurated competency-based education within a program approach. Ministerial objectives and standards (the goals of learning) were assigned for each course, in each department, within each program. When these external directives were first mandated, departments spent a great deal of time debating what the 'competencies' represented in terms of student learning and transferred them into instructional goals for each of their courses. Because of this, the PAREA research team assumed that a common understanding of the objectives and standards for each course being examined already existed and would be found in the department's course objectives. This was not the case.

The common lack of agreement across sections of the same course on what the instructional goals were highlighted the fact that in many departments a common understanding of how a particular course contributes to the intellectual development of the student does not necessarily exist. Clearly, revisiting these goals, having the discussion and reaching a consensus about what they mean in terms of student learning and how they should be assessed is a step that has to be repeated periodically. Without this important exchange, an examination of the assessments tasks used to measure the achievement of these goals becomes meaningless.

Therefore, what first appeared to be a methodological setback, soon emerged as a necessary step in an effective *Curriculum Review Process*. In many ways, this step brought the responsibility for coherence back "into" the department and actually served as the first step in establishing a common vision. Challenging the department to make sense of the external directives, that is, the ministerial objectives and standards, forced them to begin the process of combining their wisdom and expertise for the sake of the students. It challenged them to get beyond the complexity of the information, and translate the competencies into meaningful instructional goals that were understood, intellectually endorsed and integrated into classroom practice. It also challenged them to identify the content knowledge and intellectual abilities that they hoped to see develop in successful students. In some departments, this unexpected but necessary step reaffirmed a strong disciplinary identity or cultural community; for others, it served as an important first step in the formation of a community of practice with a shared vision, values and goals (Wenger, 1998).

TRANFORMING DATA INTO KNOWLEDGE THAT DIRECTS CURRICULUM DECISIONS

A collective interpretation

Once the SMEs were satisfied with their understanding and interpretation of what the results suggested, they brought their findings to their department. This step launched a period of examination and reflection, as the department worked together to determine if the results represented the kinds of knowledge and levels of cognitive complexity that were appropriate for the course under study. All department members were expected to participate in this part of the process as members expressed their concerns, questions and ideas. In most departments, these curriculum consensus building discussions resulted in a clear set of guidelines outlining appropriate tasks, formats, levels of cognitive complexity and relative grade values that were appropriate for a particular course.

Once again, the process of transforming the data into meaningful information served to inform and advance these important discussions. The variance between sections of the same course on the instructional objectives being addressed, the topics being covered and the cognitive complexity of the assessment tasks being used, served to influence the collective conscience by making the faculty more aware that equity across sections did not necessarily exist, and that the department needed to make decisions about the intellectual abilities and content knowledge required of students who complete the course being studied. Most importantly, it provoked the department to act, that is, to determine what kinds of assessment tasks would most appropriately measure the achievement of those curriculum decisions.

Establishing a shared vision

The most constructive discussions were observed in departments where the coders made a special effort to ensure that the taxonomy represented the intellectual abilities inherent in their discipline. If the coders ignored this step, which happened in one department, they were frustrated with their results and tended to blame this outcome on the limitations of the taxonomy.

Using a language to analyze the cognitive complexity of the assessment tasks being assigned that resonates with a particular disciplinary culture is beneficial because it promotes buy-in to the process and a new way to dialog about the curriculum. It provides a vocabulary that is competency-based as opposed to being content driven. In other words, taxonomies that identify the thinking skills and intellectual abilities inherent in the discipline provide a framework for the department to use when constructing their assessment tasks. This current analysis illustrated where their assessments were adequate and where their assessments needed to be adjusted. By entering the course through the “back door,” curriculum and pedagogical decisions can be based on trustworthy evidence about what is actually happening in each section of a course as opposed to hallway hearsay and unsupported assumptions.

This discourse or "digestion" period became a critical step towards creating a shared commitment to the curriculum decisions that emerged from these discussions, discussions that often took several weeks to complete. It was during this step in the process that the PAREA Research Team witnessed the merging of the project's underlying theories, practical tools and methods which lead faculty to new insights about the relationship between teaching and assessment. The development of this "shared awareness" (Senge, 1992, p. 205) is a prerequisite for the continuous implementation of the *Curriculum Review Cycle*. After a consensus was reached about what the assessment tasks in a particular course should be, the department began to prepare to offer their newly aligned course. With the exception of English and Chemistry, all departments required at least one semester to complete this preparation.

After the newly aligned course is offered, a complete data set from each teacher is collected again and the coders repeat the coding process. A new analysis reveals if the level of coherence between multiple sections of the same course has increased and whether or not the increase in coherence results in a corresponding increase in student achievement. Three of the lead departments: English, Humanities and Chemistry were able to progress to this point.

Team Reflection: Establishing a discipline-specific assessment vocabularies

> The discipline-specific nature of the assessment terminology that is used in different disciplines became evident as soon as the coding process began. Simple concepts, such as 'quiz' and 'assignment' had different meanings in different disciplines. For example, in the English department, quizzes were used to test literal understanding of assigned readings and contributed a minor amount to the student's overall grade. In Biology, 'quizzes' were utilized as precursors to class tests, resulting in questions that went beyond the literal level. The Psychology department used the word 'quiz' to describe all major tests in an attempt to reduce the level of test anxiety among their students. Despite their good intentions, it was acknowledged that their 'quizzes' were actually class tests which in one or two cases accounted for 100% of a student's grade! Given that students' approach their learning according to how they will be assessed (Ramsden, 1992), it is important that teachers and students become aware of the different disciplinary meanings given to these terms. Integrating this simple awareness into pedagogical practice may have a profound effect on student learning.

IMPLEMENTING THE REVISIONS

Each department had their own way of implementing the curriculum changes that were decided upon. Most of them passed motions at the department level and created tools and procedures to help faculty integrate these changes into their practice. The Psychology Department created a bank of short-answer questions while the English Department created a literature committee that verifies the congruence of course outlines with departmental assessment policies before they go to print. These accountability mechanisms were created internally to maintain the collegial responsibility that department members have to respect and activate the decisions of the department. The unique, spontaneous curriculum decisions made by each department and the methods used to activate and sustain those decisions are summarized in an *Issues and Resolution* table that appears at the end of seven of the eight disciplinary chapters.

Turning a *Curriculum Review Process* in a continuous *Curriculum Review Cycle* requires a collective effort, but the actual implementation of agreed upon changes depends on the individual commitment of each teacher to make the necessary changes in how they assess student learning. Involving the department coordinators and two subject-matter experts was intentional. One reason it was done was to create a sense of departmental ownership that would increase the chances of the agreed upon changes being implemented and sustained. It is the belief of the PAREA Research Team that the chances of this occurring have been increased because all decisions were evidence-based and informed by a process of collective critical reflection situated in each department's cultural, political and moral context.

CHAPTER 4

CONCLUSION

NOTE TO THE READER

It is unusual to place the concluding chapter at this point in a report. However, in this report there are eight different sets of results, each set corresponding to a department that participated. These single case studies are meant to stand alone and can be read as separate reports. Conclusions that are relevant to a particular department appear at the end of their chapter as a “Reflection.” The conclusions that are presented in this chapter relate to the study as a whole.

As eight academic departments moved through a process that was designed to help them determine the degree to which each individual section of a selected course was vertically aligned, and the degree to which multiple sections of the same course were horizontally aligned, the principal researchers observed their interactions, procedures and attitudes toward the process. These observations allowed the research team to distinguish between conditions and procedures that permitted alignment to be achieved and circumstances that thwarted an authentic curriculum review process to take place. These “lessons learned” serve as guiding principles that underlie the *Curriculum Review Process* that emerged.

REDEFINING CURRICULUM COHERENCE

When this research project was first conceived, we defined curriculum coherence or alignment as the degree to which the intended learning outcomes (instructional objectives), the instructional processes (learning activities) and the assessments (formative and summative evaluations of student learning) were connected. At the course level this means that the instructional objectives, the learning activities and the assessments used to measure the achievement of the intended learning outcomes are intricately related and connected to each other. At the departmental level, this means that in courses with multiple sections there is a common understanding of what the instructional objectives mean and how the achievement of those objectives should be measured. We also hypothesized that the variance of student grades across multiple sections of a single course would decrease, resulting in a more even distribution. In effect, one would see more B’s and C’s and fewer A’s and D’s. Consequently, pass rates would increase.

As the study progressed we realized that this traditional, concrete definition describes coherence as an objective outcome and does not account for the complex factors and conditions that must be in place for curriculum coherence to be achieved. In addition, it places the achievement of coherence as the primary goal as opposed to stressing the strategies and conditions under which it might be achieved.

Today we would describe curriculum coherence as a socially constructed phenomenon that can accommodate the never-ending tensions between the individual and the group, between freedom and control, between independence and interdependence. It is a dynamic process which involves all faculty members of a department working together to craft or continually negotiate the fit between external demands, particularly government directives, and their own individual and collective instructional goals and strategies. Today we would emphasize the importance of the process itself, how the process can lead to a fundamental paradigm shift where the members of an academic department seek to collaborate and create an environment that strengthens the opportunities for all students to learn.

The contribution of this research is that it identifies key dimensions of curriculum coherence, presents a model which outlines steps, strategies and activities that an alignment process might include, and describes conditions that will encourage the process to succeed. Steps in this process include (a) providing a need for engaging in the process, (b) reaffirming instructional goals, (c) establishing a common assessment vocabulary, (d) establishing a common vocabulary that transforms assessment tasks into kinds of knowledge and levels of cognitive complexity, (e) using that common vocabulary to steer curriculum decision making, (f) implementing the revisions, and (g) creating an accountability structure to ensure sustainability. Conditions that foster the achievement of coherence include (a) awakening a sense of moral purpose, (b) creating a sense of ownership in all participants, (c) involving faculty in the decision making process, (d) getting faculty to interact with each other regarding curriculum issues, (e) creating collective decision making structures, (e) making evidence-based curriculum decisions, (f) providing strong leadership, and (g) establishing a culture of collective responsibility toward our students and collegial accountability towards each other. Creating and sustaining a coherent curriculum is an ongoing, iterative process. When it is successful it strengthens students' opportunities to learn and increases job satisfaction for the teachers who create and sustain it.

AWAKENING A COLLECTIVE SENSE OF MORAL PURPOSE

Most teachers have a sense of moral purpose, which Fullan defines as acting with the intention of making a positive difference in society as a whole (2001). Teachers believe that their actions are improving the life of their students. When an examination of student results suggests the existence of pedagogical inequity and unfair assessment, it is difficult to ignore. In many ways the data provided evidence that something was off balance. It mobilized in most departments a sense of moral purpose which translated into a willingness to become involved in the curriculum alignment process.

In the years preceding this research project, departments that exhibited large differences in student outcomes between multiple sections of the same course were encouraged to examine the coherence within their curriculum. Several of these departments, notably English & Psychology, began to examine their assessments and began to adjust how student learning was evaluated. However, complete alignment was not achieved at that time because a documented process for achieving coherence did not exist (Honig, 2004; Fullan, 1999). It was clear, however, that an awareness of the problem needed to occur before changes to the curriculum and the assessments used to measure the achievement of it would be considered.

The building of this awareness began with the sharing of student results across the multiple sections of each course under study. Up until recently, this information was given to department chairpersons but seldom shared with all department members. Examining the variance that often exists across multiple sections of the same course was surprising and often demoralizing. It called into question the integrity and fairness of assessment practices and awakened in most teachers a desire to understand the origins of these differences. A common belief that high failure rates in certain sections were caused by fatefully having a class composed of academically weak students was repeatedly refuted by examining the high school incoming averages of the students in each section and the results they achieved on the common essay which each student writes at the end of the first English course (this practice is unique to Champlain St-Lambert's English department). Once it was established that the level of academic preparedness and general ability across these sections was homogeneous, the differences in student achievement across the sections elicited the need for further study leading to an explanation. Clearly, the process of change is prompted when the teachers involved in making the changes perceive that the change is necessary.

DIFFERENT DISCIPLINES - DIFFERENT PATHS

A shared awareness of the problem and willingness to collectively address it is ideally joined with strategies for realizing it. However, as previously stated a documented process for achieving coherence did not exist. In addition, the PAREA Research Team believed that dictating a specific route to take was premature and might reduce the sense of ownership over the process needed to sustain interest and commitment. Although specific starting steps were outlined in the training sessions given to the SMEs (coders), each department was encouraged to forge its own path. This was done intentionally in recognition of the unique culture inherent in each discipline (Donald, 2002; Geoffroy, 2001; Klein, 1990). In the end our evidence-based instincts were supported by the process we initiated and witnessed. A strong disciplinary identity or cultural community became evident in each department. For most it was a renewal, for others, it served as an important first step in the formation of a community of practice, that is, a learning community that shared a vision, values and goals (Wenger, 1998).

In each participating department there was agreement that an analysis of current practice was warranted and that something had to be done to ensure pedagogical equity and fairness. The analysis within each department, however, took different paths with each department focusing on aspects of the data that was most meaningful to them. Therefore, it can be said that each department approached the problem in their own way. What the departments had in common was a desire to understand the impact of current assessment practices on students' overall results and in what students were learning. To achieve this understanding, all members agreed to submit their course materials for analysis, and to put forward two department members to carry out the analysis and to consider their findings. From this point onward, however, each department approached the analysis and dealt with the results in their own unique way. Some departments focused on topics, others on levels of cognitive complexity, all departments clarified their objectives. The steps taken were different but the goals of the process were the same and the elements of the process, that is, data analysis, discussion, decision-making, compromise and consensus were common in departments where authentic change occurred. The unique disciplinary processes that were followed and the conclusions that were reached by each department are described in chapters five through twelve.

COMMUNITIES OF PRACTICE

A shared awareness of the problem and willingness to collectively address it transformed departments, where authentic change occurred, into a community of practice with a shared sense of purpose, a common vocabulary and a unique disciplinary framework for analysis. The project was intentionally designed to utilize each participating department's collectivity and called upon them to respond to actual data regarding their current assessment practices. It helped them question their assumptions about the role of assessment in student learning while simultaneously providing the tools needed to make decisions about what needed to be changed. At every stage of the process the decision about what to do next rested within each department's community of practice. They were called upon to decide whether or not they wanted to participate, who would represent them as subject-matter experts (SMEs), what taxonomy would be used to analyze their data, what collective interpretation would be given to their results and what changes, if any, were required to increase coherence in their courses. Their decisions were informed by their own critical reflection situated in each department's cultural, political and moral context. The process was distributed and democratic. It stretched throughout each participating department giving its members information about their practice and the opportunity to critically reflect on those findings in a democratic way. The use of student results coupled with an in-depth analysis of the assessments used to determine those grades allowed pedagogical decisions that emerged from those discussions to be evidence-based, not based on unsupported assumptions. The findings clearly touched a collective conscience while the process itself provided tools and methods to restructure the curriculum and measure student learning in a fair, constructive, meaningful way.

SHARED LEARNING RESULTS IN CHANGE

One thing that became evident early in the research project is the enormous amount of time that the process requires. Permanent, transformational change clearly takes time and commitment. One reason for this is the initial start-up time demands of any central change in an organization's way of operating. The learning process began with the coders who had to experiment with taxonomies and develop a language that not only defined the tasks used in their department to assess learning but described them in terms of the knowledge and thinking skills each task demanded. This new vocabulary provided the construct on which the assessment items could then be analyzed. When it was time for the department to consider the results, they too, had to come to a shared understanding of what the terminology meant. Through this analysis, the teachers in the department began to make sense of the relationships among the curriculum, instruction and assessments, described by Pellegrino as sensemaking (2006).

In addition, departments needed several weeks to understand, analyze and interpret their results. In fact, we found that the teachers of a department needed to be exposed to the data generated by the curriculum review process several times before they could actually begin using the results to develop a curriculum revision. In addition, once the kinds of knowledge and level of cognitive complexity appropriate for a given course were determined, a shared commitment to these decisions had to be established. Fortunately, the process itself contributed to the development of that shared commitment. It was also found that most departments need at least one semester to prepare to activate the changes agreed to across multiple sections of the same course. However, most teachers are willing to embrace a new way of operating once it is demonstrated to be effective.

An additional finding was that the discipline specific approach resulted in a re-usable framework. The shared vision of the nature of the tasks within a discipline became transferable to other courses within the same discipline. The act of looking at a discipline in this way gave each department a transferable framework for analysis. Therefore, initial investment of time spent creating procedures for analyzing the first course, can be transferred and used to analyze the department's other courses.

TURNING TOP - DOWN DIRECTIVES INTO BOTTOM - UP MOTIVATION

Achieving an aligned curriculum demands the participation, collaboration and cooperation of every member in the department. This way of operating is not the norm in most colleges. The chance of achieving this transformational change in the way of doing business will only occur if the teachers involved have a sense of ownership over the process and procedures that are followed, and the decisions that are made. This sense of ownership increases the chances for successful implementation and sustainability.

It follows then that curriculum coherence cannot be mandated; college policies and procedures, working alone, will not yield the desired results. The evidence provided in the first step of the process initiated in many individual teachers an internal commitment to grapple with the problem. This individual commitment soon evolved into a collective mobilization where teachers, together, directed the process. This bottom-up approach allowed for buy-in and commitment to what was ultimately created. It gave the teachers an authentic sense of ownership increasing the chances for successful implementation and sustainability.

If college policies on student evaluation are combined with a collective understanding about what curriculum coherence is, why it is important and what it takes to create and sustain it, then colleges' *Institutional Policies on the Evaluation of Student Achievement (*IPESA), which have recently been renewed across the college system in Quebec, will have a greater chance of being supported and incorporated into classroom practice.

THE COMPLEXITIES OF LEADERSHIP

The difficulty of transforming government directives into important educational goals within a department and getting faculty to acknowledge them in what they teach, how they teach and how they measure student learning, while maintaining a high level of faculty autonomy is not to be underestimated. Such coordination requires enormous amounts of educational insight, negotiating skill and good will. In the areas where we saw the most improvement, the leadership of the department coordinator/s played a major role in helping department members embrace their collegial power and make decisions about their curriculum, holding each other accountable in terms of making necessary course adjustments in order to activate what had been democratically decided upon. Together with the support of their SME's (coders) they scheduled department meetings to discuss the results of the analysis, put motions forward for debate, and supported changes that were made to assessment policies and practice.

At the same time the college administration assumed a complex leadership position that was simultaneously authoritative, affiliative and democratic. These three effective leadership styles mobilize people toward a vision, build emotional bonds along the way and forge consensus through participation (Goleman, 2000). Within this project this meant helping the faculty grapple with a problem that has never been solved before, asking faculty how they felt the problem should be solved and encouraging everyone to combine their efforts and put the students first. They demonstrated their support by taking part in our initial planning meetings, by encouraging departmental participation and praising, often from afar, departments that chose to become involved with this curriculum alignment initiative. This allowed the need for change to emerge from the bottom-up, despite the government directives that propelled it at first. Although the administration was legitimately

CHAPTER 5
ENGLISH

CONTENTS

Aligning the curriculum within and between sections of the same course has been a long-standing tradition in Champlain St-Lambert's English Department. This department is well known for its 101 Common Final Essay, an assessment task worth 30% that is completed by all students at the end of their first semester. All students regardless of whether they have been placed in *Introduction to Literature* (101A) or *Introduction to Literature and Composition* (101B) write this essay which is marked "blind" by two members of the department to establish inter-rater reliability. If these two readers do not agree within 3% of each other, it is read and evaluated by a third member of the department. Working toward this common goal combined with a rigorous process for grading it, ensures equity between sections and an equal opportunity for all students to achieve the desired learning outcome - an ability to write a well-organized, 750 word literary analysis. This practice was established by the department in 1996. It was a natural evolution, therefore, for this department to become one of our four lead departments in the fall of 2003.

Given that the department was content with the status of the 101 curriculum, a decision was made to focus on Genre (102) & Theme (103) courses. Although these courses had been redesigned during the reforms of the 1990s and reexamined during the CORE Evaluation process when new guidelines were stipulated (Supporting Document A), this research project gave the department the opportunity to fulfill its own recommendation that they "continue to examine genre and theme courses to determine whether the student workload is equitable" in a scientific way (CORE Evaluation, 1997, p. 98).

THE RESEARCH PROCESS

Sixteen teachers, representing 21 sections in the department, submitted their course objectives and all assignments and/or tests that contributed to the students' overall grades for the genre and/or theme courses that they taught in the fall of 2003. One member of the department chose not to participate. The sample consisted of twelve theme courses (103) and nine genre courses (102). See table 2.1 in chapter two.

The two elected SMEs (subject-matter experts or coders) decided to use the revised version of Bloom's taxonomy for different *kinds of knowledge* (Krathwohl, 2002), but kept the terms – comprehension and synthesize - from Bloom's original taxonomy and added 'create' from the revised taxonomy. Therefore the levels of cognitive complexity used in the coding of assessment tasks for the English department included: remember, comprehension, apply, analyze, synthesize, evaluate (Bloom, et al., 1956) and create (Krathwohl, 2002). Their decision was based on a shared belief that the words - *comprehension* and *synthesize* - more closely describe the cognitive processes that are focused on in English, as opposed to the revised taxonomy's terms for these categories: *understand* and *create.* The coding team also found it necessary to create a scale for level of difficulty and apply it to all items.

The 2004 fall semester was spent coding English 102 and entering the data. English 103 was coded and entered during the winter of 2005. Although the results were analyzed at the end of the winter 2005 semester, it was decided to present these results to the department in the fall semester of 2005. Given that the majority of literature courses are offered at Champlain St-Lambert Cégep in the winter semester, the department had a semester to analyze the results and help faculty members make necessary changes before the courses were offered again.

On August 18th, 2005, the coders shared the results of the fall 2003 analysis with the department. Preparation for this meeting had begun during the previous term and continued into the summer. An initial meeting with the coders and the research team was held to analyze the results and to discuss how the results would be presented to the department. It is important that the tone of the departmental meeting be one of consultation and empowerment as opposed to directed discussion by the PAREA researchers. Therefore, the observations of the coders were presented strictly as observations, and the department was asked if they agreed with the areas of concern their SMEs had identified. It was also decided that each teacher would receive an individual analysis of their own section/s. This allowed them to reflect on their own results privately and compare them with the results of the department as a whole. In this way, each teacher was given feedback, but the anonymity of all department members was respected. An example of an individual report appears at the end of this chapter (Supporting Document B).

ANALYSIS OF ASSESSMENT TASKS - GENRE - FALL 2003

Results for the genre and theme courses taught in the Fall 2003 semester are analyzed separately and appear on pages 58 to 67 for the genre courses, and pages 68 to 21 for the theme courses. For genre courses, 12 teachers participated and 143 items were coded; for theme courses, 9 teachers participated and 142 items were coded. Each assessment item is analyzed according to its type and format of task, type of knowledge required, level of cognitive complexity, the main instructional objective that it measures and its contribution to the student's overall grade.

Comparison of type of tasks & format of tasks used in Genre 102 sections

There are fourteen types of tasks and seventeen different formats of tasks being used in genre courses. The department was pleased with the variety of assessment tasks being used and the emphasis on complex writing tasks.

Figure 5.1

MEAN GRADE ALLOCATED TO TYPE OF TASK

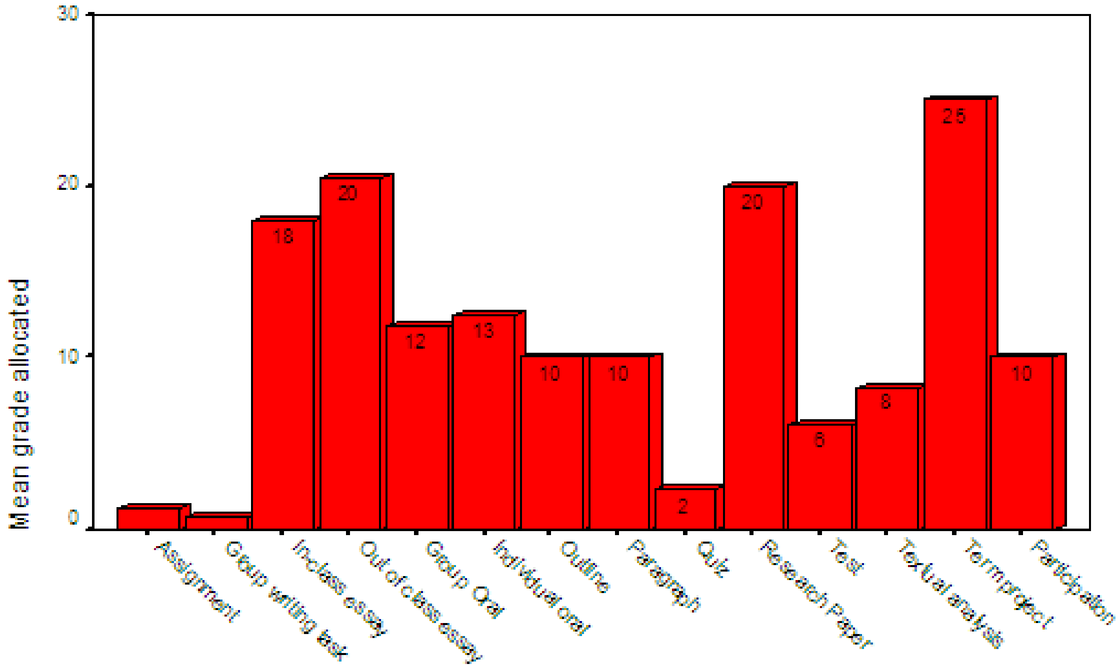
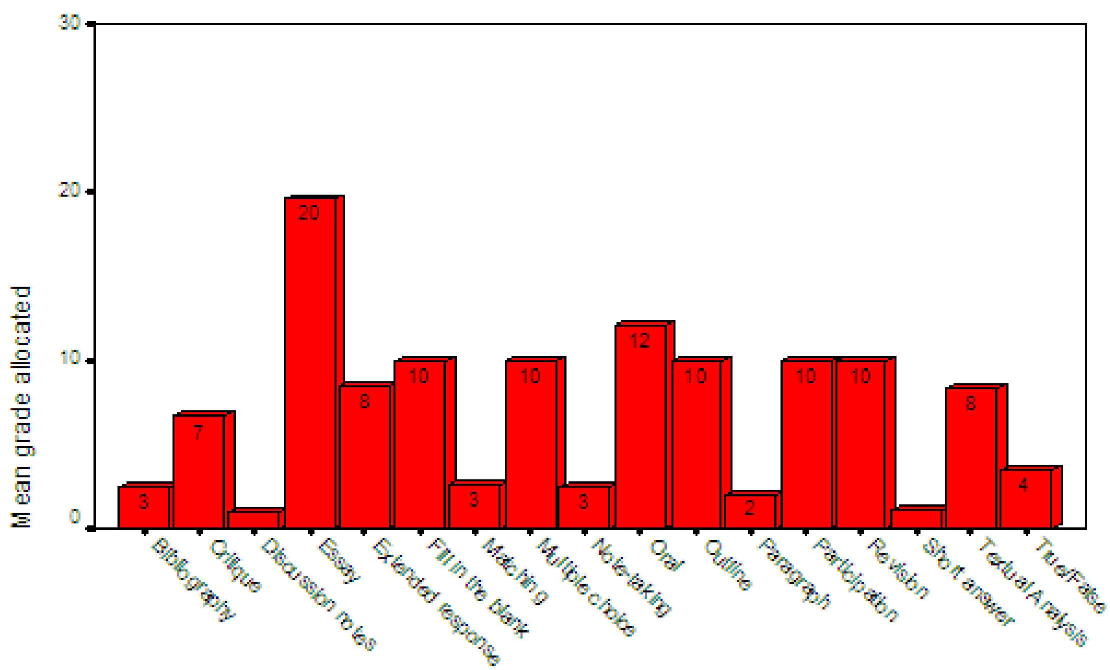


Figure 5.2

MEAN GRADE ALLOCATED TO FORMAT OF TASK

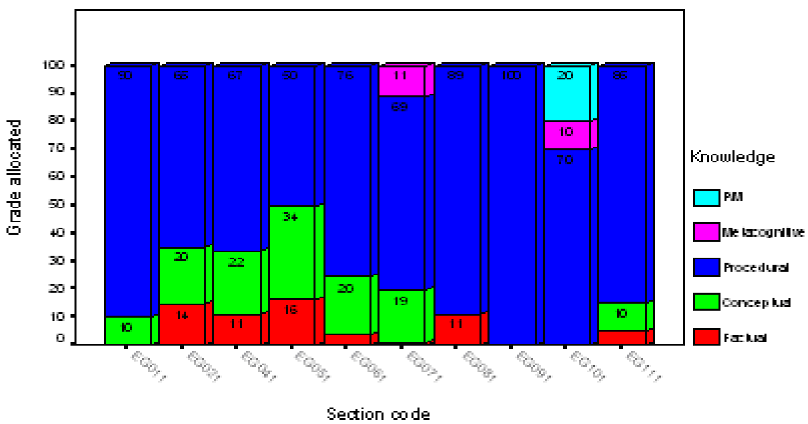


Comparison of the types of knowledge required by different teachers

Figure 5.3 indicates that genre courses focus primarily on procedural knowledge (66%-100%). This result stems from the fact that the coders decided to classify essay writing as procedural knowledge. Students are taught “how to” construct a logical, supported, analytical paper in all literature courses. In this research project, the designation of essay writing as procedural knowledge is unique to the English department.

Figure 5.3

TYPE OF KNOWLEDGE BY MARKS ALLOCATED



Comparison of the levels of cognitive complexity required by different teachers

Although the department was pleased with the emphasis on analytical thinking in the genre courses that is shown in the next two tables, sections EG071, EG081 and EG101 appear to be requiring performance at higher levels of thinking when compared to the other sections. To explore this more thoroughly, the SMEs created and applied a second level of analysis, classifying each item as easy, standard or challenging. “Easy” items have information that is not complex or implied and require the use of simple cognitive processes such as remember and understand. “Standard” items require the ability to apply and analyze information. “Challenging” items involve a degree of complexity, of logical relationship, of inference or subtle implication. They require more complex thinking the ability to analyze, evaluate, synthesize and/or create.

The results of the second level of analysis confirm the first conclusion for sections EG071 and EG101, but indicate that section EG081 is operating at a standard level. In contrast, sections EG091 and EG111 do not appear to be unfairly difficult in terms of cognitive complexity, but when each assessment item was ranked according to its level of difficulty, 33% of the items in EG091 and 70% in EG111 demanded analytical thinking at a challenging level (Figure 5.4).

Figure 5.4

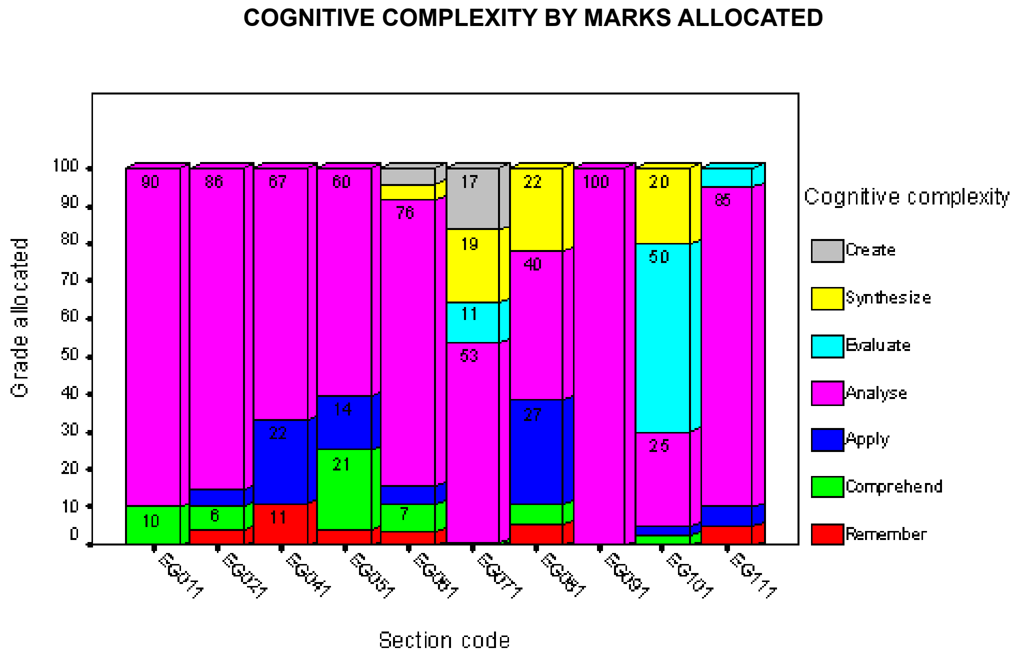
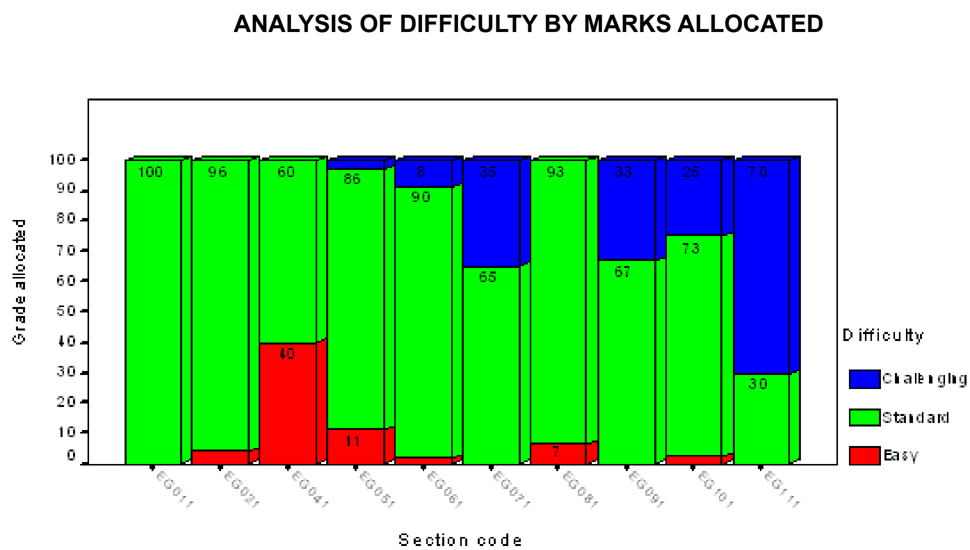


Figure 5.5

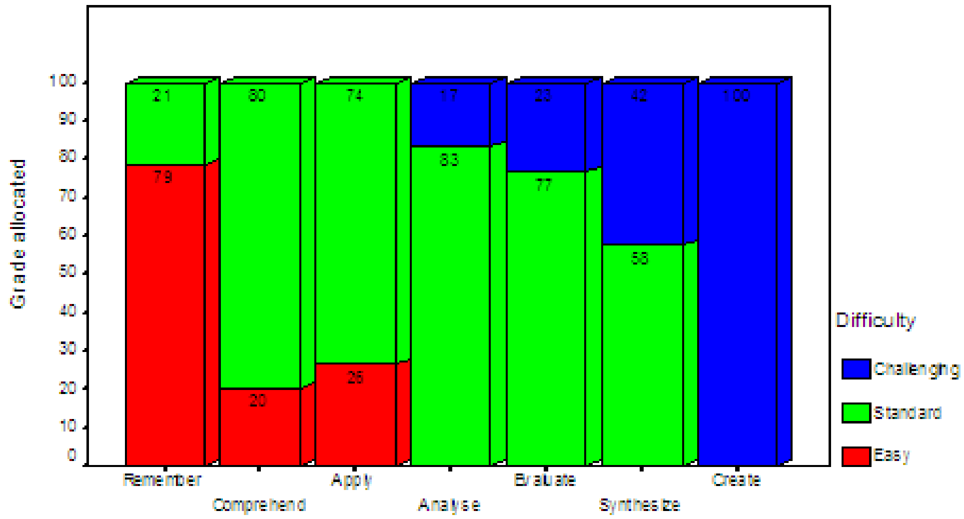


Analysis of difficulty and cognitive complexity

A conclusion of this analysis is that assessment tasks can demand different types of thinking at easy, standard and/or challenging levels. However, challenging tasks were primarily found at the analysis, evaluate and synthesis levels of thinking. All items classified at the highest level of Bloom's revised taxonomy - create - were also deemed to be challenging. It follows then, that determining the level of cognitive complexity is not sufficient in terms of studying the intellectual demand a course may be making on the learner. It is important that a discipline determine what an easy, standard or challenging task consists of, especially when designing tasks that demand higher levels of thinking.

Figure 5.6

THE RELATIONSHIP BETWEEN LEVEL OF DIFFICULTY AND COGNITIVE COMPLEXITY - GENRE

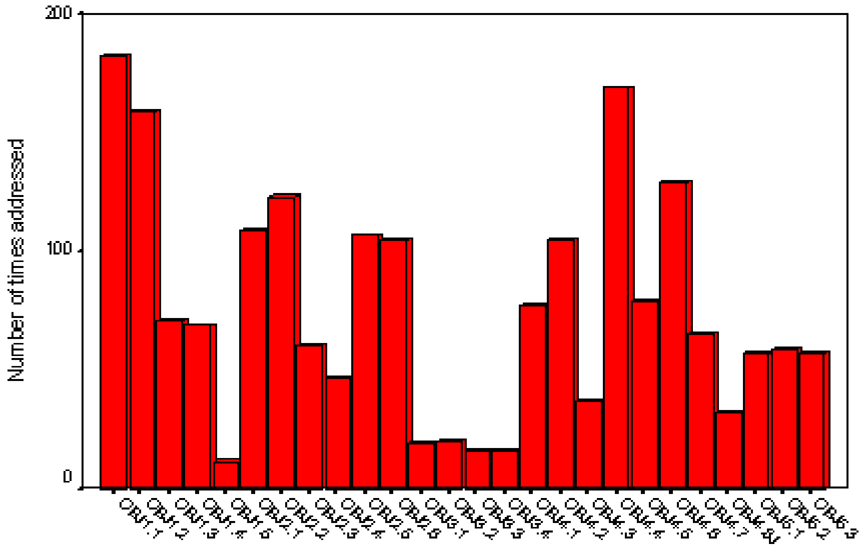


Analysis of objectives measured – genre courses – all sections combined

An assumption made in this research is that if student achievement of a particular objective is measured, one can assume that it has been addressed in the course. If it is not measured, one cannot make this assumption. A list of the instructional objectives for both genre and theme courses can be found in Supporting Document C. The following bar chart represents the extent to which each objective is being measured by the department when all genre sections are combined.

Figure 5.7

OBJECTIVES MEASURED – ALL GENRE COURSES COMBINED



An examination across sections indicates that some sections are not measuring all of the objectives. At its extreme, some sections barely measured half. Aesthetic objectives (3.1 - 3.4) were rarely measured in any section. Many sections did not include an oral component (5.1 - 5.3) despite the fact that this goal was mandated by the department during the CORE Evaluation process. To illustrate the variation across sections in terms of the objectives that are being measured, two sample sections are presented on the next page. These results concerned the department and initiated a lengthy discussion which focused on three questions raised by the coders:

(1) Are the objectives that are not being measured difficult to teach or difficult to measure?

(2) Are the objectives that are not being measured valued by the department?

(3) Should objectives not being measured be removed from the course objectives?

Figure 5.8

OBJECTIVES MEASURED – SECTION X

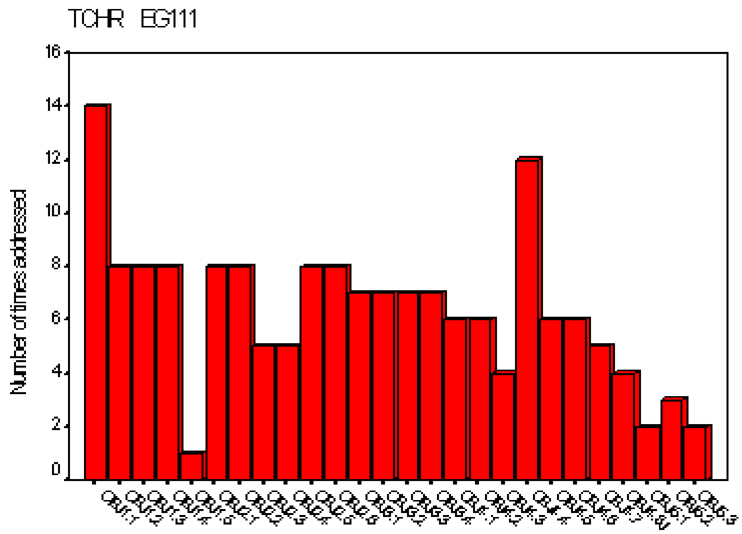
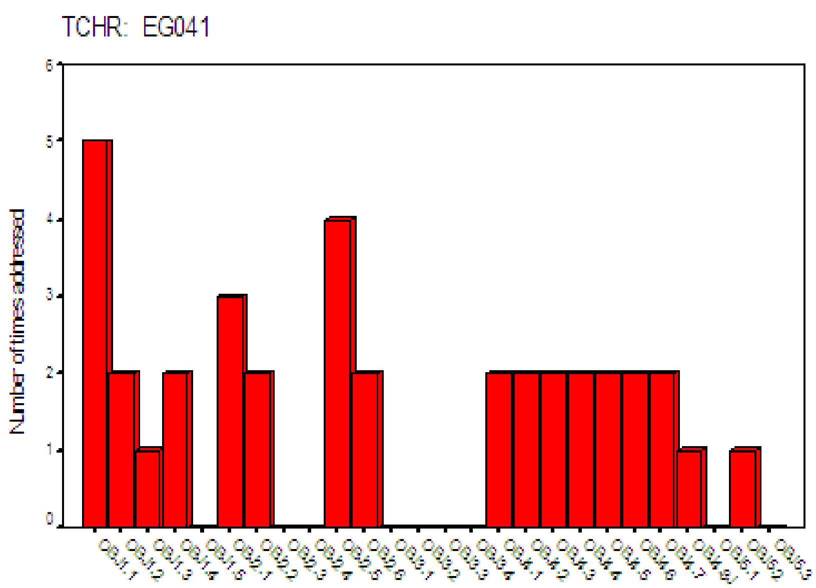


Figure 5.9

OBJECTIVES MEASURED – SECTION Y



Student Results

An essential step in the curriculum alignment process is to compare the distribution of students' incoming high school overall averages with the students' grades in each genre section. This step may begin and/or conclude the curriculum alignment process. Figure 5.10 illustrates the distribution of high school incoming averages for students taking English 102 (Genre) in the fall semester of 2003. For most sections, the median fell between 70% and 80%. Sections EG101, EG111 and EG112 are advanced classes. Figure 5.11 displays the distribution of the grades received in across sections. There is considerable variation in the high and low averages across the sections of the course as taught by the twelve teachers, but the pattern of student results closely resembles the pattern across sections of their incoming high school grades. In most sections, the median and middle quartiles remain in the same relative position. EG021 and EG091 are exceptions where 25% of the students failed.

Figure 5.10

HIGH SCHOOL INCOMING AVERAGES

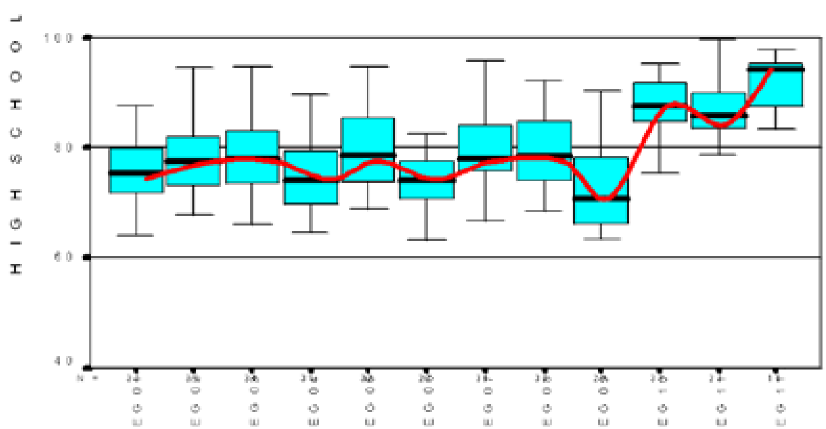
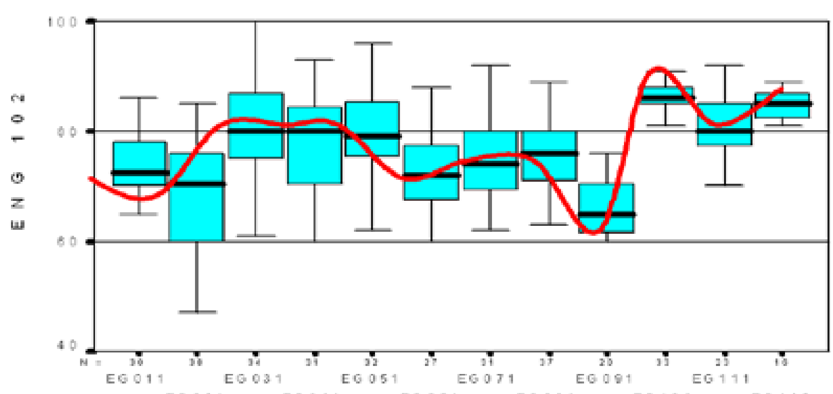


Figure 5.11

STUDENT RESULTS – GENRE – FALL 2003

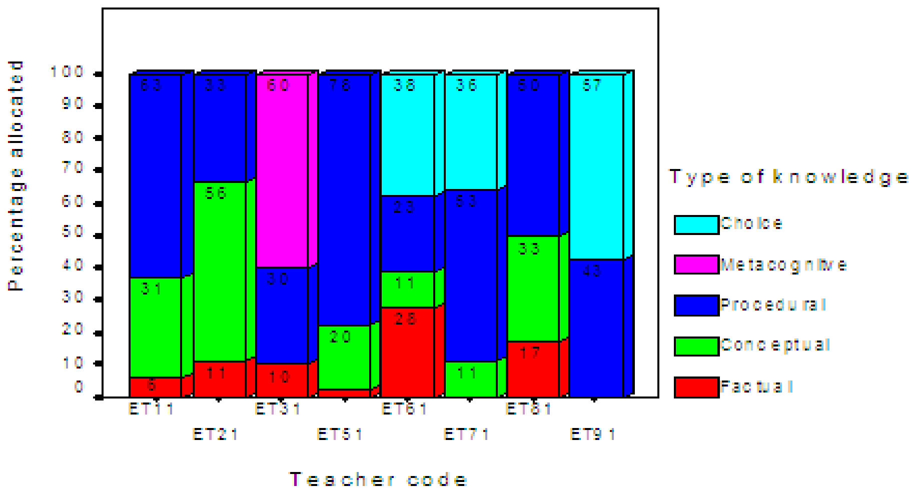


Comparison of the types of knowledge required by different teachers

The range in grades awarded for essay writing resulted in a corresponding range in the types of knowledge being focused on by the teachers of theme courses. Grades awarded for procedural knowledge ranged from 33% to 78%; while grades for conceptual knowledge ranged from 11% to 56%. A situation that clouded these results occurred when teachers offered students choices in terms of the assessment tasks they would complete. The choices often demanded different types of knowledge, a finding that is discussed more fully below.

Figure 5.14

TYPE OF KNOWLEDGE BY MARKS ALLOCATED



Comparison of the levels of cognitive complexity required by different teachers

There is an overall emphasis on analytical thinking which one would expect in a second year literature course; however, there is a variance across sections regarding the level of cognitive complexity each teacher demanded. ET21 awards 61% of the students' grades to tasks requiring application and only 33% of the students' grades' to tasks requiring analysis. ET71 awards 28% of the students to evaluation, a level of thinking which is usually reserved for more advanced courses. This result was confirmed when 71% of the assessments given by this teacher were deemed to be "challenging" (Figure 5.16). In addition, it was found that in cases where teachers offered essay "choices", which was the case in three theme courses, the choices were often at different levels of cognitive complexity (Figure 5.17). Three questions emerged during our analysis: (1) was the teacher aware of this, (2) were students made aware of this, and (3) how does having choices at different levels of cognitive complexity for the same assignment impact on student learning? Have all students had an equal opportunity to master the same intellectual abilities?

Figure 5.15

COGNITIVE COMPLEXITY BY MARKS ALLOCATED

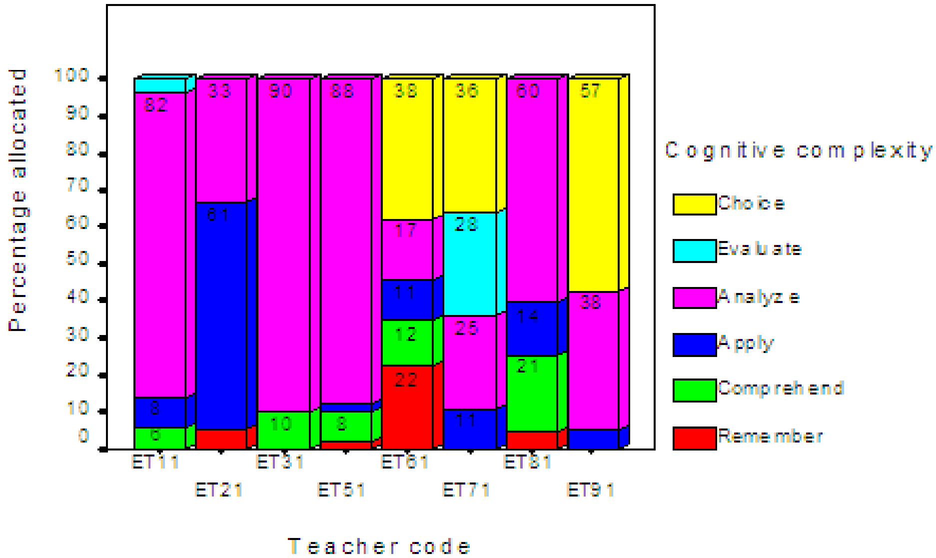


Figure 5.16

ANALYSIS OF DIFFICULTY BY MARKS ALLOCATED

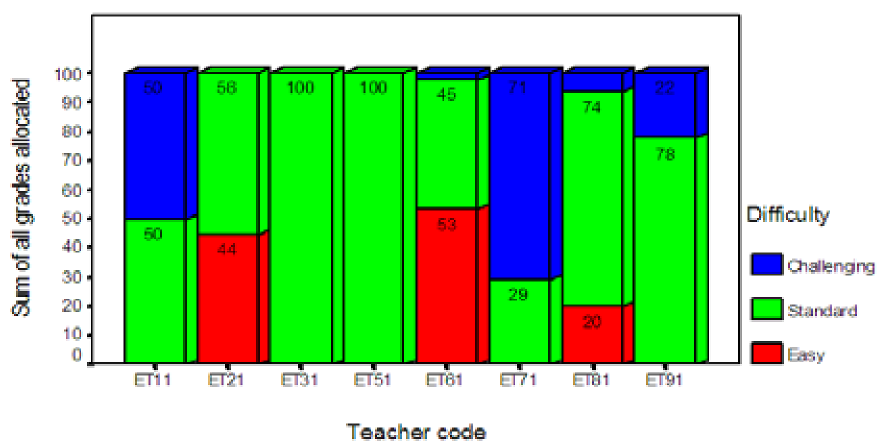
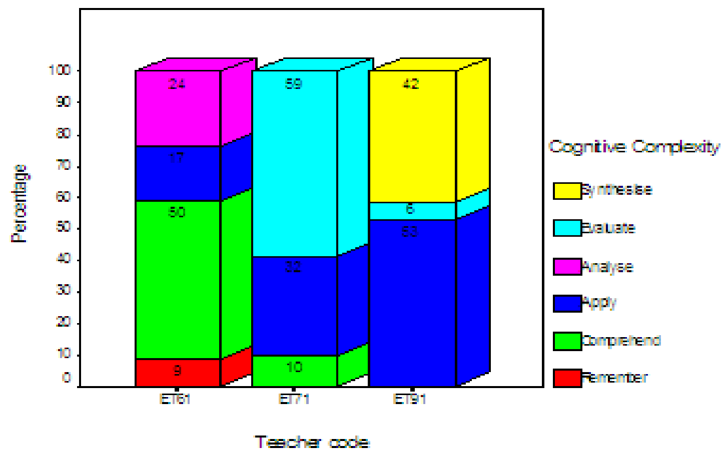


Figure 5.17

ANALYSIS OF CHOICE

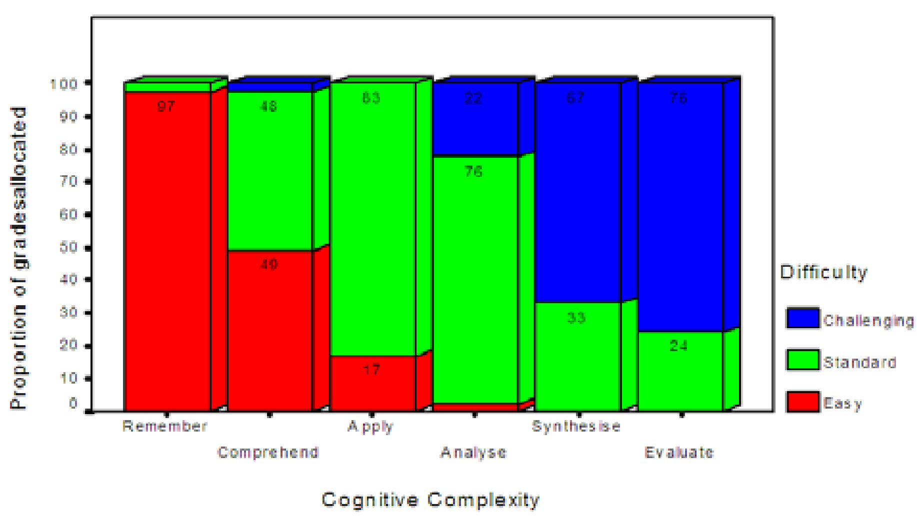


Analysis of difficulty by cognitive complexity

This analysis yielded the same results found in the genre courses. Challenging tasks were primarily found at higher levels of cognitive complexity: analysis, evaluate and synthesis.

Figure 5.18

THE RELATIONSHIP BETWEEN LEVEL OF DIFFICULTY AND COGNITIVE COMPLEXITY - THEME



Analysis of objectives measured - THEME - all sections combined

Similar to genre courses, an examination across sections indicates that the achievement of certain objectives is not being measured (Figure 5.19). Once again, only a few teachers measure aesthetic evaluation objectives (3.1 - 3.4), few measure whether students can monitor their comprehension and some teachers do not include an oral component (5.1 - 5.3). Figures 5.20 and 5.21 provide examples of the objectives measured in two different sections to illustrate the variance across sections in terms of measuring the objectives.

Figure 5.19

OBJECTIVES MEASURED - ALL THEME COURSES COMBINED

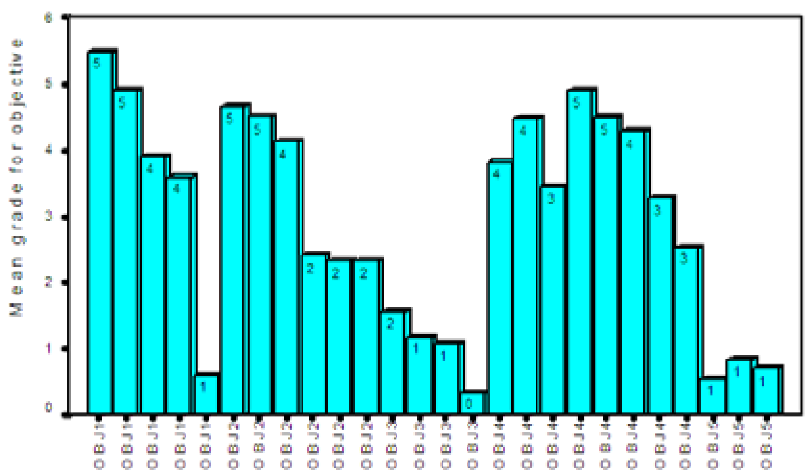


Figure 5.20

OBJECTIVES MEASURED - SECTION X

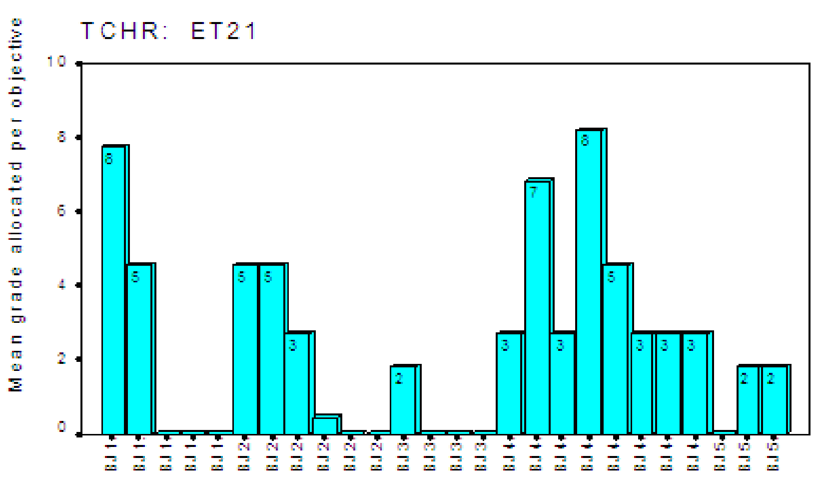
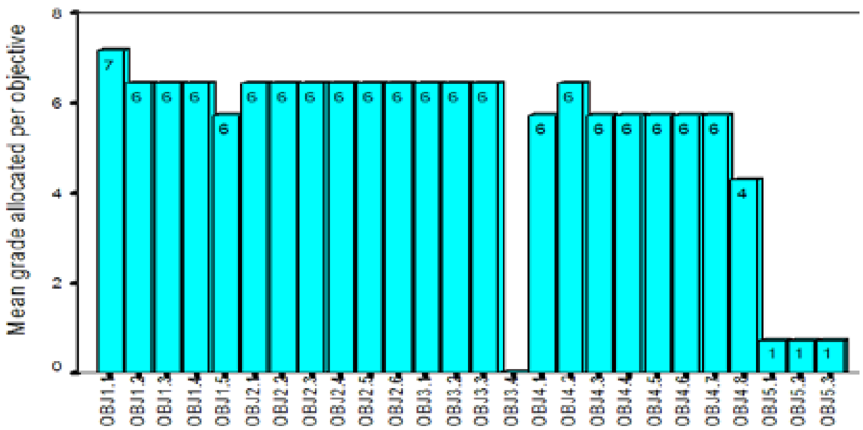


Figure 5.21

OBJECTIVES MEASURED - SECTION Y

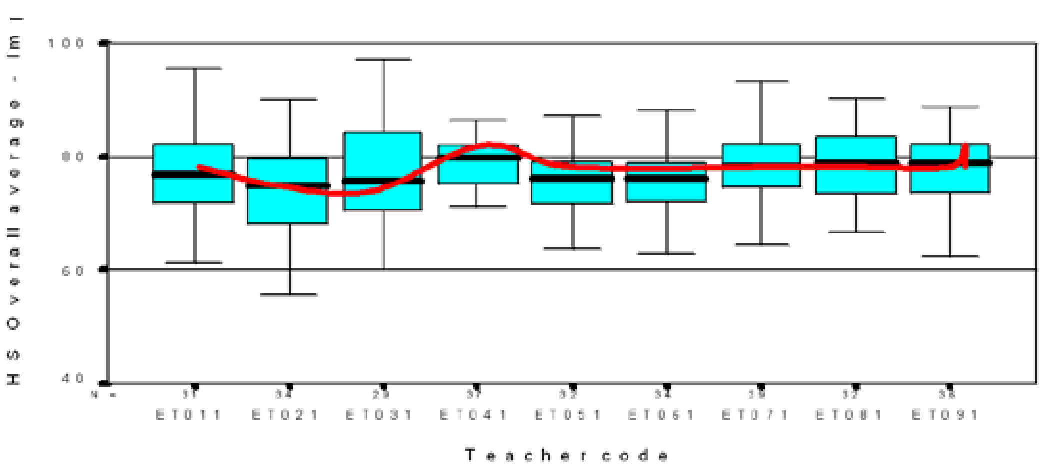


Student Results – Theme 103

The following graph illustrates the distribution of the students' high school averages when they entered college in the fall of 2003. Similar to the genre courses, there is considerable coherence between the average high school grades and the grades achieved in their theme course. This pattern of coherence is strongly maintained with all of the instructors of the theme courses except for instructors ET011, ET091 and ET031. In sections ET 011 and ET091 the variance between the students increased resulting in 25% of the students receiving grades below 60%. In contrast, the grades of the students who had ET031 decreased in variance. Incoming averages that ranged from 60% to 95% compare with grades that range from 65% to 85%.

Figure 5.22

HIGH SCHOOL INCOMING AVERAGES OF STUDENTS IN THEME COURSES - FALL 2003



ANALYSIS OF ASSESSMENT TASKS - THEME - FALL 2003

Comparison of type of tasks and format of tasks used in Theme 103 sections

The bar charts below indicate the types and formats of tasks being used by teachers of theme courses. One major concern was that grades awarded for literary essays, a main focus of the course, ranged from 30% to 80%.

Figure 5.12

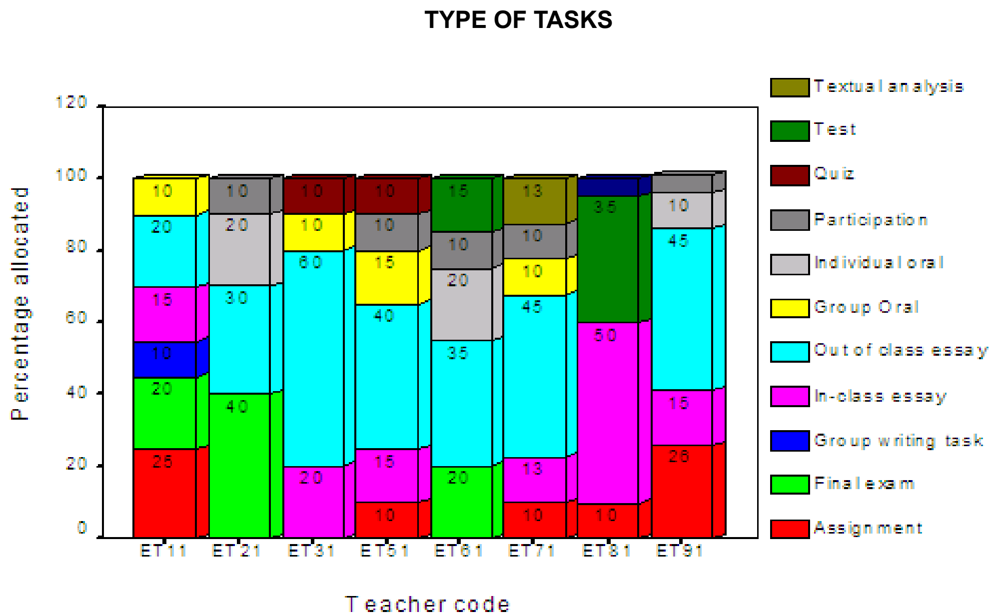


Figure 5.13

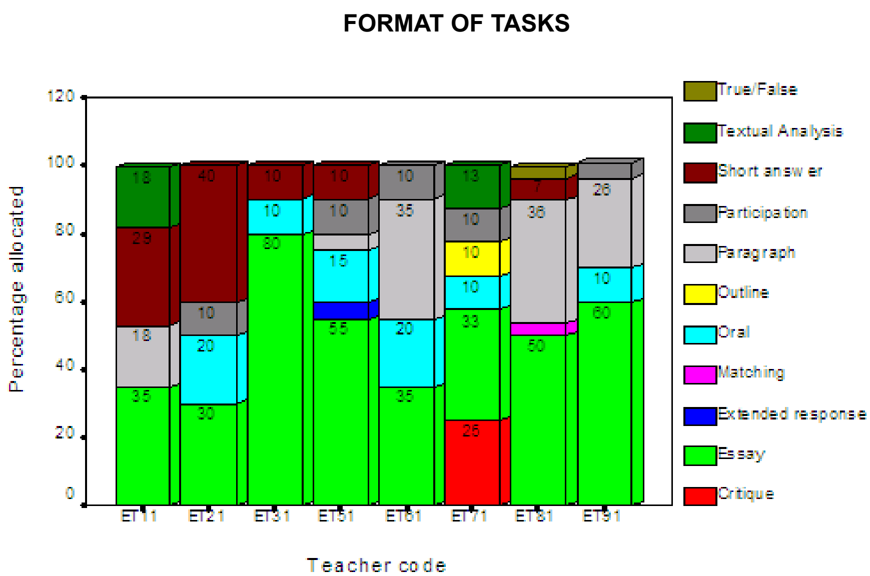
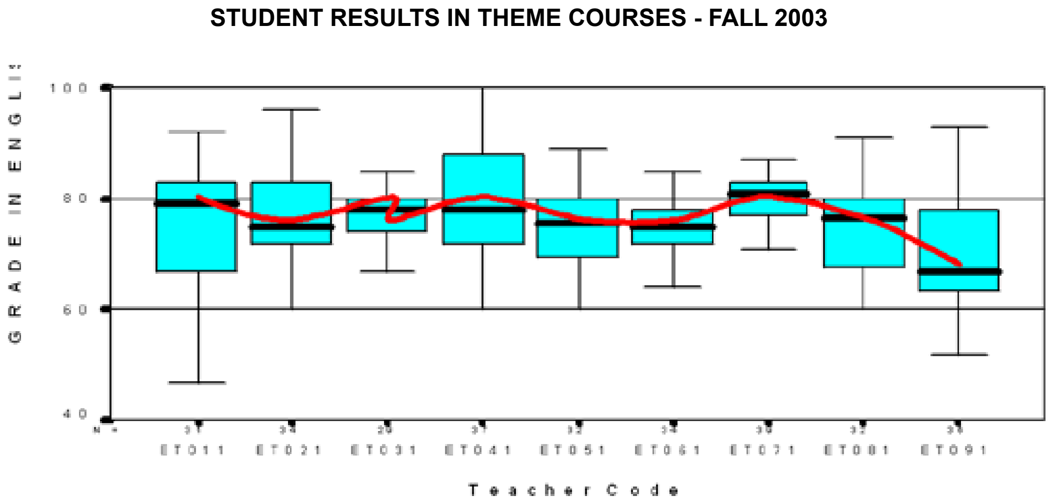


Figure 5.23



ISSUES AND RESOLUTIONS

The issues that emerged and the resolutions that were suggested were similar in the genre and theme courses; they are summarized together in Table 5.1. A new set of curriculum and assessment guidelines was formed (supporting Document F). In the next section of this chapter, the results of the re-assessment of the genre and theme courses are presented together, according to each element that was analyzed.

Table 5.1

ENGLISH GENRE AND THEME COURSES – FALL 2003 ISSUES AND RESOLUTIONS		
ISSUE	**DESCRIPTION OF THE PROBLEM**	**RESOLUTION**
• Measuring student achievement of instructional objectives.	• Some sections are not measuring student achievement in regards to all of the instructional objectives. In fact, some sections barely measure achievement of half of the objectives	• The relationship between instructional objectives and assessment was novel to some department members, especially newer department members. This issue was addressed at a workshop on coding questions and designing assessment tasks which was held on November 16th, 2005. In addition, the process followed and decisions made as a result of this project were shared with all new hires in Sept. 2006.
	• Objectives regarding aesthetic appreciation are rarely measured.	• Teachers are not obligated to measure the achievement of these objectives; however, they will remain on the course outline and have been reduced and modified.
	• Some people do not include an oral component in their curriculum. Including an oral component was mandated by the department during the CORE Evaluation (1997).	• The decision to mandate an oral component was reaffirmed. • Semi-formal or formal oral presentations can comprise 10-20% of the final mark.
	• Many teachers are using AV material. Should the objectives be adjusted to reflect this?	• No • Instructional strategies are the privy of each teacher. They are not part of the department's agreed upon instructional goals.
• Establishing equity in terms of what is demanded of students in each section by respecting departmental guidelines	• There are differences across sections in terms of the work demanded and the marks awarded for this work. For example, dept. guidelines state that the total value of essays should fall within the range of 40% - (no maximum). The range found was 30 - 80%.	New Guidelines were established: • Essays will comprise 40%-70% of the final mark • Students must write 2-3 essays, one of which must be 1000 words • Oral component is required; can be individual or group activity and comprise 10%-20% of the final mark • Participation, if used, must have criteria and can only count for 10%
• Grading for participation	• Everyone respects the 10% maximum value allowed for participation; however, few teachers actually provide criteria for students to understand how they can achieve a good grade.	• A motion was passed that clear criteria describing how participation will be graded must appear on the course outline in sections where participation counts towards the overall grade.

ENGLISH GENRE AND THEME COURSES – FALL 2003 ISSUES AND RESOLUTIONS		
ISSUE	**DESCRIPTION OF THE PROBLEM**	**RESOLUTION**
• Ensuring equity across sections in terms of difficulty and grading.	• There were discrepancies between the levels of course assessment demands and the grades assigned. For example, EG 91 was a weaker group compared to the others upon entry (see high school box plots), participated in a challenging course but everyone passed. EG21 was a strong group upon entry, participated in a standard course but 25% of the students failed.	• New guidelines were established and ratified (see above) • A system to monitor adherence to the guidelines in fair, collegial manner was designed. This collegial sharing of responsibility for ensuring the integrity of the literature curriculum is a 'first' in the history of the English Department at Champlain St-Lambert Cégep. See Supporting Document F for a brief description of the process that is now followed and the instrument that is used.
• Helping students make the transition from course to course easier by establishing a common assessment vocabulary and writing clear instructions for all assessment tasks.	• Teacher assignment descriptors ranged from very specific to ambiguous (to the point where the coders did not know what was expected). • As students move from section to section, it can become confusing for them adjusting to new terminologies and different degrees of clarity of the expectations.	• Writing clear questions and instructions was addressed in a workshop on November 16th, 2005. • Course committees have been established to oversee each course's curriculum and how each teacher proposes to measure the achievement of the course objectives.
• Distinguishing genre from theme courses. What are the differences between our theme and genre courses? Do we intend genre to be more challenging then theme?	• Genre courses involved higher level cognitive complexity tasks when compared to theme courses. Furthermore, a smaller range of tasks was observed in theme as opposed to genre. Less oral work was done in theme than genre.	• The department consensus was that there should not be a difference in the cognitive complexity and level of difficulty of the genre and theme courses. • Department guidelines regarding the type, number and value of assignments will hopefully solve this problem.
• Offering students choices in essay assignments	• In situations where teachers offer essay "choices," the choices often had different levels of cognitive complexity. • Was the teacher aware of this? Were the students made aware of this? What impact does this have on the fairness and equity of student learning?	• The workshop on coding questions raised awareness about this issue. • It was acknowledged that giving choices can increase student motivation and be beneficial provided the teacher designs the choices intentionally to be similar or different and knows why they are being designed a particular way.

RECODING OF GENRE AND THEME COURSES
REPEATING THE CURRICULUM REVIEW CYCLE

TYPE & FORMAT OF TASKS (BOTH COURSES)

The type and format of tasks found in the genre and theme courses that were offered in the winter of 2006 were similar to what was offered in the fall of 2003. This time it was even more important for teachers to see the relationship between what they were asking students to do and what was being asked of students in other sections. Therefore, the type and format of assessment tasks used in each section was analyzed and graphed for each teacher separately. Each teacher received a copy of everyone's results. This allowed them to determine whether they, individually, and the department, collectively, was operating within the departmental guidelines for coherence that were agreed upon in the fall of 2005 (Supporting Document F).

Genre Courses

Most teachers followed the guidelines agreed upon in the fall of 2005. All teachers assigned an oral in the genre courses, but for EG081, the oral was only worth 5%. Section EG051 allotted only 20% for essay writing and continued to use *Participation* for 10% without clearly stated criteria. Sections EG011, EG021, EG061 violated rule "D" of the guidelines which states that students must complete at least two different assignments from the suggested list of "other" assignments to be worth between 20% and 50% of the students' final mark.

Theme Courses

Most teachers followed the guidelines. All teachers assigned an oral in the theme courses within the correct range of grades. Section ET101 continued to use Participation without clear criteria and count it for 5%. Section ET041 only allotted 20% for essay writing and sections ET031, ET061 violated rule "D" of the guidelines, that is, that between 20% and 50% of the final mark be awarded for other types of assignments in the course. A copy of the final guidelines appears at the end of the chapter.

Figure 5.24

SAMPLE INDIVIDUAL TEACHER REPORT FOR TYPE OF TASK

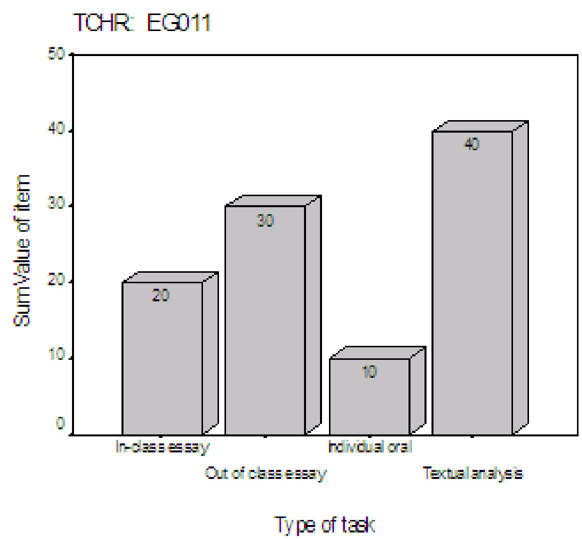
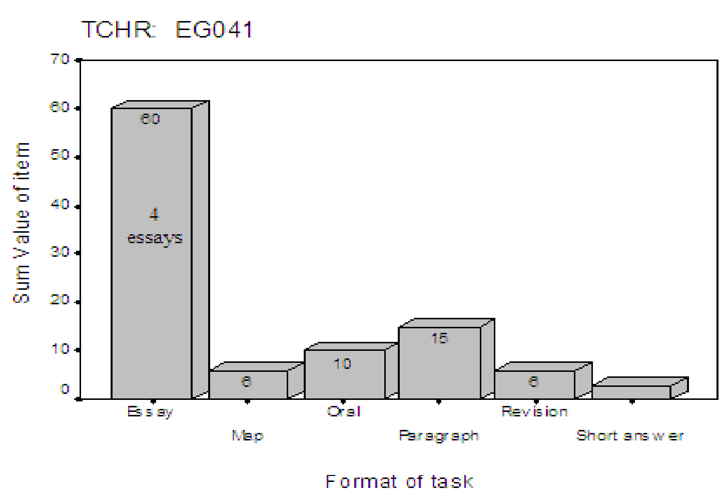


Figure 5.25

SAMPLE INDIVIDUAL TEACHER REPORT FOR FORMAT OF TASK



TYPE OF KNOWLEDGE (BOTH COURSES)

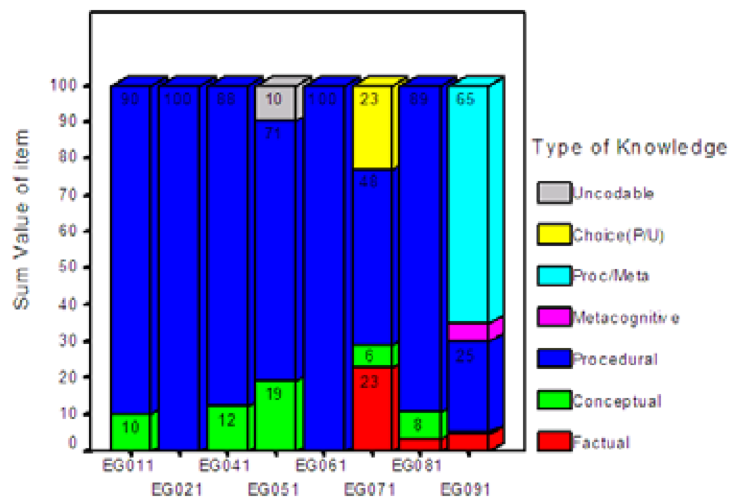
There was more coherence between the teachers of the genre and theme courses in 2006 when compared with the teachers in 2003 in terms of the type of knowledge being focused on in their courses. Clarified guidelines, with a re-emphasized focus on writing, most likely account for this result.

Genre

In 2003 genre courses, grades awarded for tasks requiring procedural knowledge across teachers ranged from 50% to 100%. This contrasts with grades awarded for tasks requiring procedural knowledge in 2006 ranging from 71% to 100%. The table below illustrates these results. EG071 and EG091 have assignments that were coded as both procedural/understand and procedural/metacognitive. For comparative purposes these assignments were collapsed into the procedural knowledge category.

Figure 5.26

TYPE OF KNOWLEDGE - GENRE – WINTER 2006

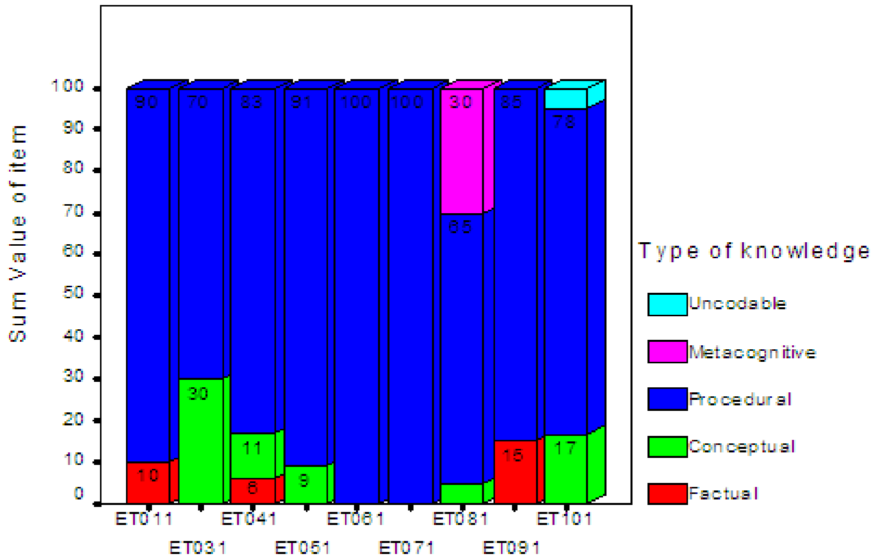


Theme

In 2003 theme courses, grades, across teachers, awarded for tasks requiring procedural knowledge ranged from 33% to 78%. This contrasts with grades awarded for tasks requiring procedural knowledge in 2006 ranging from 65% to 100%. One factor contributing to this increase in coherence was the resolution of how to give students a choice in an assignment and simultaneously ensure that each choice is at the same level of cognitive difficulty.

Figure 5.27

TYPE OF KNOWLEDGE – THEME - WINTER 2006



COGNITIVE COMPLEXITY (GENRE & THEME)

The degree of coherence between the teachers of the genre and theme courses in 2006 when compared with the teachers in 2003 in terms of the cognitive complexity remained the same. An interesting result of the new curriculum guidelines, however, was a greater emphasis on tasks that required students to synthesize their ideas. For example, although the main emphasis in 2003 genre courses was analysis, three teachers asked students to synthesize compared to six in 2006. In 2003 theme courses, synthesis tasks were not assigned by any teacher. In 2006 six teachers assigned synthesis tasks which contributed from 20% to 60% to the students' overall grades. This change may be a consequence of the clear guidelines put forward in 2005 regarding the level of writing which is required at this level. Requiring students to synthesize increased the intellectual challenge of these courses to an appropriate level of difficulty.

Finally, the 'choice' problem, which clouded the 2003 results, was resolved and did not appear in the 2006 results. Teachers who gave choices in their assessment tasks continued to do so, but they intentionally designed these tasks at a specific level of cognitive demand.

Figure 5.28

COGNITIVE COMPLEXITY - GENRE - WINTER 2006

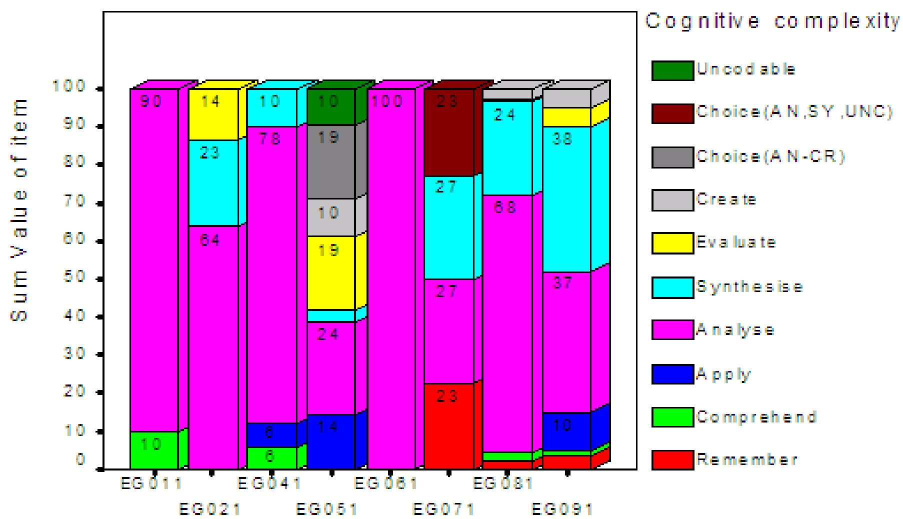


Figure 5.29

COGNITIVE COMPLEXITY – THEME - WINTER 2006

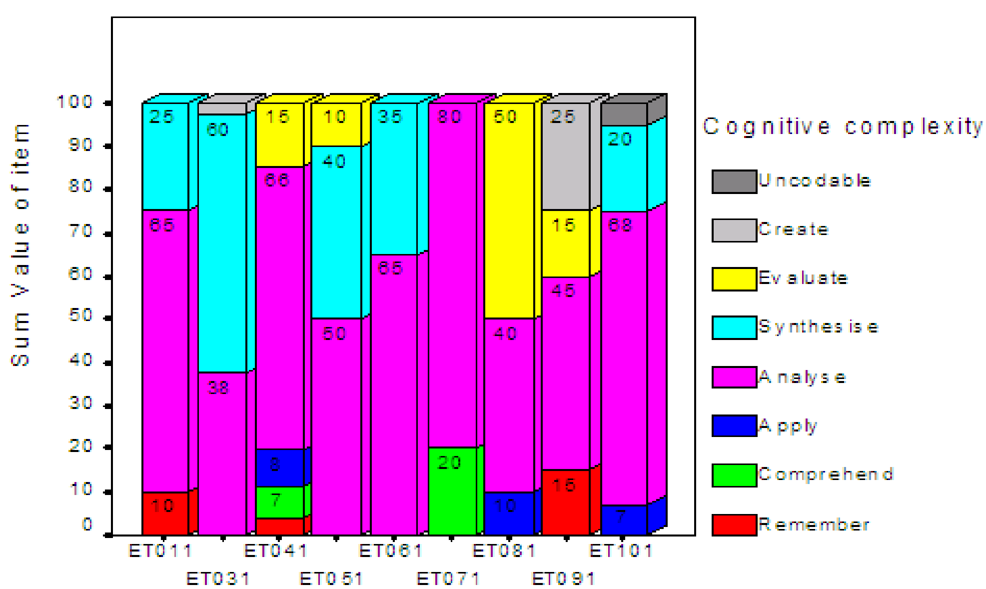


Figure 5.30

LEVEL OF DIFFICULTY BY GRADES ALLOCATED - GENRE - 2006

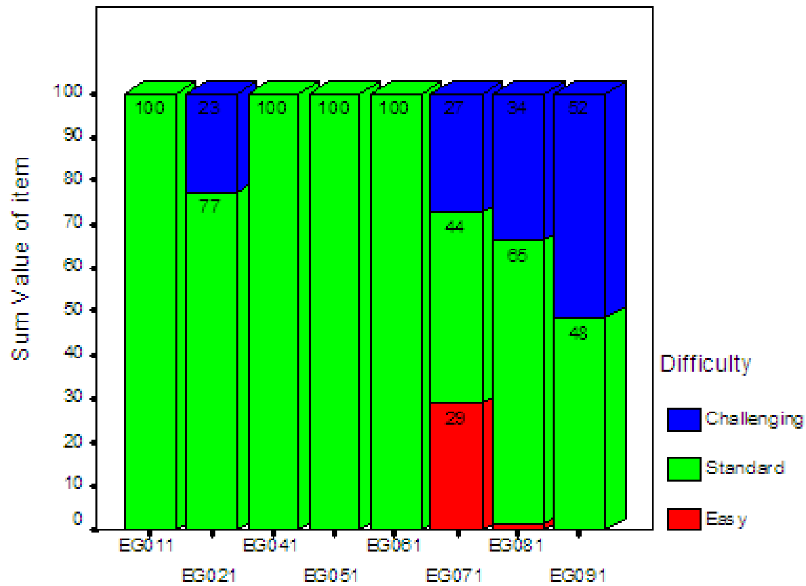
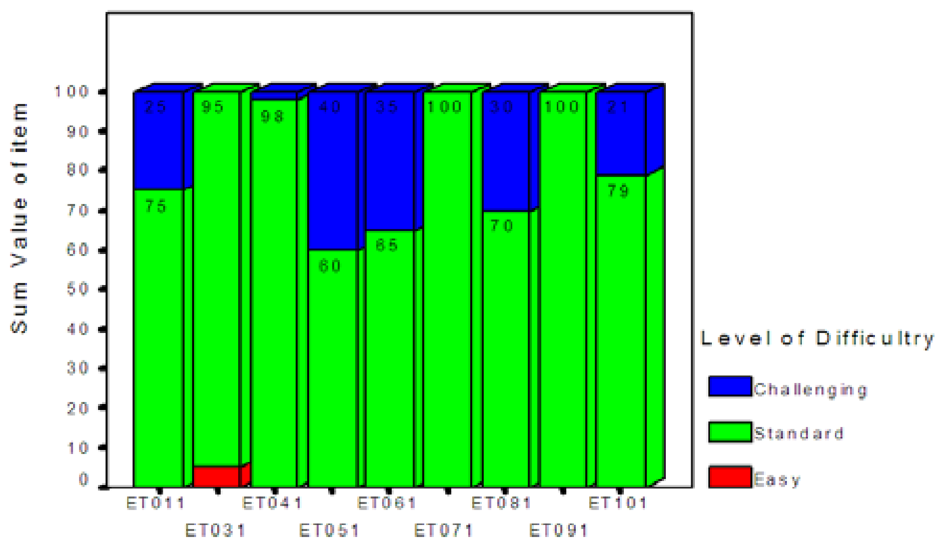


Figure 5.31

LEVEL OF DIFFICULTY BY GRADES ALLOCATED THEME - 2006



Analysis of objectives measured - genre courses - all sections combined

A major problem identified in both courses by the data analysis was that some sections were not measuring student achievement in regards to all of the instructional objectives. Figures 5.32 and 5.33 indicate that this has been corrected in both courses. This serves as an important validation of the genre and theme curriculum.

Figure 5.32

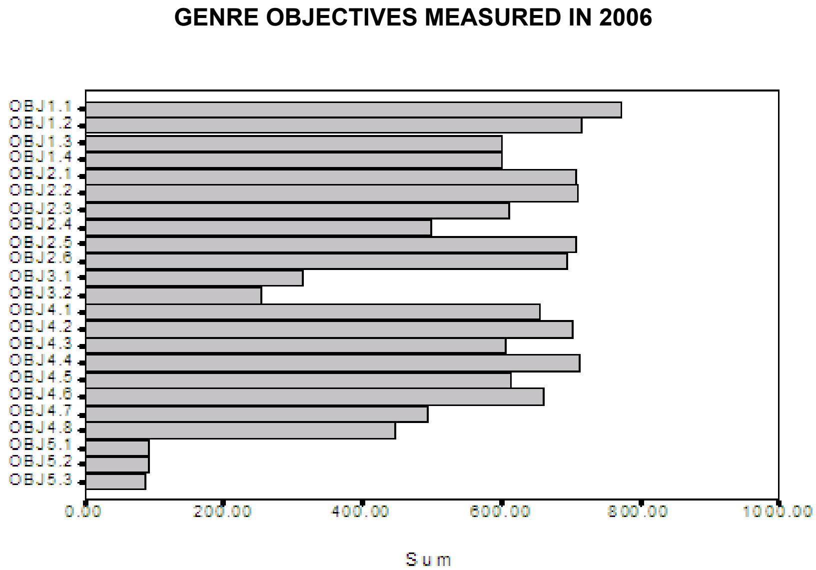
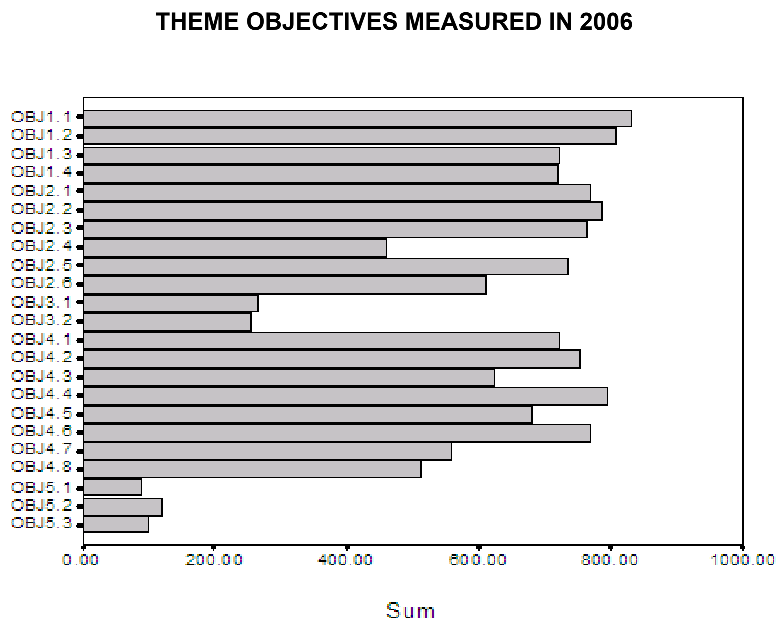


Figure 5.33



REFLECTION

The department has had a long time interest in the establishment of equity across sections and the assurance that students in each section develop the same intellectual skills and abilities as their peers in other sections. After spending several years organizing their introductory course (English 101), the teachers in the English Department were ready to move on and study the performance of their other courses. Preliminary examination of the student results in the Genre (102) and Theme (103) series indicated that there were sufficient differences across the sections that there would be a benefit to analysing them in a scientific way. Thus the department chose to enter into this research project early in the Fall of 2003 and teachers of these courses began to save and submit their assessment items for coding during Winter 2004. The coders initially studied the revision of Bloom's Taxonomy as proposed by Krathwohl (2002), and decided to adopt it, but maintained the category *comprehension* instead of *understand* and chose to use *synthesize* instead of *create* as this terminology was more consistent with the way English teachers think about their discipline. In addition, the coders realized that there was a need for incorporating a coding system for indicating the differential levels of difficulty of the assessment items.

Several issues emerged when the results of the analysis were presented to the department. It became obvious that although the department had previously established clear and concise objectives for these courses, the achievement of several these was not measured in some sections. For example, students in some sections were making oral presentations, as mandated by the department, while in others there was little evidence that this component was assessed. There were also considerable differences in the types and formats of tasks assigned to students and the mark values assigned to them. Although there was less variety across the sections in terms of types of knowledge assessed and levels of cognitive complexity demanded, there were important discrepancies that needed to be addressed. Further, although all teachers assigned only 10% of the course grade for class participation, only a few provided students with the criteria for acquiring these marks. There were also differences in the terminology used in assignments, and in the quality and detail of the instructions given to students. The coders had encountered difficulty dealing with assignments where students had the option of choosing from among several questions. These questions often required very different skills and abilities. There were also major differences between the two courses, genre and theme, in terms of the requirements, types of knowledge and levels of cognitive complexity required.

The department chose to focus attention on aspects of these courses through two teacher workshops. One was organized in August 2005, prior to the beginning of classes and another during the Fall pedagogical day. The intention here was to establish agreement among the teachers on the course objectives, guidelines for marking schemes, criteria for participation, a common vocabulary for types and formats of tasks, as well as the types of knowledge and levels of cognitive complexity demanded of the these two courses before they were offered to students in the Winter of 2006. These meetings were well attended and general consensus was reached about resolving the issues. Course committees were formed to coordinate and implement the changes being made, as well as to guide the new teachers to be hired for Fall 2006. The teachers agreed to submit their assignments and assessments during the Winter 2006 to the coders, so that these could be re-evaluated.

The coders worked diligently to complete this task by the Fall of 2006. This re-examination of the situation revealed that although the courses given in 2006 were similar to those given in 2003, change had indeed occurred. By providing the teachers with a copy of their individual results as well as a composite of the group results, and individuals could determine how well they had conformed to the departmental guidelines. While most had followed the departmental guidelines on marking schemes, a few teachers had not. There was increased coherence across the sections on the type of knowledge required, but the levels of cognitive complexity remained essentially the same, although many teachers increased the number of items requiring students to synthesize their ideas and thus raised the level of complexity. The problems related to providing students with choices did resolve so that the choices offered were of similar level. Differences in the levels of difficulty of the items persisted.

When the department examined the results, they were generally pleased with the progress made. However, the remaining differences across the sections and the apparent disregard for the guidelines by some teachers were a cause for concern. After discussion of the results, the department decided to implement a system of accountability beginning with the Winter 2007 semester, through which teachers of these courses must submit their course outline complete with their objectives and marking scheme to the course committee for approval before beginning the course.

As one of our lead departments, the English teachers had actually completed a curriculum review cycle by December 2007. As a consequence, the English Department has become more aware of the principle of assuring students with equity across the sections by organizing the courses to meet the department’s goals and objectives, by requiring similar assignments and assessment tasks with similar grading and marking schemes. They have developed further the community of practice first developed through the organization of English 101, by working together to improve their Genre (102) and Theme (103) courses.

SUPPORTING DOCUMENT A

CORE EVALUATION

ENGLISH

Planned Actions by Discipline

The following recommendations and guidelines regarding our Genre and Theme courses were ratified during the CORE Evaluation Process. They are stated on page 98 of the CORE Self-Evaluation Report, which was submitted to the Ministry of Education in May of 1998.

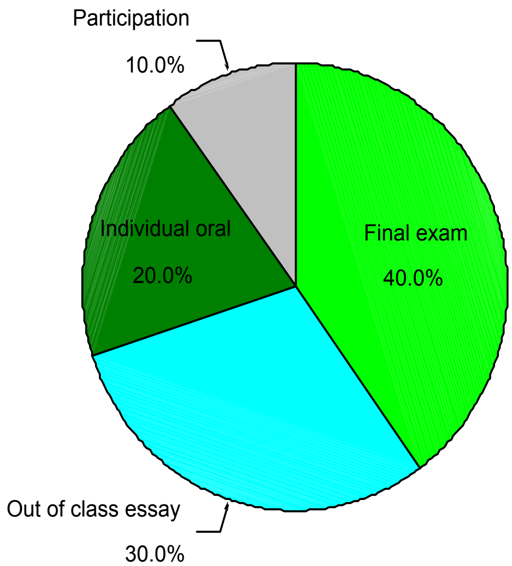
<u>Literary Genre and Literary Theme Courses</u>

- endorse recommended adjustments to specific course objectives (Appendix 6.2) (see attached pages)
- endorse guideline for assessment and grading
    - there will be a minimum of two and a maximum of four formal essays assigned in each literature course
    - a minimum word length of 1,000 words is required on at least one essay
    - essay writing should account for a minimum of 40% of the student's overall grade
    - include an oral component worth a maximum of 30% (can be individual or group oral presentation of group work)
- continue to examine genre and theme courses to determine whether the student workload is equitable

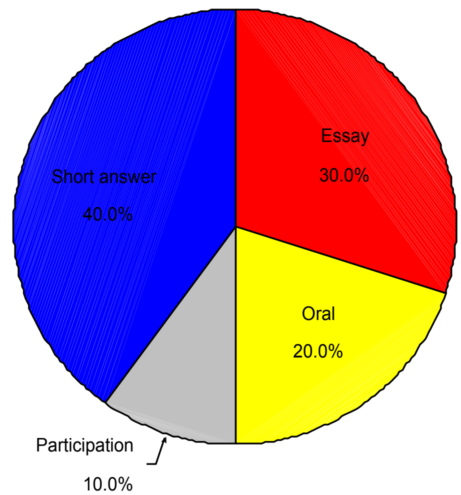
Supporting Document B

SUMMARY REPORT ON SECTION - ET 021

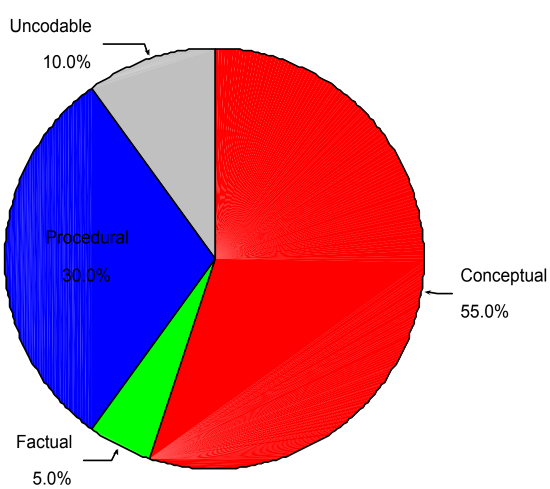
TYPE OF TASK



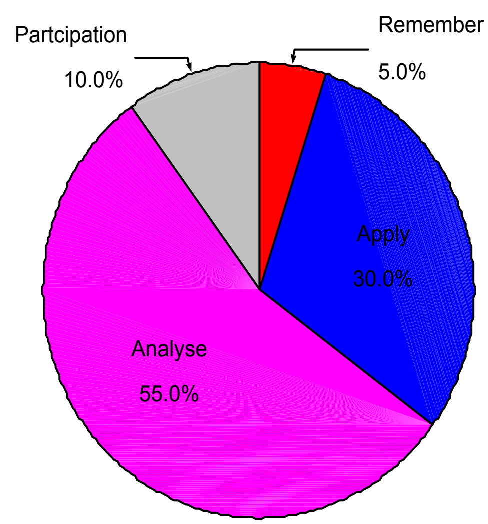
FORMAT OF TASK

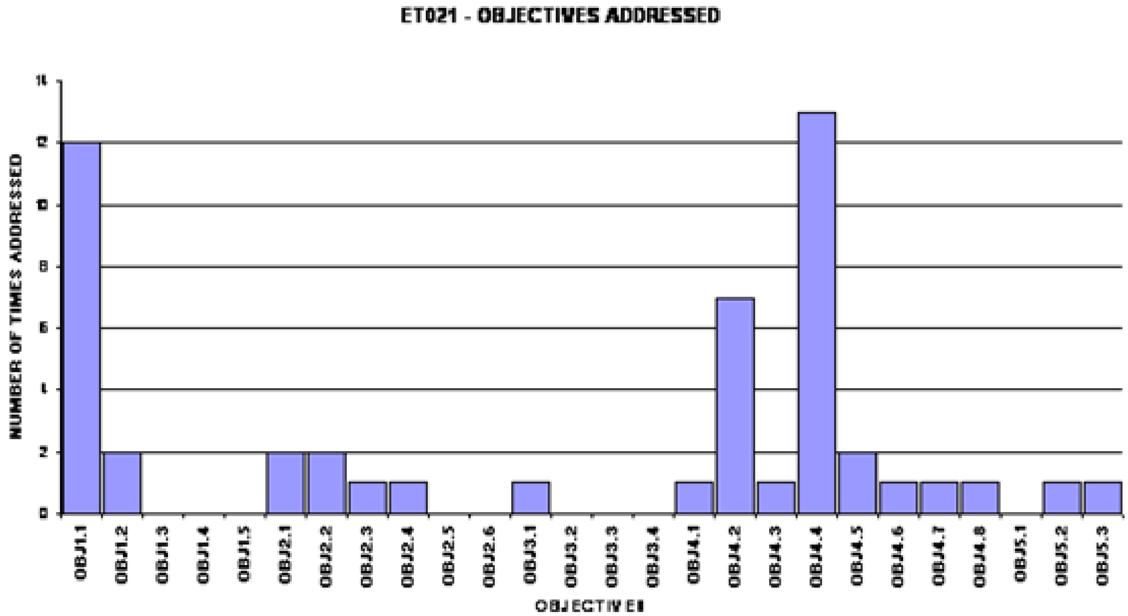


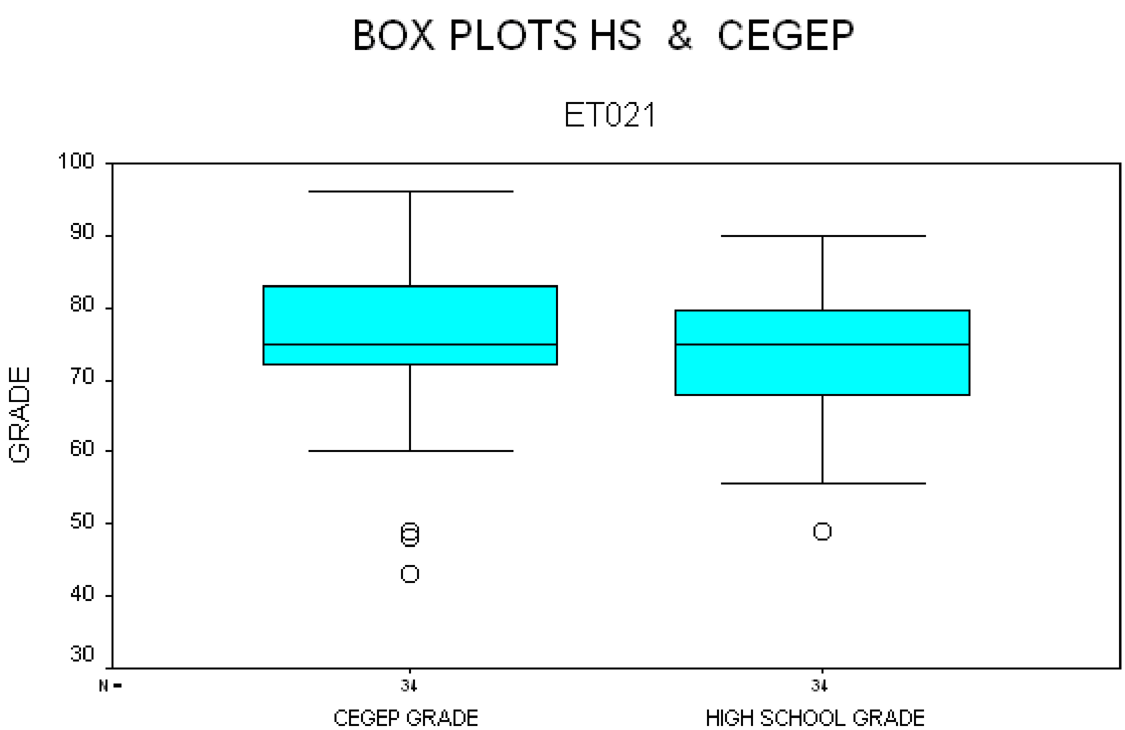
TYPE OF KNOWLEDGE



COGNITIVE COMPLEXITY




ET021 - OBJECTIVES ADDRESSED
NUMBER OF TIMES ADDRESSED
OBJECTIVE#
OBJ1.1
OBJ1.2
OBJ1.3
OBJ1.4
OBJ1.5
OBJ2.1
OBJ2.2
OBJ2.3
OBJ2.4
OBJ2.5
OBJ2.6
OBJ3.1
OBJ3.2
OBJ3.3
OBJ3.4
OBJ4.1
OBJ4.2
OBJ4.3
OBJ4.4
OBJ4.5
OBJ4.6
OBJ4.7
OBJ4.8
OBJ5.1
OBJ5.2
OBJ5.3


BOX PLOTS HS & CEGEP
ET021
GRADE
100
90
80
70
60
50
40
30
N =
34
34
CEGEP GRADE
HIGH SCHOOL GRADE

SUPPORTING DOCUMENT C

GENRE COURSES – ENGLISH 102

LEARNING OUTCOMES / INSTRUCTIONAL OBJECTIVES

Students who successfully complete this course will be able to write a literary analysis, demonstrating competence in the following areas:

1. Reading Abilities: Read Closely, Actively, Analytically and Critically

- 1.1 comprehend the text at a literal level
- 1.2 make reasonable inferences based on well chosen textual details
- 1.3 recognize a central idea or theme in a literary text
- 1.4 distinguish between a main theme and supporting details
- 1.5 monitor their own comprehension

2. Literary Analysis Abilities:

- 2.1 distinguish between an analysis and a personal reaction to a literary work
- 2.2 recognize and describe the distinguishing characteristics of one or more literary genres
- 2.3 situate a text in its historical and literary period
- 2.4 explain the historical and cultural significance of a text
- 2.5 identify the literary conventions used in the genre(s)
- 2.6 explain the effects of devices, patterns and elements used in the text

3. Aesthetic Evaluation:

- 3.1 recognize the author's distinctive writing style
- 3.2 recognize how this style evokes the reader's personal response
- 3.3 evaluate how well the author uses literary and stylistic devices
- 3.4 integrate aesthetic evaluation with critical analysis

4. Writing Abilities:

- 4.1 apply prewriting, drafting and editing techniques
- 4.2 use terminology appropriate to literary criticism
- 4.3 formulate a thesis statement and topic sentences that unifies the analysis
- 4.4 supply appropriate supporting evidence
- 4.5 organize ideas and construct a coherent well-supported essay
- 4.6 use a mature sentence structure and vocabulary
- 4.7 integrate quoted and paraphrased material
- 4.8 format and document a source according to MLA guidelines

5. Oral Communication Abilities:

- 5.1 participate actively in group discussions and make relevant contributions
- 5.2 articulate ideas clearly and logically
- 5.3 listen to others and form thoughtful responses

THEME COURSES - ENGLISH 103

LEARNING OUTCOMES /INSTRUCTIONAL OBJECTIVES

Students who successfully complete this course will be able to write a **thematic analysis**, demonstrating competence in the following areas:

1. Reading Abilities: Read Closely, Actively, Analytically and Critically

1.1 understand the text at a literal level
1.2 make reasonable inferences based on well chosen textual details
1.3 recognize the theme in a literary text
1.4 distinguish between a theme and supporting details
1.5 monitor their own comprehension

2. Literary Analysis Abilities:

2.1 distinguish between a thematic analysis and a personal reaction
2.2 identify the use and effect of significant literary elements in a work
2.3 recognize the elements in the text which reveal and reinforce the theme
2.4 situate a text in its cultural and historical context
2.5 examine the elements in a work which reveal a value system
2.6 explain the value system inherent in a literary text and relate it to its historical and cultural setting

3. Aesthetic Evaluation:

3.1 recognize the author's distinctive writing style
3.2 recognize how this style evokes the reader's personal response
3.3 evaluate how well the author uses literary and stylistic devices
3.4 integrate aesthetic evaluation with critical analysis

4. Writing Abilities:

4.1 apply prewriting, drafting and editing techniques
4.2 use terminology appropriate to literary criticism
4.3 formulate a thesis statement and topic sentences that unifies the analysis
4.4 supply appropriate supporting evidence
4.5 organize ideas in a coherent fashion
4.6 use a mature sentence structure and vocabulary
4.7 integrate and document quoted and paraphrased material
4.8 format and document a source according to MLA guidelines

5. Oral Communication Abilities:

5.1 participate actively in group discussions and make relevant contributions
5.2 articulate ideas clearly and logically
5.3 listen to others and form thoughtful responses

SUPPORTING DOCUMENT D

LEARNING OBJECTIVES: 102 GENRE COURSES (REVISED)

1. READING ABILITIES: Read closely, actively, analytically and critically

1.1 Comprehend the text at a literal level
1.2 Make reasonable inferences based on well chosen textual details
1.3 Recognize the central idea or theme in a text
1.4 Distinguish between a main theme and supporting details

2. ANALYSIS ABILITIES

2.1 Distinguish between an analysis and a personal reaction to a text
2.2 Recognize and describe the distinguishing characteristics of one or more literary genres
2.3 Situate a text in its historical and literary period
2.4 Explain the historical and cultural significance of a text
2.5 Identify the literary conventions used in the genre(s)
2.6 Explain the effects of devices, patterns and elements used in the text

3. AESTHETIC APPRECIATION

3.1 Recognize the author's distinctive writing style
3.2 Recognize how this style evokes the reader's response

4. WRITING ABILITIES

4.1 Apply prewriting, drafting and editing techniques
4.2 Use terminology appropriate to literary criticism
4.3 Formulate a thesis statement and topic sentences that unify the analysis
4.4 Supply appropriate supporting evidence
4.5 Organize ideas and construct a coherent well-supported essay
4.6 Use a mature sentence structure and vocabulary
4.7 Integrate and document quoted and paraphrased material
4.8 Format and document a source according to MLA guidelines

5. ORAL COMMUNICATION ABILITIES

5.1 Participate actively in group discussions and make relevant contributions
5.2 Articulate ideas clearly and logically
5.3 Present ideas to the class in a semi-formal or formal manner

6. GENERAL LEARNING OUTCOMES

6.1 Demonstrate college-level academic behavior
6.2 Monitor and self-assess their mastery of these learning objectives

LEARNING OBJECTIVES: 103 THEME COURSES (REVISED)

1. **READING ABILITIES: Read closely, actively, analytically and critically**
    - 1.1 Understand the text at a literal level
    - 1.2 Make reasonable inferences based on well chosen textual details
    - 1.3 Recognize the theme in a text
    - 1.4 Distinguish between a theme and supporting details

2. **ANALYSIS ABILITIES**
    - 2.1 Distinguish between a thematic analysis and a reaction
    - 2.2 Identify the use and effect of significant literary elements in a text
    - 2.3 Recognize the elements in the text which reveal and reinforce the theme
    - 2.4 Situate a text in its cultural and historical context
    - 2.5 Examine the elements in a text which reveal a value system
    - 2.6 Explain the value system inherent in a text and relate it to its historical and cultural setting

3. **AESTHETIC APPRECIATION**
    - 3.1 Recognize the author's distinctive writing style
    - 3.2 Recognize how this style evokes the reader's response

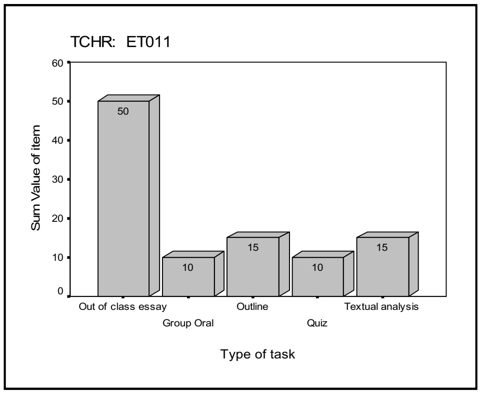
4. **WRITING ABILITIES**
    - 4.1 Apply prewriting, drafting and editing techniques
    - 4.2 Use terminology appropriate to literary criticism
    - 4.3 Formulate a thesis statement and topic sentences that unify the analysis
    - 4.4 Supply appropriate supporting evidence
    - 4.5 Organize ideas in a coherent fashion
    - 4.6 Use a mature sentence structure and vocabulary
    - 4.7 Integrate and document quoted and paraphrased material
    - 4.8 Format and document a source according to MLA guidelines

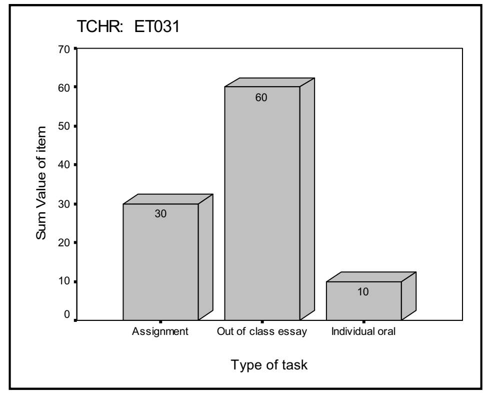
5. **ORAL COMMUNICATION ABILITIES**
    - 5.1 Participate actively in group discussions and make relevant contributions
    - 5.2 Articulate ideas clearly and logically
    - 5.3 Present ideas to the class in a semi-formal or formal manner

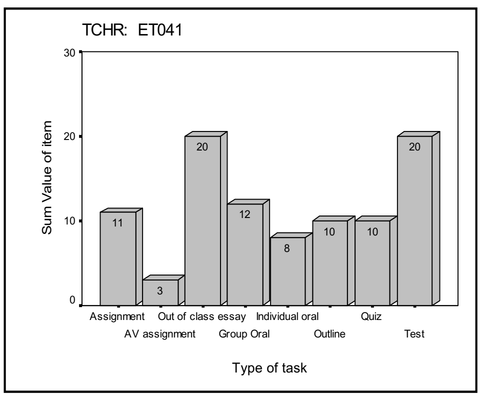
6. **GENERAL LEARNING OUTCOMES**
    - 6.1 Demonstrate college-level academic behavior
    - 6.2 Monitor and self-assess their mastery of these learning objectives

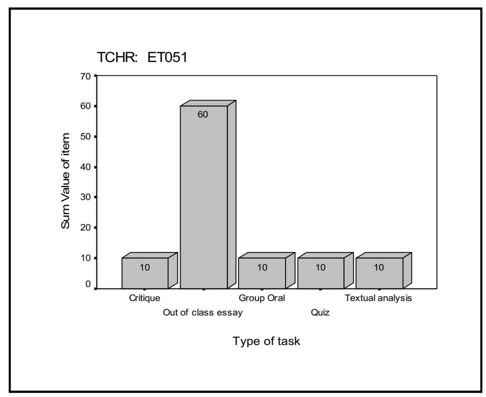
SUPPORTING DOCUMENT E

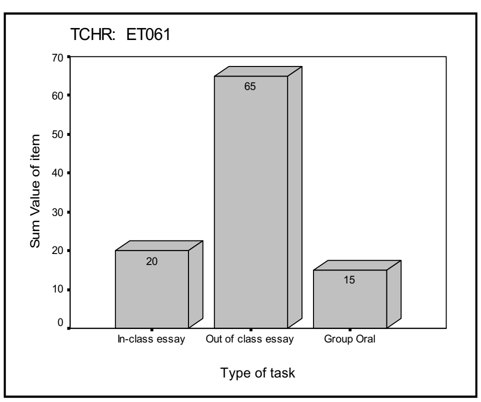
TASK TYPE (more specific) - THEME

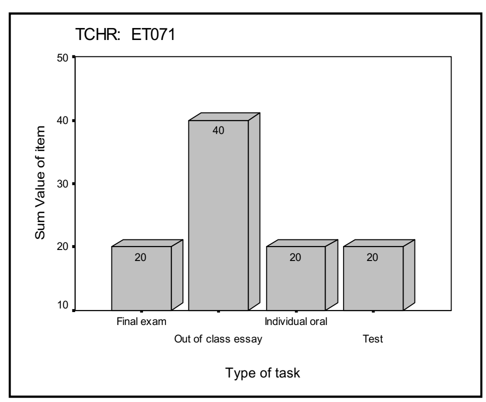




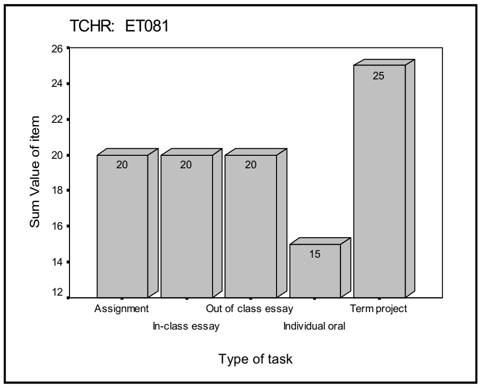


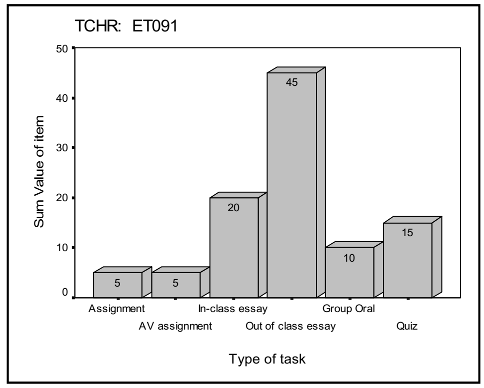


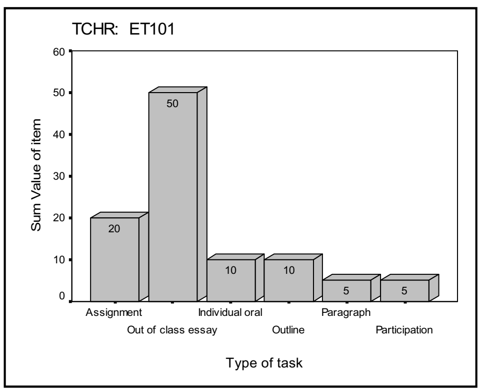




TASK TYPE (more specific) - THEME







CHAPTER 6

CHEMISTRY

CONTENTS

The Chemistry Department of Champlain St-Lambert Cégep has a long history of working together to achieve coherence within their courses and across multiple sections of the same course. The culture within the Department is such that the members have a positive professional relationship. They share common goals about the delivery of the courses and common ideals about their responsibilities to the discipline, to the students and to each other. The curriculum committee has the membership of the entire department and meets several times during the semester. These committee meetings are conducted in a formal manner and each member has the opportunity to give input into issues regarding curriculum regardless of their seniority within the department. The department strives to reach a consensus on any decisions taken. The department shares common objectives, similar grading schemes and common final exams with common marking of those exams for all courses offered. They also use the same textbook for the same courses. A course manual is provided by each teacher separately which reflects their individual instructional approach. These departmental qualities and processes support the conclusion reached by the recent *Science Program Evaluation* that the Chemistry Department's strengths lies in its diverse and committed faculty.

The courses offered are generally basic introductions to the discipline. At this level, most students do not possess an in-depth knowledge in Chemistry and therefore, practical applications of Chemistry concepts are the focus in each course. Therefore, the Chemistry Department uses methods that foster the development of content knowledge and thinking skills that have been stipulated in the Science Program goals such as understanding the steps of and applying the scientific methods. Formal lecturing and various forms of media are used along with small group problem-solving and discussion sessions. All courses include a common laboratory component which the department monitors to ensure the close coordination of lab content with theoretical material so that the topics taught in class are reinforced in the lab through practical applications. This process is facilitated through a common lab manual. The laboratory offers an ideal environment to emphasize oral communication skills and practical applications of the theory learned in class.

THE RESEARCH PROCESS

In the fall of 2003, a comparison of Chemistry NYA final grades for both fall 2001 and fall 2002 were presented to the Department. A slightly different way of organizing the data was taken in that the results for 2001 and 2003 were combined and sorted by teacher. This was done because the data was also being compiled as part of the 2003 Science Program Evaluation.

Final grades were compared to the incoming high school grades of the same students. Although there appeared to be differences in the level of preparedness among the students in the groups taught by different teachers, the distribution of students' final grades, by teacher, deviated even further from their incoming level of achievement. This finding made the Chemistry teachers uncomfortable and, consequently, the department decided to take part in the PAREA research project to examine the fall 2003 sections of NYA more closely. The Department selected two faculty members to represent them as subject-matter experts, a role referred to in this project as "the coders". The department coordinator assisted them in that role and also served as one of the principal researchers on the PAREA research team.

The two faculty members attended a training workshop given by the PAREA team in January 2004. The purpose of this training workshop was to educate the coders about how to analyze and code different assessment tasks according to Bloom's Taxonomy (Krathwohl, 2002) and to introduce them to the methodology of the curriculum review process. The coders then collected all course outlines and assessment tasks for Chemistry NYA as taught during the fall 2003 semester and removed any identifying information that connected the teacher and the section to ensure anonymity and reduce the possibility of bias in coding.

The coders began their work by examining the course outlines to determine if they were coherent across various sections of the same course. In the case of Chemistry NYA, the stated objectives and topics covered were identical. However, there were slight variations in the assessment schemes. Generally, final grades for courses consisted of 2 or 3 class tests and quizzes. Each course had a laboratory component weighted at 15% and an Integrative Activity counting for 5%. Most courses based their final grade on a flexible grading option for class tests, and course work such as quizzes and assignments. The final exam could weigh no more than 50% but no less than 30%. So, if a student did better on their class tests and quizzes then on the final exam, the final exam would only count for 30%. This grading scheme allows each student to choose the scheme that is most advantageous for them.

For all sections there was a common final exam covering material for the entire course and graded through a common marking procedure designed to ensure equity in marking. This means that each Chemistry teacher grades one section of the exam for all students taking the course. The coders then began to examine the assessment items for each teacher. They adopted Bloom's taxonomy for coding the types of knowledge and the levels of cognitive complexity.

The PAREA Research Team presented the preliminary results to the coders in the fall of 2004. The coders found several aspects of the type and format of task that needed to be refined. They also clarified the distinction between evaluation and analysis. It also became evident that coding the questions according to the ministerial competencies required by the science program demonstrated how the course connected to those competencies in a general way, but did not capture the depth of the specific subject-matter knowledge that was being addressed in class (see Table 6.1). Therefore, the assessment tasks were coded a second time according to the subject-matter knowledge that the question or task assessed.

When the re-coded analysis was presented to the coders, they noticed that a large portion of the grades required the cognitive complexity levels of application and analysis. These questions also required conceptual and procedural types of knowledge. The coders realized that simply classifying these types of questions at the application or analysis levels did not reveal that there were differences between them. One could have a relatively easy or difficult question that asks the student to analyze. The coding team decided to add a difficulty scale to their coding. They labeled these levels as easy, standard and challenging. Challenging questions are unfamiliar questions that have many concepts incorporated into the question, whereas, an easy question uses one concept and usually requires the straight forward application of a formula or factual knowledge. At the same time the coding team solidified their understanding of conceptual/application and analysis type questions. Application was a direct use of a concept whereas analysis was used for questions that required justification of the answer. As in many other disciplines the coders struggled with the idea of assigning the level of the question if a similar one was given in previous formative assessment tasks such as an in-class problem solving session. Since they had no knowledge of what teaching/learning strategies were used in various classes, they considered that it would be unfair to downgrade the level of a question based on speculation, and thus used the face value of each task to determine its level of difficulty.

The process covered many months and in June 2005, the coders discussed some of the results of their analysis with the Chemistry Department. The process and the analyses gave direction and focus to the discussions about the curriculum and the teachers became aware of ways to improve their course. As a result, teachers agreed to make certain modifications and adjustments before starting the course in the fall semester of 2005. The department shifted chemical reaction topic kinetics to Chemistry NYB, the second level course, and substituted colligative properties of liquids and solutions. In addition, topics such as the Bohr model of the atom, which had not been stated in the course outlines, though covered in the course, were added.

The final analysis of the data was presented to the department on September 14, 2005. The presentation began with an overview of the journey followed by the coders and an explanation for why the data was coded three times. This addressed the concern that the data being presented was from fall 2003 and that some teachers may have already made changes to their courses based on informal discussions about the project. There was not enough time to completely study the findings, determine if changes needed to be made and develop a plan of action. Therefore, the Department agreed to an additional meeting held on the November 2005 pedagogical day. This second meeting began with a workshop on coding the Chemistry NYA final examination of fall 2003 so that the Department's participants could have a deeper understanding of the implications of the coded data. It was found that there was a large variation in the coding by the department members, as they did not have the coders' expertise. The concept, however, that assessment tasks and test questions make inherent intellectual demands on the learner and that these demands can be identified in terms of kinds of knowledge and levels of cognitive complexity was established and understood. In the next section the final data as shown to the department is presented and discussed.

Table 6.1

CHEMISTRY NYA MINISTERIAL OBJECTIVES
1. Use concepts, laws, and principles 2. Use the appropriate chemical terminology 3. Explain the probabilistic model of atomic theory 4. Represent the behaviour of matter at the atomic and molecular levels, by writing the necessary chemical equations and by drawing the appropriate diagrams or sketches 5. Perform experimental procedures and techniques properly 6. Adhere to safety and environmental protection regulations 7. Accurately perform calculations 8. Write laboratory reports that conform to established standards

ANALYSIS OF ASSESSMENT TASKS

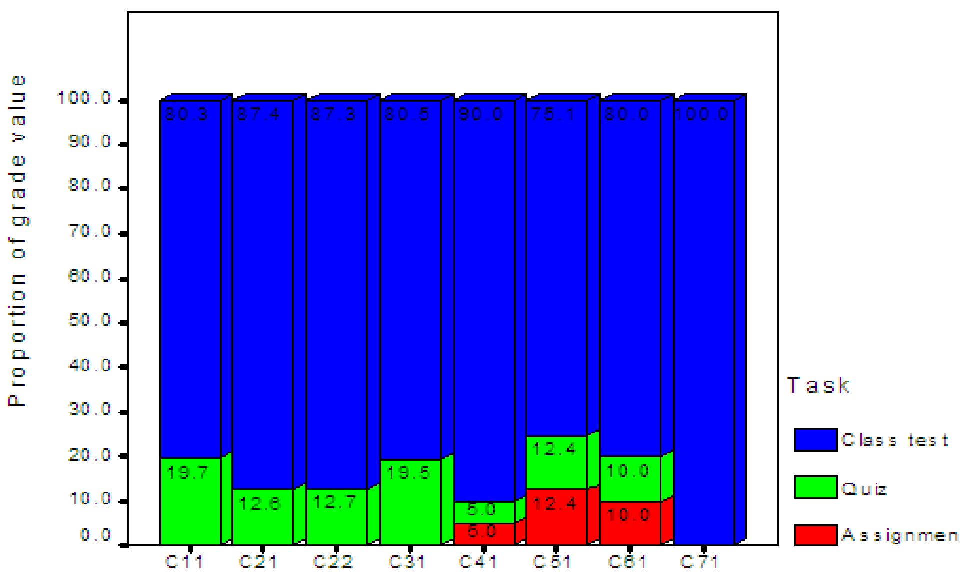
Each assessment item used in Chemistry NYA classes in the fall of 2003 is analyzed according to its type and format of task, type of knowledge required, level of cognitive complexity, the main instructional objective/s that it measures, the topic it addresses, and its contribution to each student's overall grade.

Type of tasks used in Chemistry NYA

There are three different types of task being used by the teachers of this course with a preponderance of grades allotted to class tests. It was found that not all teachers used this variety of tasks. For example, C71 did not use assignments or quizzes. The department agreed that class tests should not be the only type of in-class assessment used. Consequently, the department strongly recommended that a minimum of three class tests, or two class tests and other assessed activities that are equivalent to a class test be given during the term. In addition, a final exam is mandatory.

Figure 6.1

TYPE OF TASK USED IN CHEMISTRY NYA



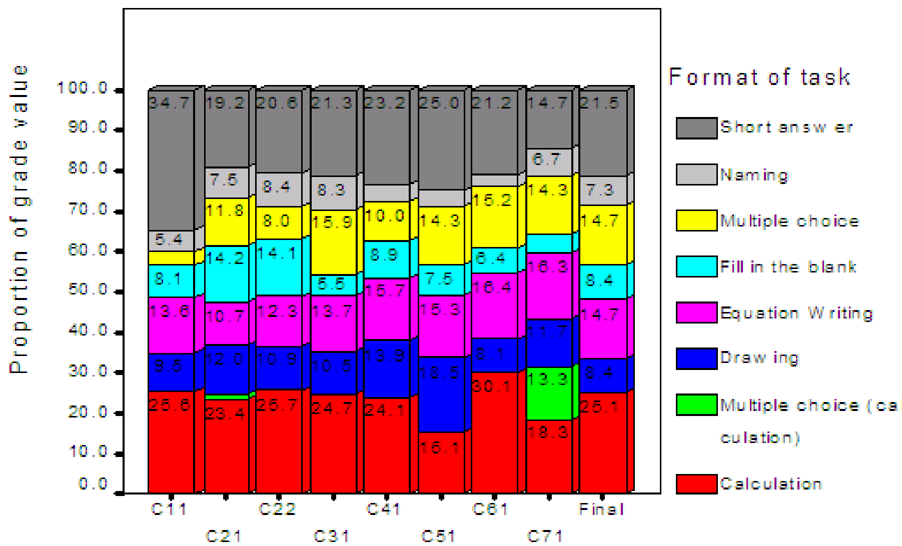
Format of tasks used in Chemistry NYA

Because there is a tradition in this department to have a common final exam, it was decided that it was important to examine the degree of alignment between assessment tasks used during the term and the final exam. The result of analyzing the final exam, therefore, appears as the last column in subsequent figures.

Figure 6.2 indicates a strong coherence across teachers in the format of questions used and their overall contribution to students' grades. It is also clear that the final exam is an accurate reflection of the format of tasks used during the term.

Figure 6.2

TYPES OF FORMAT USED IN CHEMISTRY NYA

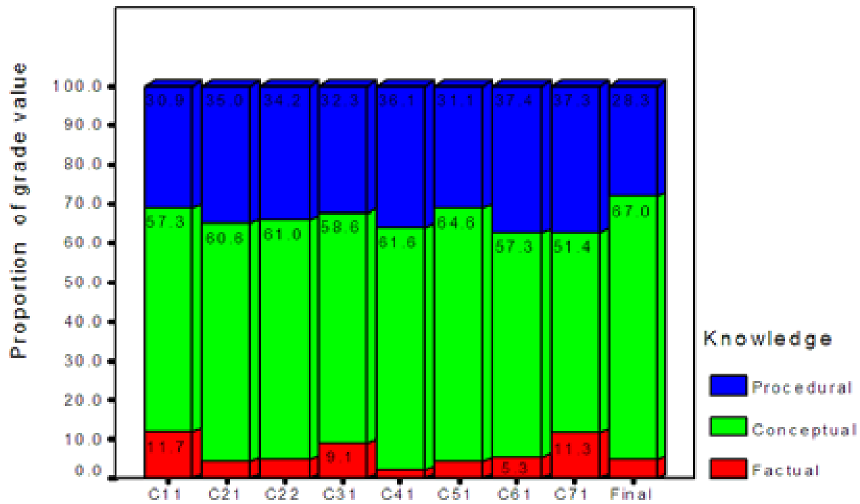


Comparison of the types of knowledge being assessed by different teachers

There is a high degree of coherence across teachers in the type of knowledge that is being assessed on class test, quizzes and assignments. There is an emphasis on conceptual questions that require a practical application which the department agreed was appropriate for this level of Chemistry. General Chemistry NYA is a descriptive course rather than a problem solving based course. The department debated about whether the number of factual questions should be increased. There seems to be an assumption that questions that demand only factual knowledge are at a lower level of cognitive difficulty and that by increasing this type of knowledge in test or exam questions, one might inadvertently lower the overall cognitive complexity of the course. It also seems that an increased emphasis on factual questions is contrary to the goals of the science program which are to increase the opportunity for students to apply what they have memorized, that is, to begin to think like a chemist. However, it was decided that questions requiring only factual knowledge should be increased by 2-3% on tests and exams

Figure 6.3

TYPE OF KNOWLEDGE ASSESSED BY SECTION

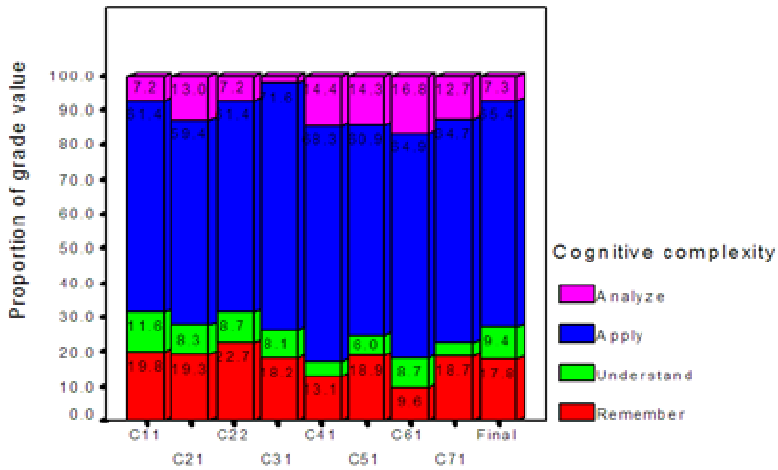


Comparison of the Levels of Cognitive Complexity Required by Different Teachers

There is a high degree of coherence across teachers in the cognitive complexity of the questions that are being asked on class tests, quizzes and assignments. The greatest emphasis was placed on application questions which ask students to apply their content knowledge. This is not surprising as much of Chemistry NYA focuses on equation writing, evidenced in test items that were all deemed to be at the application level of thinking. Discussion ensued about how difficult this topic can be made and that the Department needed to find a middle ground on the level of difficulty of equation writing questions, perhaps using standard textbook type questions.

Figure 6.4

LEVELS OF COGNITIVE COMPLEXITY REQUIRED BY DIFFERENT TEACHERS



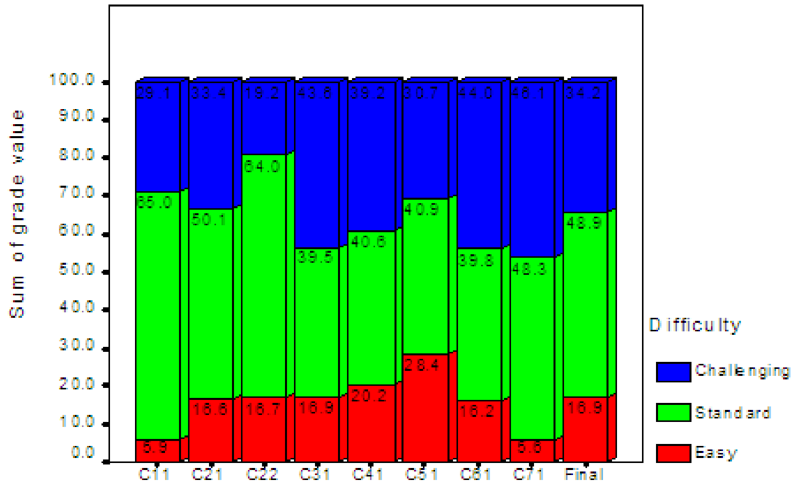
Analysis of difficulty and cognitive complexity

The cognitive complexities of the questions used on the final exam seem to closely resemble the questions asked by teachers during the term. However, when the coders reexamined the items that were identified as apply or analyze questions and determined whether or not they were easy, standard or challenging, the strong coherence between the teachers in terms of the cognitive complexity of the questions they ask decreased. When this data was presented, the members of the department acknowledged that there were differences, though no explanations were offered.

As a result of data that described the type of knowledge and the cognitive complexity of the courses and final exam, it was decided to increase conceptual analysis questions by using images that require conceptual understanding to solve problems such as those found in the student's text-book. It was also decided to decrease the number of questions that only require that the student remember and increase the number that require understanding. In addition, it was determined that a reasonable range of difficulty for questions on a class test or final exam would consist of 10-20% easy, 40-50% standard and 30-40% challenging questions.

Figure 6.5

LEVEL OF DIFFICULTY AND COGNITIVE COMPLEXITY

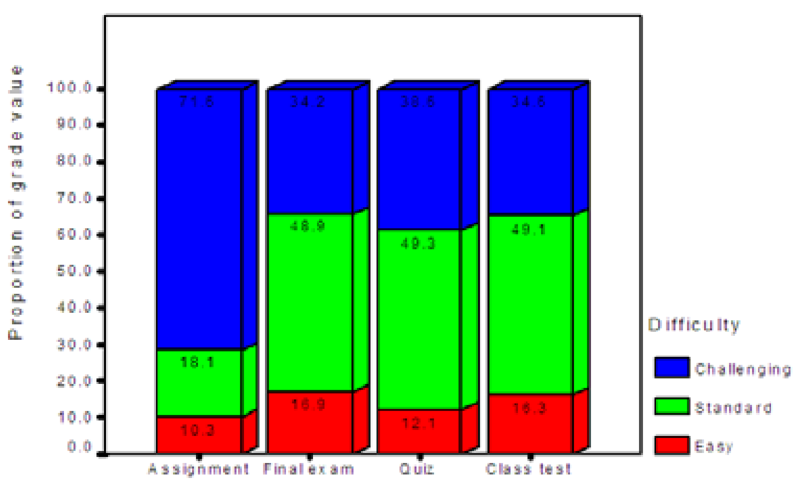


Analysis of difficulty and type of task

A comparison of the type of task and difficulty showed that 71.6% of take-home assignments were more challenging than in-class tests. This was considered normal practice since students have access to information and are not restricted by time constraints when completing assignments. There was strong coherence between the level of difficulty of quizzes, class tests and the final exam.

Figure 6.6

LEVEL OF DIFFICULTY AND TYPE OF TASK

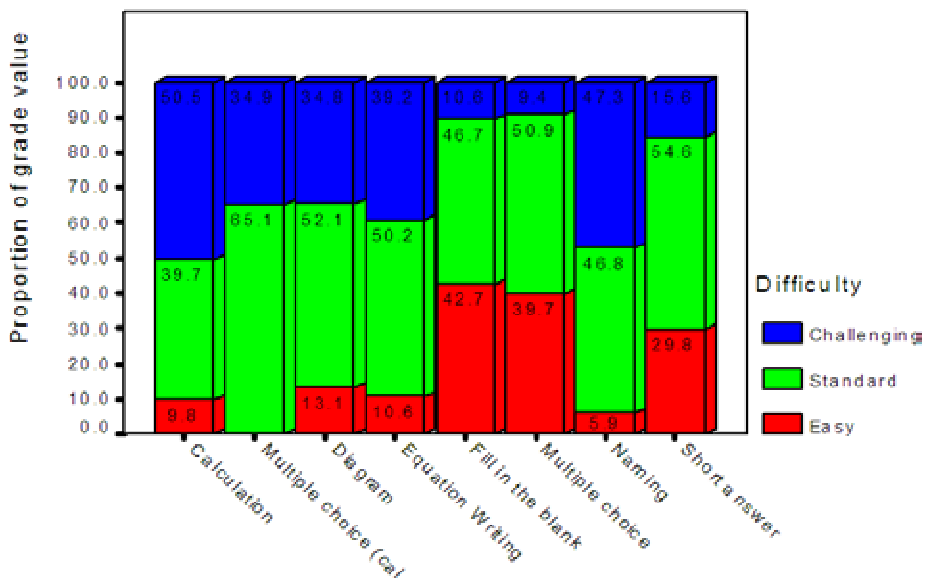


Analysis of difficulty and format of task

The relationship between the format and level of difficulty of the task indicated that performing calculations and naming compounds are considered to be challenging tasks. Approximately 40% of fill-in-the-blank and multiple choice items were classified as easy in terms of level of difficulty.

Figure 6.7

LEVEL OF DIFFICULTY AND FORMAT OF TASK



Analysis of objectives measured

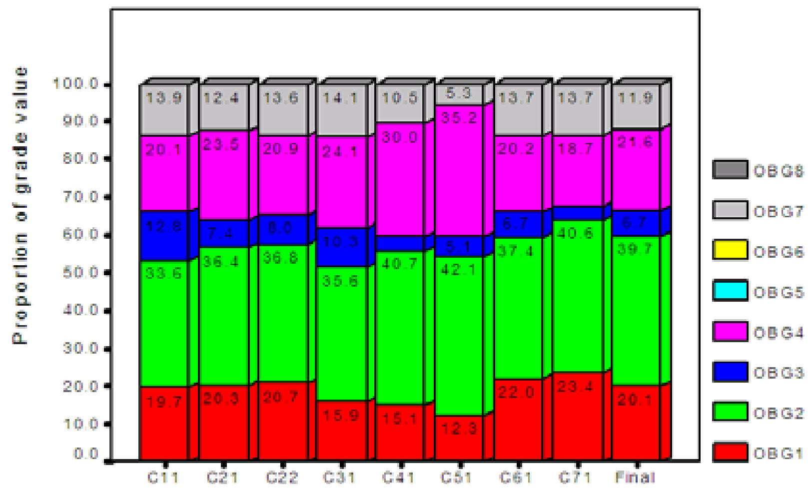
The proportion of grades allocated to items measuring the achievement of the ministerial objectives, which represent general competencies as opposed to topics, was found to be coherent across the different sections of the course and appropriate in terms of how much each objective is emphasized and valued in terms of its relative contribution to the students' overall grades. For example, the ability to use appropriate chemical terminology, objective #2, is a main focus in the course and accounts for approximately 40% of each student's grade. Likewise, the value given to an ability to explain the probabilistic model of atomic theory, objective #3, accounts for 6-10% of the overall grade as this represents a small portion of Chemistry NYA.

Objective #4, which represents the ability to represent the behaviour of matter at the atomic and molecular levels by writing the necessary chemical equations and by drawing the appropriate diagrams or sketches, is a main focus of this course and appropriately accounts for 20 - 35% of the overall grade. Items that measure objective #8 refer to the laboratory component of this course which is worth 15% of the final grade in all sections. These items were not coded in this study.

An initial concern with the variation in the grades allocated for objective #1 (12 - 23%), an objective that deals with the ability to properly use concepts, laws, and principles, was resolved when the coders pointed out that this finding is somewhat misleading as this objective could have been applied to almost every item.

Figure 6.8

OBJECTIVES MEASURED - ALL SECTIONS



The relationship between topics and cognitive complexity

As the coding progressed, it became clear that some topics were missing in the course outlines. As a result, the coders decided to add topics to the list during the coding process. When this information was brought to the attention of the department, a decision was made to refine this list and reach consensus about which topics should be included in Chemistry NYA. These decisions were implemented in all sections offered in fall 2006.

Further analysis was done when the department members became interested in knowing whether different topics could be classified as easy, standard or challenging, and whether an unequal focus on any one topic might weaken the coherence between sections. For example, questions that required the student to calculate a response dealing with kinetics, stoichiometry and atomic theory were most often coded as conceptual/application. Items that required the student to draw molecular structures were coded as factual/remember and conceptual/application. The student must first have a factual knowledge about how to draw simple Lewis structures and remember the rules that govern the preliminary sketch of the molecule and then apply more sophisticated concepts to draw an orbital schematic with an understanding of molecular hybridization. Questions that pertain to the use of periodic properties and the ability to classify substances according to their structure were coded as conceptual/analysis, a higher level of cognitive complexity. See figures 6.9 and 6.10.

Figure 6.9

THE RELATIONSHIP BETWEEN TOPICS AND COGNITIVE COMPLEXITY (1)

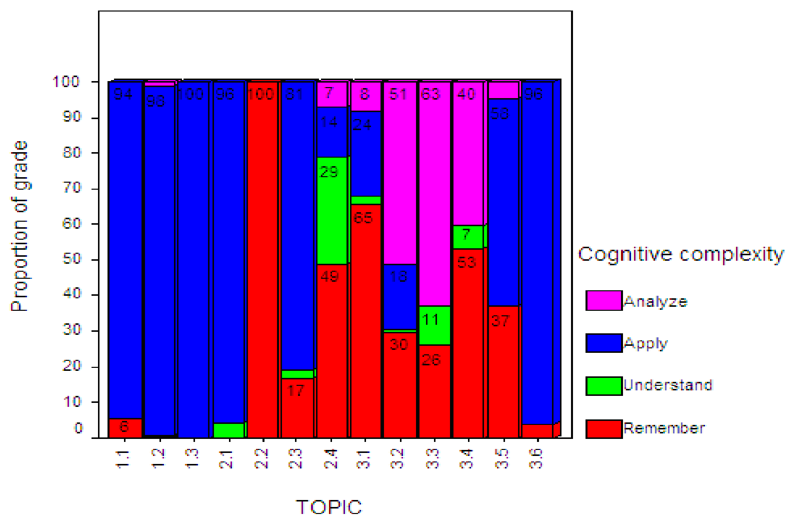
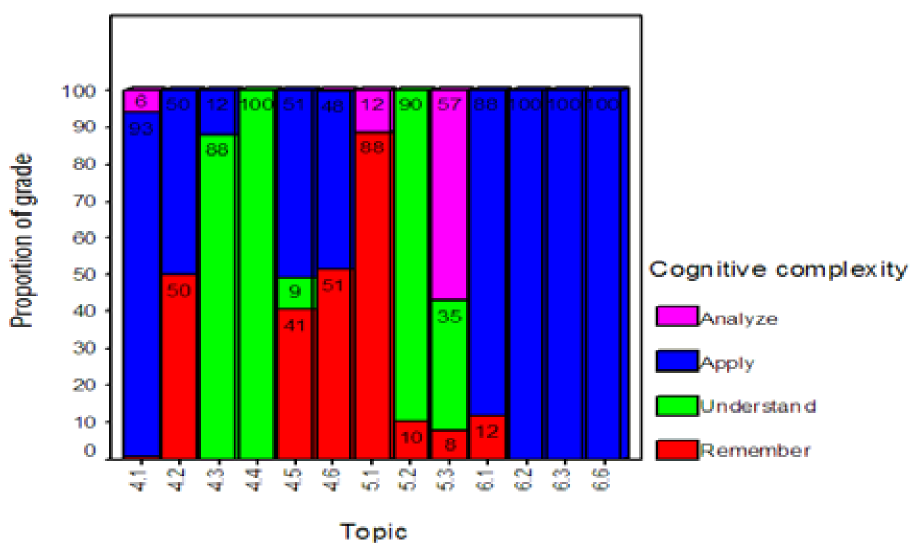


Figure 6.10

THE RELATIONSHIP BETWEEN TOPICS AND COGNITIVE COMPLEXITY (2)



It was also noted that the level of cognitive complexity with respect to the topics tested in the final exam were coherent with the cognitive complexity of questions given in class tests. See figures 6.11 and 6.12

Figure 6.11

TOPICS AND COGNITIVE COMPLEXITY ON THE FINAL EXAM (1)

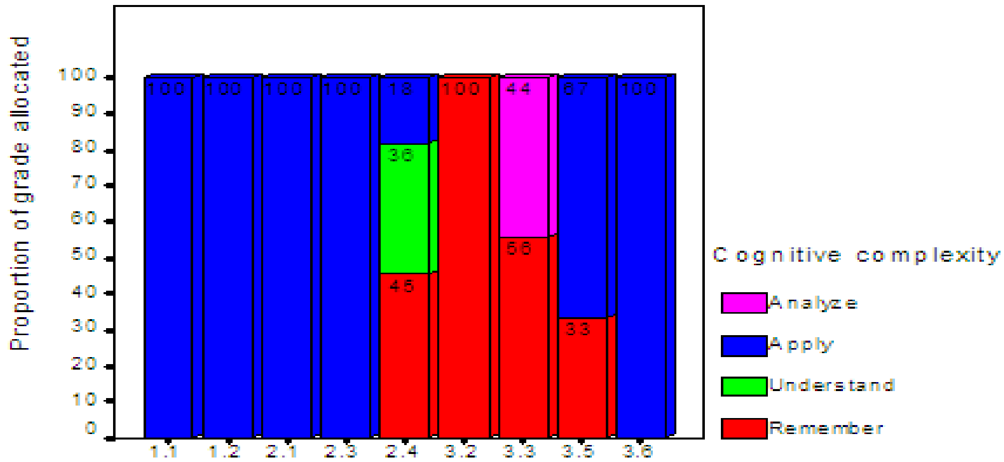
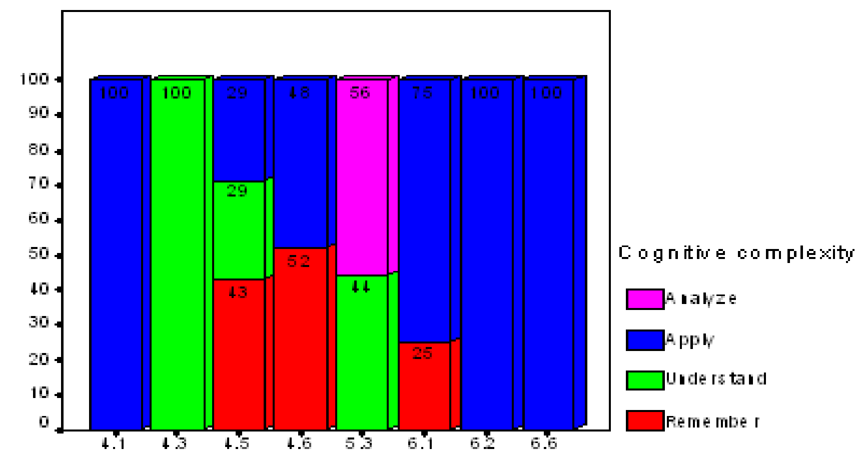


Figure 6.12

TOPICS AND COGNITIVE COMPLEXITY ON THE FINAL EXAM (2)



Grades allocated by topic

The presentation of the topic analysis evoked the most controversy. It was noticed that there was too much emphasis on some topics, at the expense of others, on in-class assessments compared to the final exam, particularly for topics 5.0 to 6.6. Hence, the final exam was more heavily weighted on the last topics covered in the semester. See Figures 6.13 and 6.15.

In addition, there was a large variation in the grades assigned to certain topics in quizzes and class tests by teacher. An example of this variation is demonstrated in Figures 6.15 and 6.16. It appears that Teacher X assessed the students on almost all of the topics covered in the semester whereas Teacher Y did not assess the last two units given in the course. The Department felt that the students of these two sections were not treated equitably and that all students should be tested or quizzed before the final exam.

Figure 6.13

TOTAL GRADE PER TOPIC - OVERALL

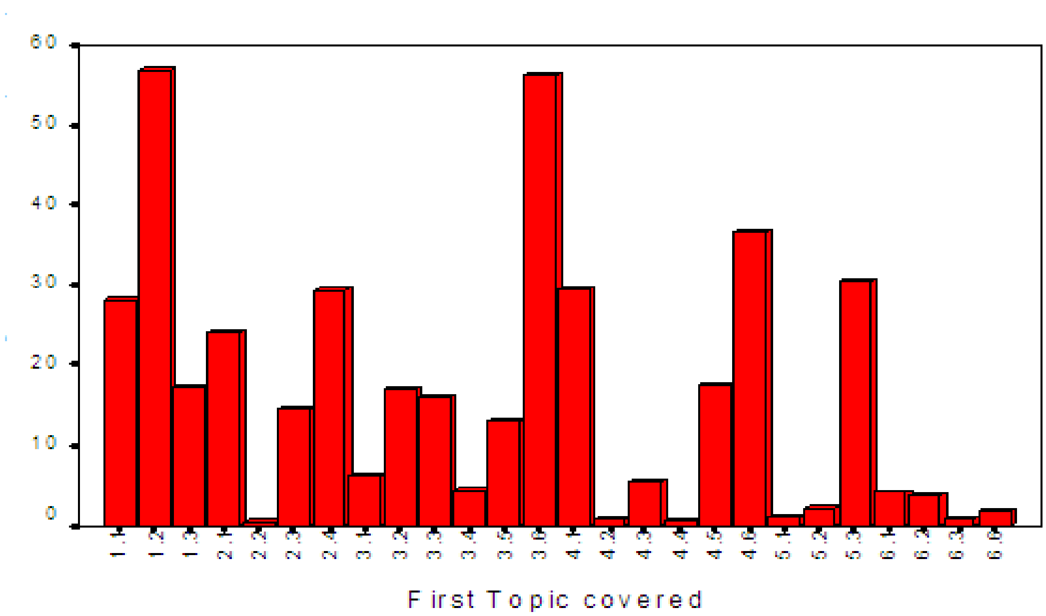


Figure 6.14

TOTAL GRADE PER TOPIC - FINAL EXAM

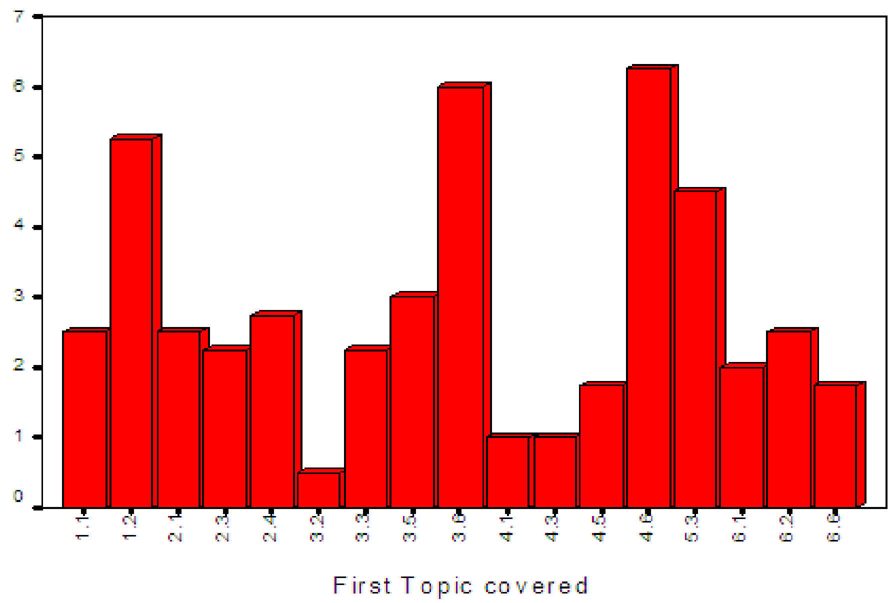


Figure 6.15

TOTAL GRADE PER TOPIC – TEACHER X

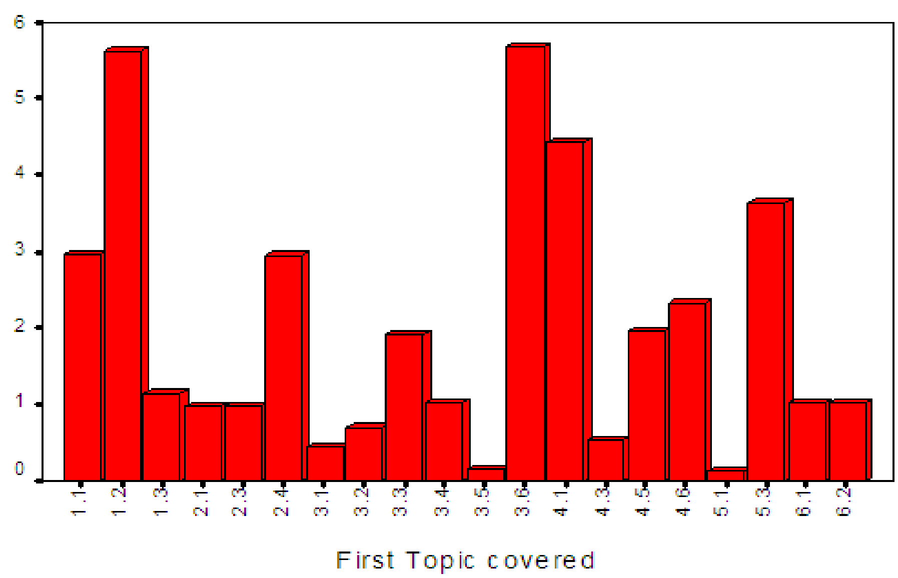
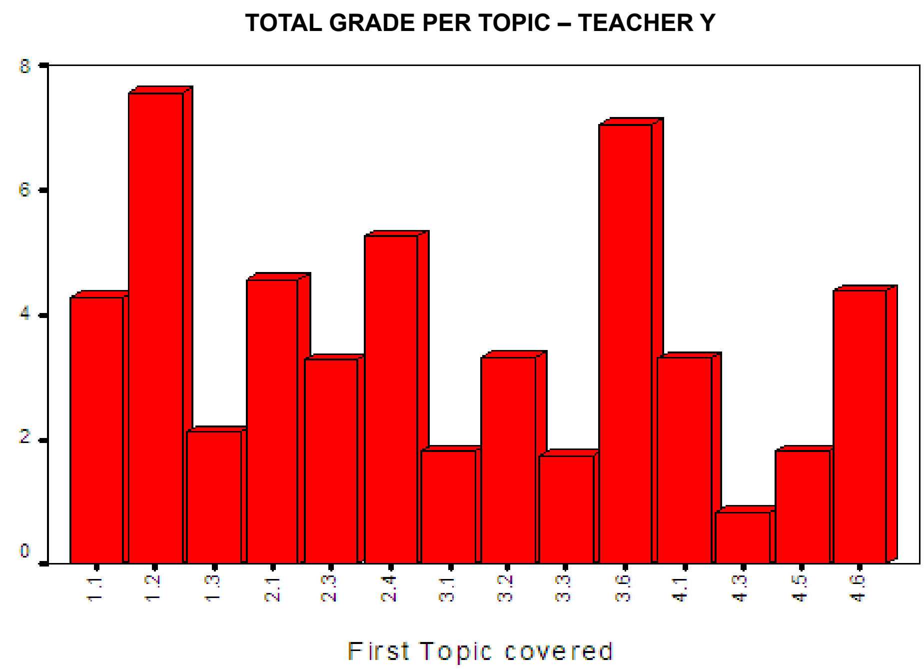


Figure 6.16



Analysis of final course grades - Fall 2003

The overall high school averages of students who took Chemistry NYA in the Fall of 2003 were fairly coherent across the different sections despite two special groups. Section C022 was comprised of students with lower than average high school Chemistry grades. These students were taking part in a special project which provided them with an additional 1.5 hours of instruction per week. Section C011 was an International Baccalaureate class, a class of high-achieving students.

The High School averages were higher and more closely distributed than the first term Cégep grades. Although the pattern of the Chemistry NYA grades were consistent with the pattern of the high school grades, the Department felt that there was room to improve the coherence between the sections.

Figure 6.17

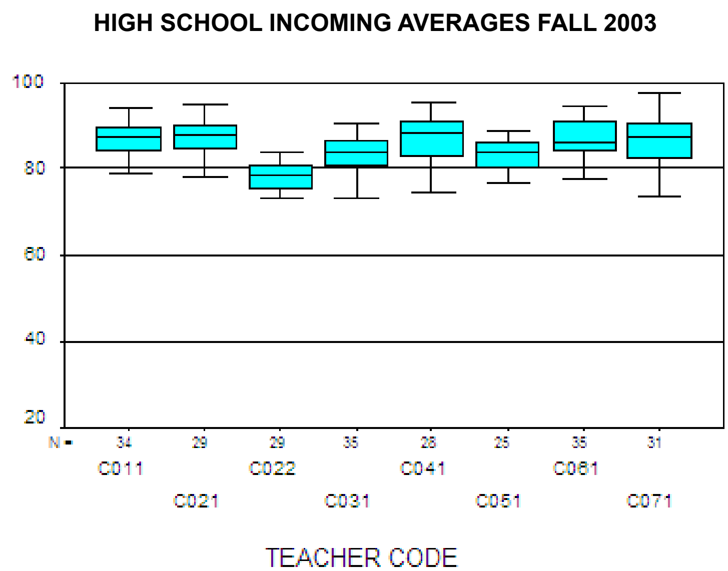
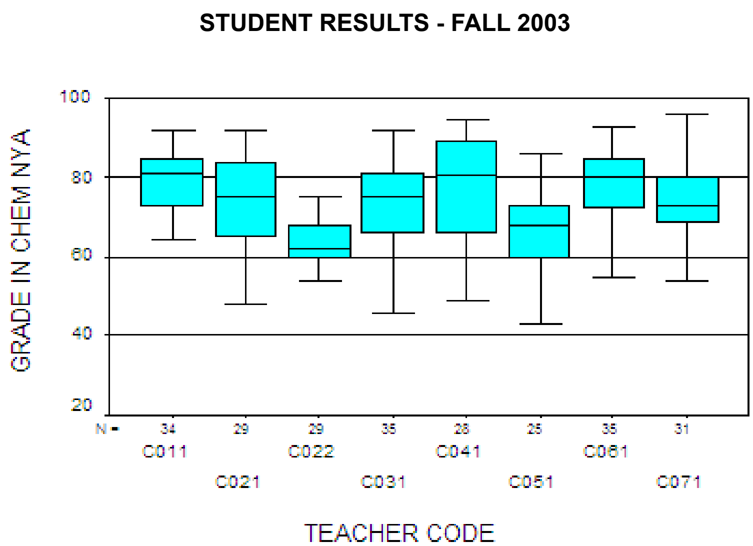


Figure 6.18



Additional analysis comparing in-class grades with the final exam results provoked much discussion. The grades in Figure 6.19 do not include the contribution of the final exam results to the students' grades. However, significant variation in the grades by section was observed when comparing class marks to the final exam marks. In most cases, the final exam grade was lower than the class mark. The Department argued that this phenomenon was due to the fact that the final exam assesses students on the entire course, whereas class tests usually cover only one or two modules within the course.

Figure 6.19

FINAL EXAM RESULTS - FALL 2003

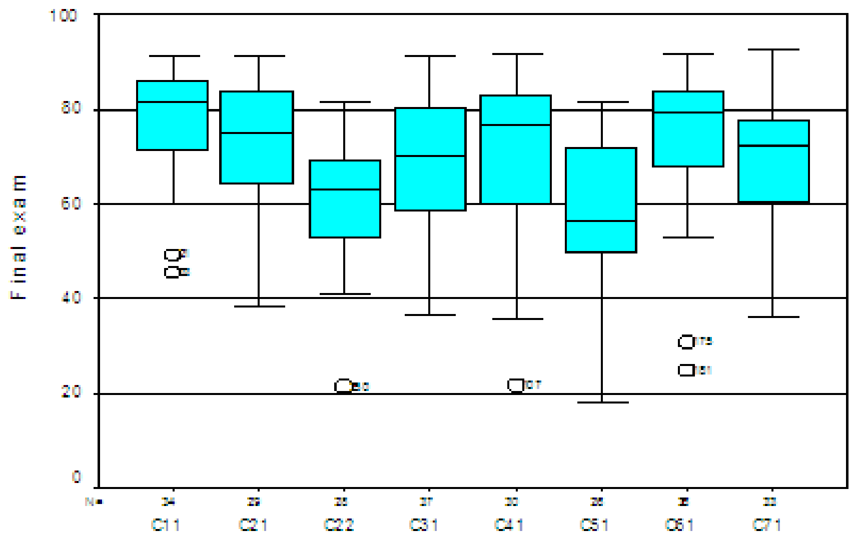
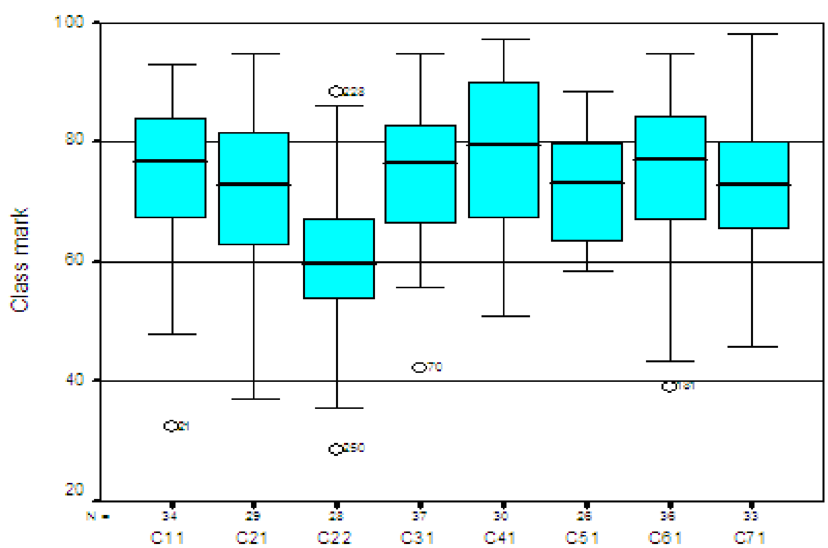


Figure 6.20

IN-CLASS ASSESSMENT RESULTS - FALL 2003



ISSUES AND RESOLUTIONS

Modifications to Chemistry NYA as a result of the study

Table 6.2 summarizes the issues identified and resolutions made by the department after reviewing the analysis of the Fall 2003 courses. The department began to implement these changes in the Fall 2005 semester.

Table 6.2

CHEMISTRY NYA - FALL 2003 ISSUES AND RESOLUTIONS		
ISSUE	**DESCRIPTION OF THE PROBLEM**	**RESOLUTION**
Types of in-class assessment tasks used by different teachers	Although class tests are the primary method of evaluation during the term, most teachers also use quizzes and three teachers also give assignments. One teacher only used class tests.	Types of assessment tasks ideally includes: • minimum of three class tests, • or two class tests and other assessed activities that are equivalent to a test • final exam (required)
Type of knowledge and cognitive complexity of test items.	Type of knowledge being assessed and the level of cognitive complexity being required was heavily focused on conceptual application questions.	An agreement was made to increase the number of conceptual/understand and application questions in assessments
Role of questions that only demand factual knowledge	The department wondered whether this should be increased.	The use of factual knowledge questions should be increased by 2-3% in tests and exams.
Topics	Variation in topics listed on course outlines. The kinetics of chemical reactions module is somewhat rushed at the end of NYA; more time is needed.	• Consensus was reached regarding the topics to be covered in NYA. • Kinetics of chemical reactions was moved into NYB • Colligative Properties was moved onto NYA
Depth of Topics	Concern that some topics can be dealt with at different levels of depth and complexity.	Agreed to increase conceptual/understand and application questions in assessments. Removed organic Chemistry nomenclature, energy calculations of certain non-hydrogen species & De Broglie's principle.
Marking schemes	Guidelines for marking schemes were established	Lab work counts for 20% The final exam can count for 30% or 50% depending on which amount favors the student.

REFLECTION

The history of a strong team spirit and collective pedagogical decision making indicated that the Chemistry Department's first course for science students would be coherent and well aligned. This view was confirmed by the results of the analysis of their assessments. However, there were several inconsistencies that disturbed these teachers sufficiently to promote adjustments to their curriculum and evaluations.

The Curriculum Review Process provided definitive information about the types of knowledge, levels of cognitive complexity and levels of difficulty required by the course. This information became the basis for the discussion of change in their curriculum and assessments. Having acquired a clearer understanding of what they were asking students to do on the quizzes, tests, and the final examination, the teachers were then able to decide what they needed to do in class and laboratories to help students achieve the objectives, and also what types of questions they wanted students to answer. As well, they were able to set standards for measuring student achievement.

As a consequence of the deliberations, guidelines were established for the marking schemes and the number of class tests required. The teachers decided to increase the number of conceptual/understand, conceptual/application, and factual knowledge questions, while reducing the number of items in other categories. The topics covered in the course were also discussed and modified. Subsequently some topics were interchanged with the second course, Chemistry NYB. The SMEs had also coded test and examination questions by level of difficulty. This stimulated a discussion about the relative depth at which each topic should be learned and assessed. Consequently, a major adjustment was made to the final examination for the Fall 2005. The assessment items on that examination were coded and a comparison made with the examination used in Fall 2003.

Rather than recode the entire Chemistry NYA course, the department chose to move on and apply the *Curriculum Review Process* to the department's second course, Chemistry NYB. The two courses work together to provide students with an introduction to general chemistry. Having found the process useful to building a spirit of collegiality and accountability, the Chemistry Department is also planning to analyse the third course in the sequence in the near future. As they complete these analyses and continue the cycle, they hope to see a change in the student's final course marks, with increased coherence and equity across the sections of their courses.

The Chemistry Department is an example of an academic department that has become a true community of practice transferring the *Curriculum Review Process* into a continuous, iterative *Curriculum Review Cycle*. They have and continue to achieve alignment, equity and fairness, which will increase learning for their students and increase job satisfaction for their teachers.

CHAPTER 7

HUMANITIES

CONTENTS

For the Humanities Department, participation in the PAREA project has been a truly transformational experience. When the English Cégeps were being developed in the early 1970s, there was a desire to create a new level of education where students would experience a different environment from that of their secondary school while preparing them for either the workplace or the university. The development of the Humanities program was central to this process. In the French sector, this discipline extended from philosophy departments and the social thinking of the period considered that all post-secondary students should develop thinking skills that questioned the origins of knowledge and how knowledge itself develops. At the same time students were encouraged to question the established social milieu as well as their values and attitudes toward society and other people. The emphasis was on freedom of thought and freedom from established rules and social norms. This was also the era of sexual freedom and the development of gender equality. There was a growing social awareness of different cultures and ideas and a need for tolerance of these. The public English Cégeps were not allied to any particular religion and certainly students were encouraged to evaluate their religious sentiments. All of this encouraged a culture of diversity and teachers of many different disciplines and cultures were attracted to and taught in Humanities Departments.

Champlain's Humanities Department was established in a similar way. There was little direction from the Ministry of Education about course content or methods of instruction. Most of the teachers for these courses also taught courses in other disciplines, but their Humanities course was considered as an opportunity to explore new topics, new ways of learning, and new methods, unfettered by the conventions of their original discipline. For example, a chemistry teacher might offer a course in music appreciation in the Humanities Department, while an English teacher might be teaching a Humanities course with an environmental theme. At that time all Cégep students were expected to complete four Humanities courses, but little attention was paid to curriculum structure and sequence. The approach was often compared to a smorgasbord where the student could pick and choose courses to his or her liking. A given course might also have students from each year of college with first and fourth semester students exchanging ideas and views with their teacher.

This certainly led to the development of diversity within the Humanities Department. The diversity was also coupled with a strong sense that each teacher was the owner of his/her particular courses and was therefore free to develop them independent of any department interference. Each teacher was also at liberty to establish the evaluation scheme and the assignments, tests and learning activities to support it. When the Ministry of Education imposed more structure on Cégep curriculum through the reforms of the 1990s, teachers in this department were obviously upset. First of all the Humanities program was reduced by one course to three required courses.

Each of these courses was to be redeveloped around certain distinct ministerial guidelines such that Humanities 103 should develop students' knowledge about knowledge and its development; Humanities 102 should be focused on varying world views; and the third Humanities course should be organized to explore knowledge and ethics in a way specific to the student's program at college. While seeming to exert more structure on the department, the curriculum reform was to a great degree ignored and the culture of the teacher's individual autonomy persisted.

THE RESEARCH PROCESS

The Humanities Department was first exposed to the problem of differential student success over various sections of their 103 course in a presentation by the Student Success Committee in the fall semester of 2001. The presentation of the problem made several members of the department uncomfortable, and there was certainly a willingness to discuss the situation. However, in the absence of an approach to working on the problem, nothing substantial was accomplished over the following two years. In the Fall of 2003, when our team began to develop our method of approaching the curriculum alignment issue, the Humanities Department coordinator and two teachers were invited to participate in a discussion to determine if the department was prepared to join our project. Subsequently a proposal was made to the department and accepted by them. It was initially decided to analyze the *Knowledge and Media* courses offered by five teachers in the Fall of 2003.

The coding team joined faculty from other participating departments in January of 2004 for a day long seminar that introduced the process of assessment analysis. They then accumulated the required documents which included the course outlines, the tests, quizzes, and assignments for each teacher. The coders began the process of coding the different assessment items and were able to provide the code for the type of knowledge required and the level of cognitive complexity expected for each question. They used Bloom's Taxonomy. There were some ambiguous or undefined questions which had to be described as uncodable. More importantly, when they tried to link the assessment items to topics and objectives, they discovered a major problem. Analysis of the course outlines of even only five teachers revealed that there was a great deal of diversity and variety in the actual objectives, assignments and assessments of these courses. Likewise it was extremely difficult to determine how particular assessment items were linked to the individual's course objectives.

This difficulty led to a lengthy discussion among the three teachers involved in the coding as to the nature of the objectives. In order to achieve a consensus for the common objectives of the five varieties of the course a modified Delphi technique was used. Each teacher's objectives were transferred to small sheets of coloured paper and laid out on a table top. Then, the coders grouped similar objectives and finally summarized them into a format that could be used for the coding process. Further, this exercise stimulated a discussion among the coding team about how the objectives for *Knowledge and Media* course were linked to the ministerial objectives and the designated competencies for the Humanities 103 course.

As a result of this pilot process in the Fall of 2004, the humanities coding team was able to present real data to the department about the *Knowledge and Media* courses and to confront the department with the issues that arose from the diversity of objectives, grading schemes and standards. With this evidence, all the teachers of the department, with a few exceptions, were able to agree to enter into a full scale investigation of their individual versions of the courses as offered in the Fall of 2004. This meant that each teacher agreed to submit all class activities, assignments, quizzes, tests, and term papers that contributed to each student's final course grade. As well they submitted copies of their course outline with the objectives, competencies required, and evaluation schemes used to develop the course and its marks. Early in January 2005 the coding team began the work of coding the assessment items and analyzing the various course outlines. Again the key words were *variety* and *diversity*. The coding team developed their coding dictionary and attempted to bring the individual course objectives together to provide a unified set for coding purposes. Because of the variety of topics across the different sections, there was little to be done with this area. As the coding and discussions continued through the winter of 2005, the coding team became more convinced of a direction that the department should take to bring the various sections into alignment, while providing the teachers with the opportunity to present their individual course. This direction included a common understanding of specific intellectual abilities related to Humanities, general intellectual abilities related to learning and specific course content (Supporting Documents A and B).

A Humanities Department meeting held in the spring of 2005 was presented with preliminary data resulting from the coding process. The department realized through this process that it should address several issues before the beginning of the fall 2005 semester. The department agreed to organize a pedagogical day in late May following the end of classes. The focus of this day was the editing and approval of the coding dictionary developed by the coders, and the editing and approval of the Humanities 103 course objectives. Both goals were accomplished and the group arrived at a consensus that the coding team should finalize the dictionary and objectives and convene another meeting about two weeks later to both approve the final versions and to discuss the implementation of the new objectives in the course sections planned for the Fall of 2005. At this second meeting, further discussion of the issues occurred and the teachers decided that they would like to have a department seminar during the fall semester on the coding and writing of questions for tests and assignments.

For this purpose two sessions were organized in October 2005. Teachers were introduced to Bloom's Taxonomy for coding the types of knowledge and cognitive complexity of each type of question. They were then given a set of sample questions that had been chosen from all the Fall 2004 items that had been analyzed by the coders in the spring of 2005. Each teacher was asked to code the questions. Discussion then followed about the different questions, how they had been coded, and, in some cases, the actual author's intention for the question. At these meetings about coding, the department's teachers became interested in the concept of metacognition and asked that another series of seminars be planned for later in the semester about this concept. Following the second set of seminars, the Humanities Department embraced this concept as a major aspect of their work. In the winter of 2006 the coding team continued their work in leading the department through the development of a handbook of guidelines for the Humanities 103 course; the reorganized course was presented to the department for use in fall 2006. The coding team collected the requisite materials from the teachers for that semester and coded those assessment items during the winter of 2007. A discussion of these results follows the presentation of the situation in 2004.

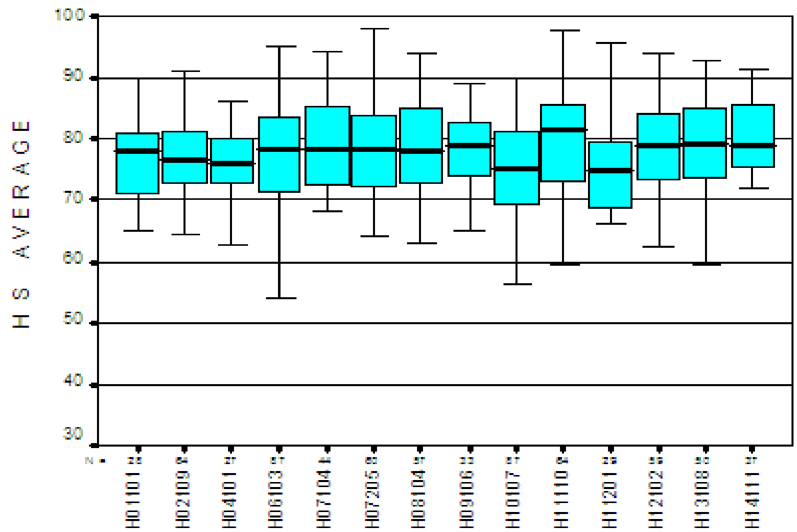
STUDENT RESULTS

Fall 2004

The first step with each department is to compare the distribution of students' incoming high school overall grades with the subject being studied. Student grades are grouped according to the instructor. The following graph illustrates the distribution of the students' high school averages when they entered college in the Fall of 2004. While there is considerable diversity of the high and low high school averages across the different sections of the course as taught by the fourteen teachers, the medians and middle quarters of the groups are fairly aligned.

Figure 7.1

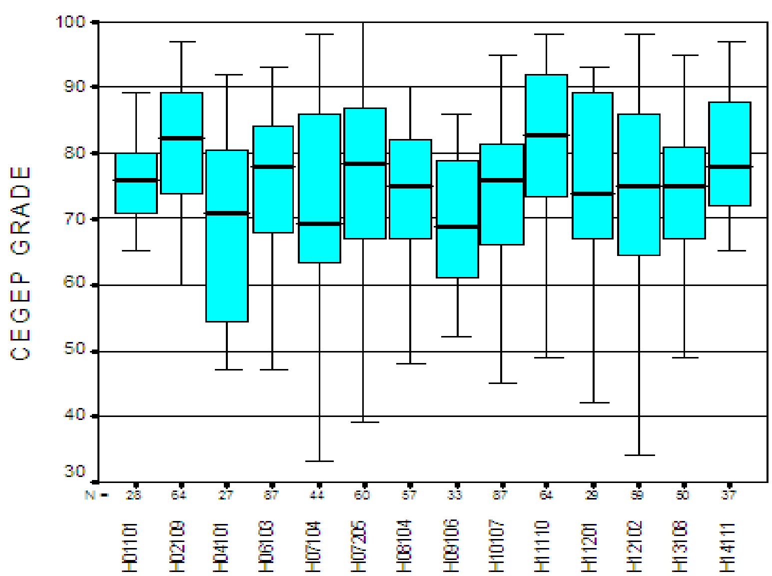
HIGH SCHOOL INCOMING AVERAGES



In contrast, Figure 7.2 illustrates the distribution of the marks for the different teachers' sections at the end of the fall 2004 semester. Comparing the two graphs, one can easily see that there is considerably more diversity in the outcomes of the students after their first Humanities course, than was seen in the high school averages of the same incoming students.

Figure 7.2

STUDENT RESULTS – FALL 2004



The data for previous semesters was similar to this and, when it was presented to the Humanities teachers, there was recognition of a problem. Given this type of data the department was moved to carry out the major investigation of the assessments as described above. Twelve of the fourteen teachers involved in teaching the course participated in the study by providing copies of their course outlines, assignments and tests to the coding committee. Of the two who did not participate, one teacher was unable to complete the semester due to illness and the other was near to retirement. The data resulting from the coding process and the survey of the course outlines is presented on the following pages.

ANALYSIS OF ASSESSMENT TASKS

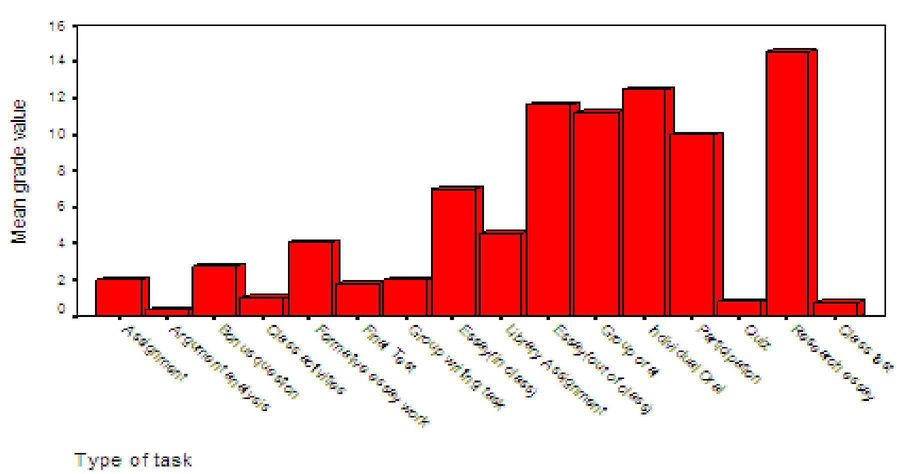
All assessment items are analyzed according to the type and format of task, type of knowledge required, level of cognitive complexity, the objective/s that it measures, and its contribution to a student's final grade.

Type of tasks used in Humanities 103

There are sixteen different types of task being used by the teachers in this course with a preponderance of grades allotted to research and out of class essays. A problem that became evident is that teachers use different names for similar types of activities. Likewise, different grade values are allotted to activities that might require similar amounts of student work.

Figure 7.3

MEAN GRADE ALLOCATED TO TYPE OF TASK

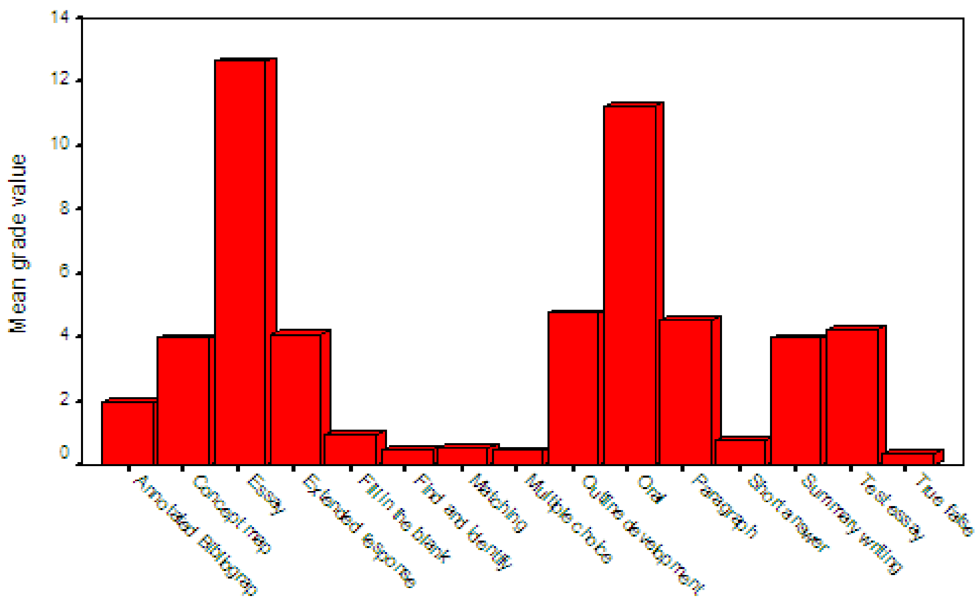


Format of tasks used in Humanities 103

Similarly, one sees diversity and a preponderance of essay work. Not reflected in the graph below is the diversity among the various essay assignments in their types of topics, scope and actual word length requirements. It was realized by the coders that the use of a long essay as an assessment task often disadvantages students with weaker English language skills. As well some students might be tempted by cheating and plagiarism if the task becomes overwhelming.

Figure 7.4

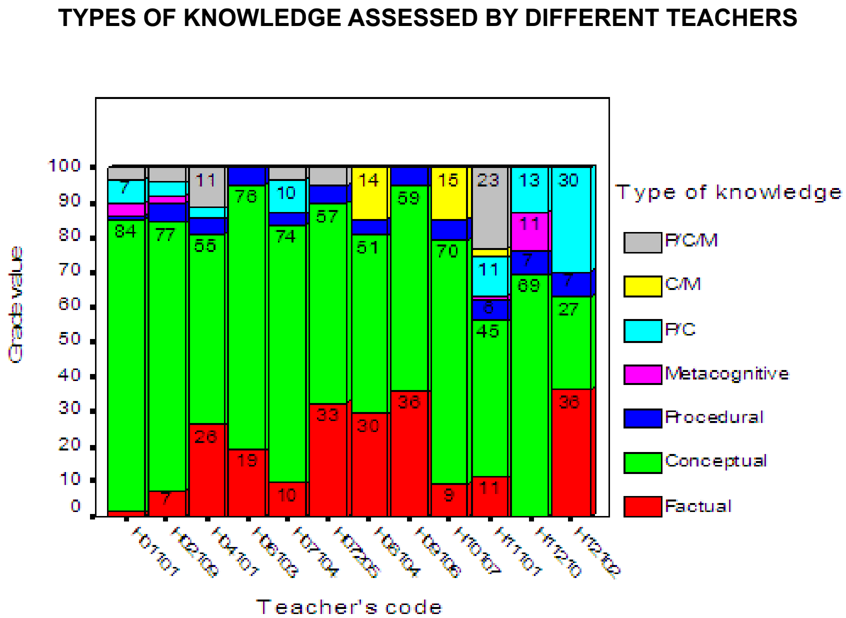
MEAN GRADE ALLOCATED TO FORMAT OF TASK



Comparison of the type of knowledge being assessed by different teachers

As might be expected, the graph below indicates that there is diversity in the types of knowledge that are required of the students. The code P/C is used for items that require both procedural and conceptual knowledge. The code C/M stands for situations requiring students to use both conceptual and metacognitive knowledge and the code P/C/M is used for items requiring procedural, conceptual and metacognitive knowledge. From this data one might observe that these courses, as given in the Fall of 2004, were mainly focused on the development of conceptual knowledge with varying levels of the other types of knowledge.

Figure 7.5

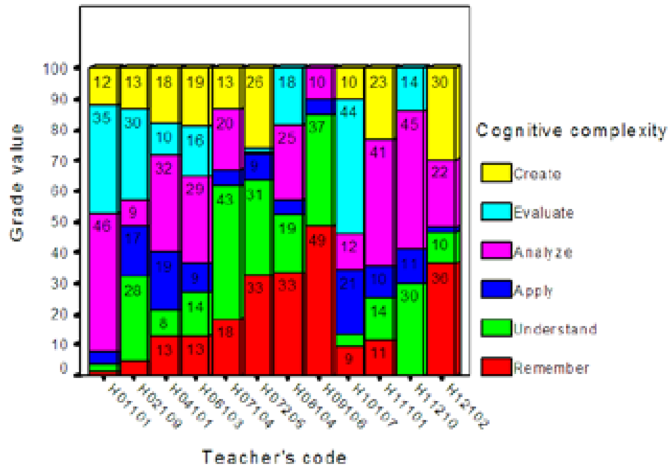


Comparisons of the levels of cognitive complexity assessed by different teachers

In this part of the study one can observe the extent of the diversity across the sections. For example, students in some sections were not required to do any work requiring them to create something new based on their reading or class experience, while in one other section 30% of the grade was based on this kind of task. Likewise, there are many different degrees of the use of tasks requiring students to evaluate or analyze. These three levels of cognitive complexity are considered to be more challenging for students and can make a particular section more difficult than a section with a high level of remember and understand items. This differential in course requirements can be linked to differential grade outcomes in the students if one compares the various sections shown in this chart with the appropriate box plot shown above.

Figure 7.6

LEVELS OF COGNITIVE COMPLEXITY ASSESSED BY DIFFERENT TEACHERS



Relationship between assessment tasks, kinds of knowledge, and cognitive complexity

The following four charts highlight the cognitive demands of different types of assessment tasks. Depending on how these different types and formats of assessment tasks are chosen for a particular section, a teacher can create different levels of difficulty for that section within the course. The intellectual demand of the course is determined by which assessment tasks are chosen to measure student learning.

Figure 7.7

TYPE OF TASK BY TYPE OF KNOWLEDGE

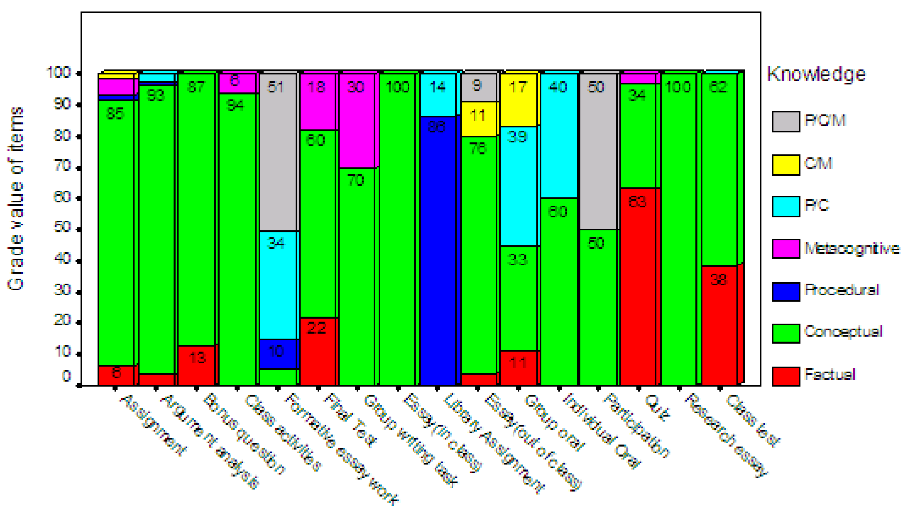


Figure 7.8

TYPE OF TASK BY COGNTIVE COMPLEXITY

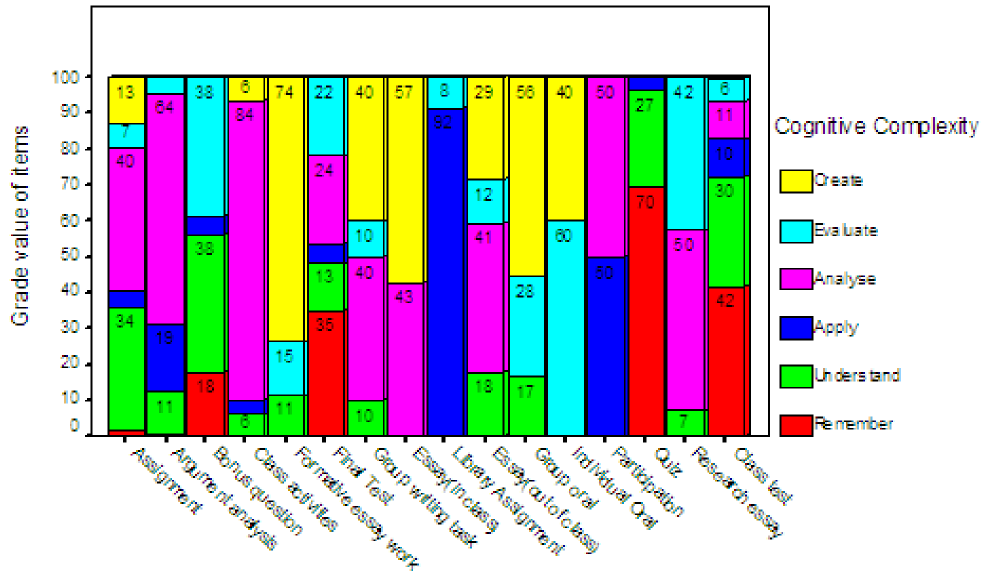


Figure 7.9

FORMAT OF TASK BY TYPE OF KNOWLEDGE

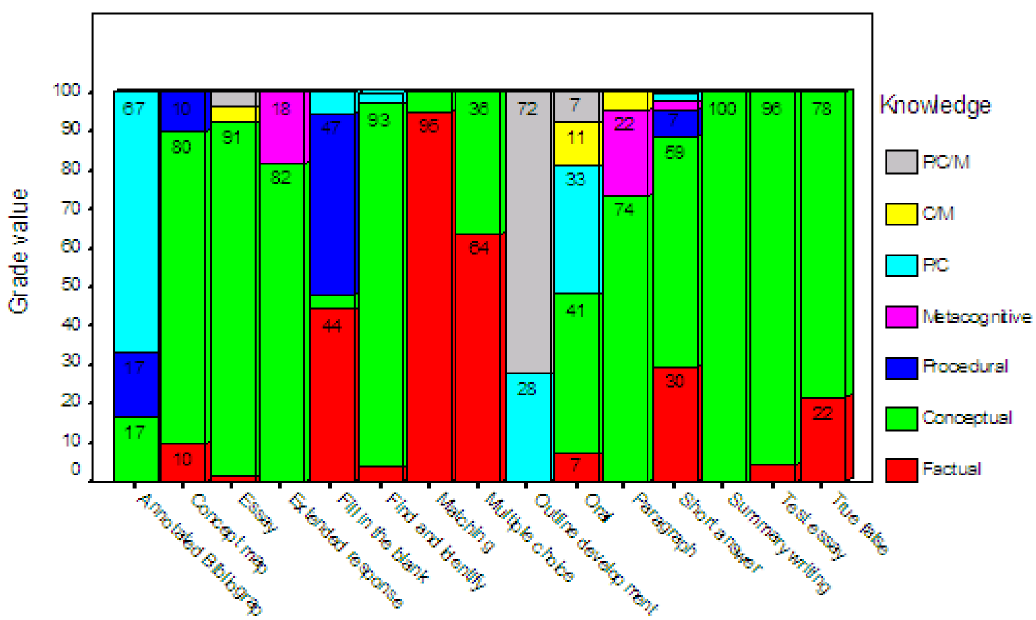
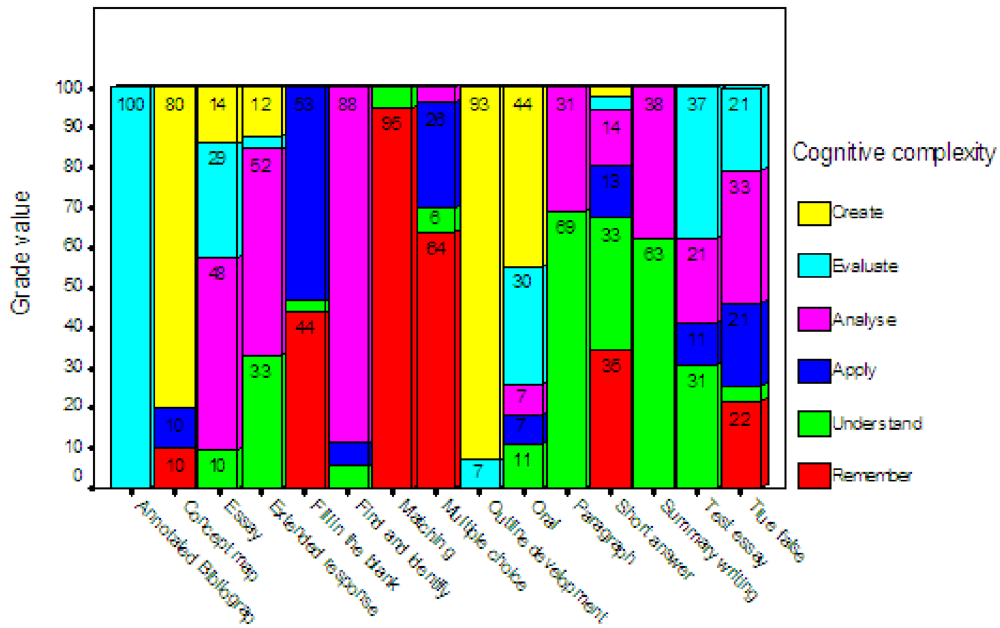


Figure 7.10

FORMAT OF TASK BY COGNITIVE COMPLEXITY



TOWARDS A TRANSFORMATION OF HUMANITIES 103

WINTER 2005 - FALL 2006

Using the results from this analysis to inform their decision-making process, the coding team formulated new curriculum decisions and policies to increase the coherence within and between 103 sections. These proposals were presented to the teachers at department meetings and pedagogical days in the spring and Fall of 2005 and became policy after discussion, revision and the development of a consensus among the department's teachers. Subsequent to this review process the various items have been compiled into a binder which is now provided to every teacher of this course. A summary of the contents of the binder describes the new and current state of this course, which has been in use since the Fall 2006 semester.

The binder opens with the following statement:

> All Humanities courses are multidisciplinary. This means several disciplines must be incorporated into each course. These disciplines should be apparent in the course content and assessed in the evaluation tools.

The evaluation guidelines follow this introduction:

- Attendance should be taken but no marks should be awarded for attendance.
- There should be formative evaluations at the beginning of the semester. The final course mark should accumulate less rapidly at the beginning of the semester so that students can learn from their error and still do well in the course.
- There must be some form of assessment before the official course withdrawal date.
- By mid-term, between 15-30% of the evaluation should be completed.
- There can be no more than 20% of the final mark assigned to in-class tests in the last two weeks of classes.
- All out-of-class assignments worth 20% or more of the final grade must be assigned before the last five weeks of class.

The next section of the binder is the **Humanities Assignments Lexicon** which is based on the coding dictionary that developed as the coders went through the items for the Fall 2004 assessment items (Supporting Document C). The lexicon provides definitions to differentiate among the various types of testing instruments: quiz, test, final test and examination. This had been problematic in the initial coding process. Several teachers used the term quiz but actually demanded tasks requiring a whole teaching period, covering several weeks of instruction. Students might approach their studying differently for a quiz as compared to studying for a test. The lexicon also provides definitions of the various types of writing tasks used by teachers in this department, such as essay, research essay, test essay, outlines reports and summary. It sets word limits on the different exercises and explains the types of work required for each tasks' completion. Likewise there is a description of the other types of assessments that may be used in these sections. These are items such as an argument analysis, bonus questions, class activity, concept mapping, group-writing tasks, library assignment, note-taking assignment, oral presentation, and self-assessment. Establishing these guidelines will increase standardisation of the student workload across the sections while the teacher is still free to determine the content on which the assignment is based.

The binder also includes an extensive section on the coding process and introduces Bloom's taxonomy and the levels of cognitive complexity. It explains these terms and gives the reader examples of what is required of a student at the different levels. There is a series of Humanities questions that have been coded to show examples of the different types of questions that might be asked at the different levels. There is a section dedicated to how teachers should establish criteria and standards for grading. Included in this section are examples of the rubrics used to correct various assignment and suggestions for adjusting scales to diminish the possibility of grade inflation.

The **Humanities 103 Curriculum Guidelines** (Supporting Document A) provide the following description of the course and ministerial standards:

> **General Course Description**
>
> The 103 course is the first in the sequence of three Humanities courses. The focus of this course is knowledge. Students analyze knowledge claims and the reasons behind such claims. They also acquire college level critical thinking, research, note taking and communication skills. The underlying goal is to increase students' metacognitive awareness, understood as both their knowledge about knowledge and their comprehension of their own learning process. The title-specific content of a course is the vehicle for teaching these concepts and skills.
>
> **Summary of Ministerial standards**
>
> At the conclusion of this course, students will be able to define and describe the organization, uses and limitations of knowledge within a multidisciplinary context. Student will also be able to apply, analyze and evaluate the relevance of historical context and the uses and limitations of a selected form of knowledge.
>
> Throughout the course students will be expected to use correct terminology and appropriate reference material in a series of assignments, including a significant written component.

The **Evaluation Guidelines** define a range of value to be allotted to each type of assignment and assessment instrument. Then there are ranges of value that should be allotted for each of the course components: knowledge, critical thinking, specific course content, research and library skills, and integrated assignments. Percentage guidelines are given for each type of knowledge and the levels of cognitive complexity required by the assessment tasks. The department has also indicated the maximum and minimum values for various assessments and set various length limits for major assignments and essays. Teachers are directed to provide the library assignment during the first five weeks of the course. The guidelines also establish that no marks are to be assigned for participation or presence. They suggest that participation in a class activity can be evaluated in the form of quizzes, reports, or other concrete tasks. Planning charts are provided so that each teacher can balance the various aspects of the assignments when planning his/her specific course.

Continuing in the **Overview** section one also finds summaries of the compulsory and optional aspects of the knowledge component, critical thinking component, and skills components of the course. More details for each of these components are provided in separate sections elsewhere in the binder. For example, the section for the knowledge component introduces the teacher to the Perry Schema of Adult Cognitive Development which the department found as interesting way of viewing how they were involved in the cognitive development of first semester students as they move through the positions of dualism and multiplicity (Moore, 1994). There are also extensive definitions and examples of classroom exercises for developing the skills required by this component. Theoretical background is provided through relevant articles to supplement teacher knowledge. In addition to the overview of the requirements, there is a major section of the binder that is dedicated to the development of critical thinking in the students. Again one finds definitions of terms and suggestions for teaching this section as well as sample exercises for students. Similar sections of the binder are dedicated to note-taking, and library assignment.

After the realization that each teacher was actually teaching to different course objectives, the coders had to formulate a set of objectives to use in the coding process. During the winter semester of 2005 a good deal of effort was spent on formulating a set of objectives which were presented to the department and ratified at subsequent meetings. There are three objectives that are common to all courses relevant to the development of knowledge:

1. Reflect on the concept of knowledge and your development as a “knower.”
2. Describe basic criteria for knowledge and truth claims.
3. Understand and use appropriate terminology.

Then there are four more objectives that are related to the development of skills:

4. Communicate effectively through correct and coherent writing, and clear oral communication.
5. Demonstrate critical thinking skills through reading critically and analyzing arguments
6. Develop effective note-taking skills
7. Demonstrate reliable research skills

Finally each of the specific courses within the Humanities 103 group has three to eight objectives related to the specific course content. These course specific objectives were also developed through discussions with the teachers who developed and taught those specific courses and then were presented to the department as a whole for their approval.

The Humanities Department was introduced to the concept of **metacognition** at the coding workshops in the Fall of 2005. In thinking about this type of knowledge their was a collective discovery that much of what is to be accomplished in the courses of this department was in the category of metacognition, even though few assessment items of this type were actually being used. The teachers wished to explore this further and as mentioned above a set of workshops was organized to more fully explore this phenomenon and how it could be applied within the courses. At that time the teachers defined metacognition as follows:

- Reflecting on what knowledge is
- Thinking about how we think; “cognizing” about one’s own cognition; becoming conscious of the thought process
- Thinking about how we learn
- Organizing knowledge self-consciously
- Stepping back to reflect on “the box,” not what’s in the box; being able to be in and out of the box at the same time
- Evaluating and reflecting on self-progress; monitoring the effectiveness of one’s learning strategies; understanding where one is as a learner and creating a plan for improvement.

The section of the binder dedicated to the **Developing Students’ Metacognitive Awareness** describes how these definitions fit with the objectives of the 103 Course. It shows the links between Psychology and Philosophy and the three different course components, Learning Skills, Theories of Knowledge and Critical Thinking. There are suggestions for developing metacognitive learning activities and examples of questions and activities to foster the development of metacognitive ability.

The binder establishes a new approach to Humanities 103 based on a new consensus among the current faculty. This approach was implemented in the fall semester of 2006 after being reviewed and presented to new faculty members just before the semester began in August 2006. During that semester each teacher was asked to submit all assessment items to the department coordinator and thus to the coding team. The coders have now gone through the process a second time and coded those items in the same way as they had for the courses offered in Fall 2004. Tables 7.1, 7.2, and 7.3 present data about the types and formats of assessment tasks used by the thirteen teachers of the different sections of Humanities 103 in fall 2006. These indicate that there is still diversity across the sections on the number of assessment items that a student can use to demonstrate their learning with a range of 87 items in one section versus 18 in another. This seems to imply that teachers are still acting independently when it comes to the actual implementation of the course and production of assessment tasks. The data also shows that most teachers are conforming to the course requirement for a research essay as a common type of assessment across all sections.

Table 7.1

THE NUMBER OF ASSESSMENT TASKS USED IN EACH SECTION IN FALL 2006

Teacher Code	Frequency	Percent
H01	49	7.2
H02	78	11.5
H03	53	7.8
H04	46	6.8
H05	54	8.0
H06	56	8.3
H07	87	12.9
H08	68	10.0
H09	35	5.2
H10	49	7.2
H11	47	6.9
H12	37	5.5
H13	18	2.7
Total	677	100.0

Table 7.2

THE TYPE OF ASSESSMENT TASKS USED BY TEACHERS IN FALL 2006

Type of Task	Frequency	Percent
Assignment	93	13.7
Argument Analysis	51	7.5
Bonus Question	3	0.4
Class Activities	55	8.1
Formative Essay Work	6	0.9
In Class Essay	2	0.3
Library Assignment	13	1.9
Group Oral Presentation	8	1.2
Individual Presentation	3	0.4
Quiz	12	1.8
Research Essay	32	4.7
Class Test	399	58.9
Total	677	100.0

Table 7.3

THE FORMAT OF ASSESSMENT TASKS USED BY TEACHERS IN FALL 2006

Format of Task	Frequency	Percent
Annotated Bibliography	5	0.7
Concept Map	3	0.4
Essay	26	3.8
Extended Response	35	5.2
Fill in the blank	28	3.8
Find and Identify	63	7.8
Matching	11	1.6
Multiple Choice	122	18.0
Outline Development	10	1.5
Oral Presentation	11	1.8
Paragraph	47	6.9
Short Answer	284	41.9
Summary Writing	9	1.3
Test Essay	6	0.9
True/False	29	4.3
Total	677	100.0

When one compares the types of knowledge assessed by the different teachers in Fall 2004 (Figure 7.5) with that assessed in Fall 2006 (Figure 7.11), a considerable difference is seen. In keeping with the guidelines established by the departmental consensus, there has been a reduction of items demanding factual knowledge and an increase in items requiring conceptual, procedural and metacognitive knowledge. There were very few uncodable items. Likewise, comparing the levels of cognitive complexity demanded in fall 2004 (Figure 7.6) with those of fall 2006 (Figure 7.12), there is a shift from a very diverse pattern to one where there is a more even distribution of tasks that require higher levels of thinking such as analyze, evaluate and create. Again this reflects the guidelines that were established and presented in the information binder.

Figure 7.11

TYPES OF KNOWLEDGE ASSESSED BY DIFFERENT TEACHERS IN 2006

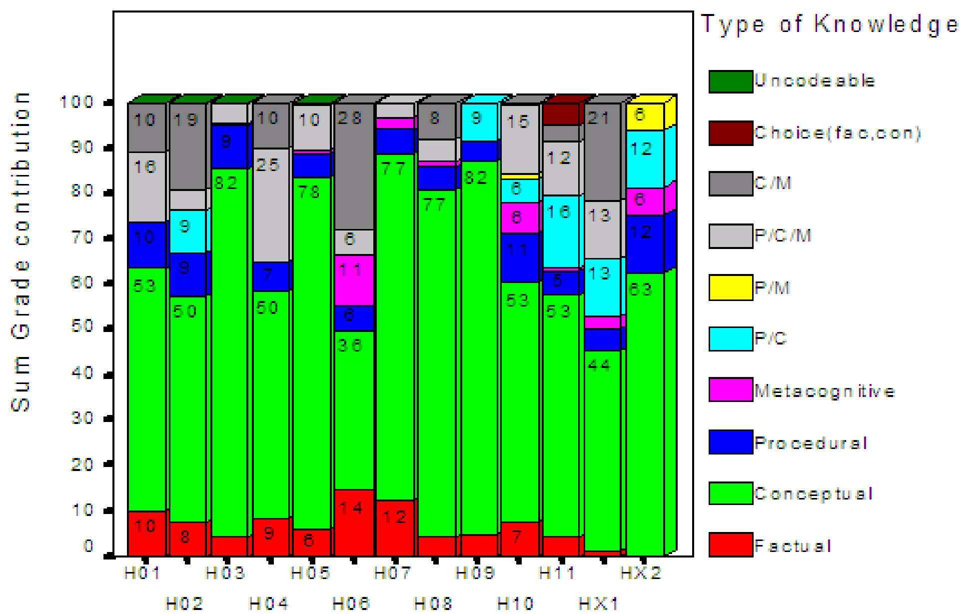
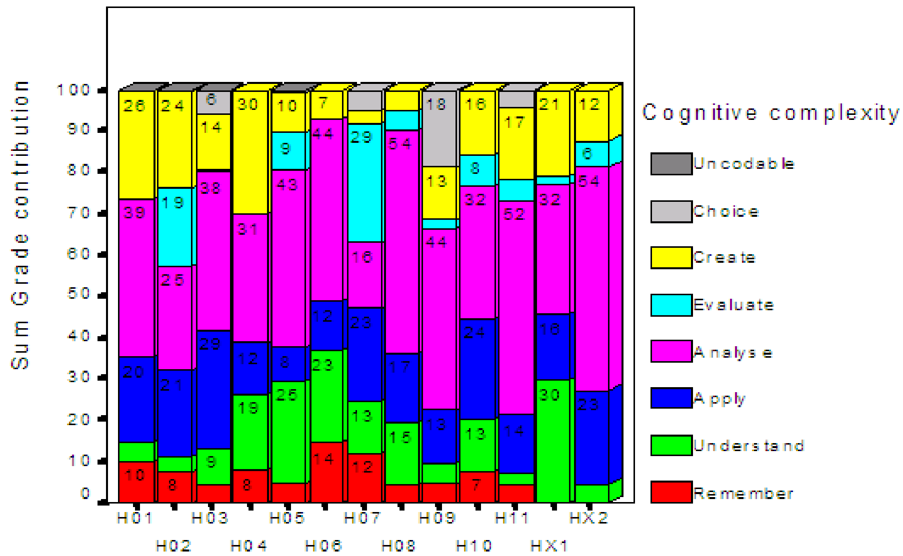


Figure 7.12

LEVELS OF COGNITIVE COMPLEXITY ASSESSED BY DIFFERENT TEACHERS



Furthermore, it is useful to compare the coverage of the objectives across the sections of the course. In Fall 2004 there had been such a diversity of objectives that it was impossible to make any meaningful comparison. After the work done on course revision, the department developed a set of seven common objectives that should be attained in each section. These are oriented in the direction of the processes that students should master in the development of their skills for dealing with the nature of knowledge, argument analysis, and critical thinking. As well basic academic skills, such as using the library, and citing of references are covered in this group. Figure 7.13 indicates that now there is a fairly even pattern of the assessment of these objectives across all sections. Then there are objectives that are particular to the course content through which the students develop these skills. These are considered as objectives 8+. As expected there is more variability as seen in Figure 7.14. Each specific course has a different number of objectives specific to the content and the teachers have the freedom to develop their courses in this regard.

Figure 7.13

MARKS ALLOTTED TO GENERAL COURSE OBJECTIVES 1-7

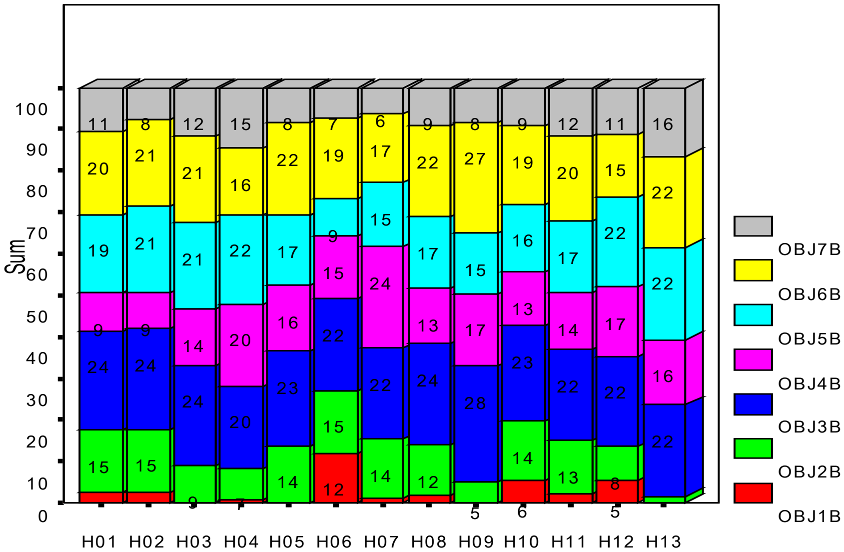
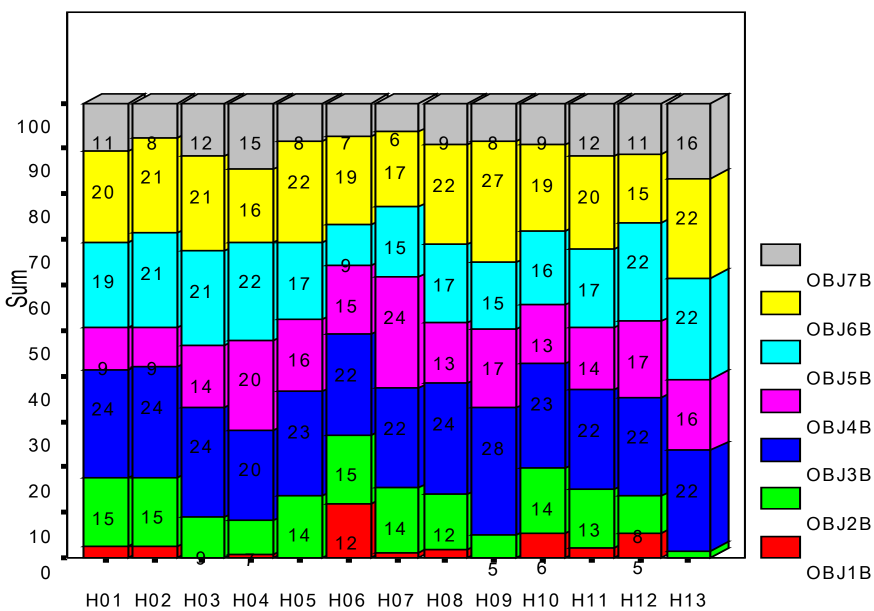


Figure 7.14

MARKS ALLOTTED TO THE COURSE SPECIFIC (8+) OBJECTIVES



A major goal of this project was to improve the coherence across courses with multiple sections and to ensure that there is equity across the sections in the assessment of student learning. The analysis of the Fall 2006 curriculum indicates that for the Humanities department this goal was achieved. When student results were compared there appeared to be less variation among the median grades and in the upper quartile of each teacher's grades.

Figure 7.15 presents the distribution of high school grades for each Humanities teacher in Fall 2006 and indicates that there is an even distribution of student ability across the sections.

Figure 7.15

HIGH SCHOOL INCOMING AVERAGES

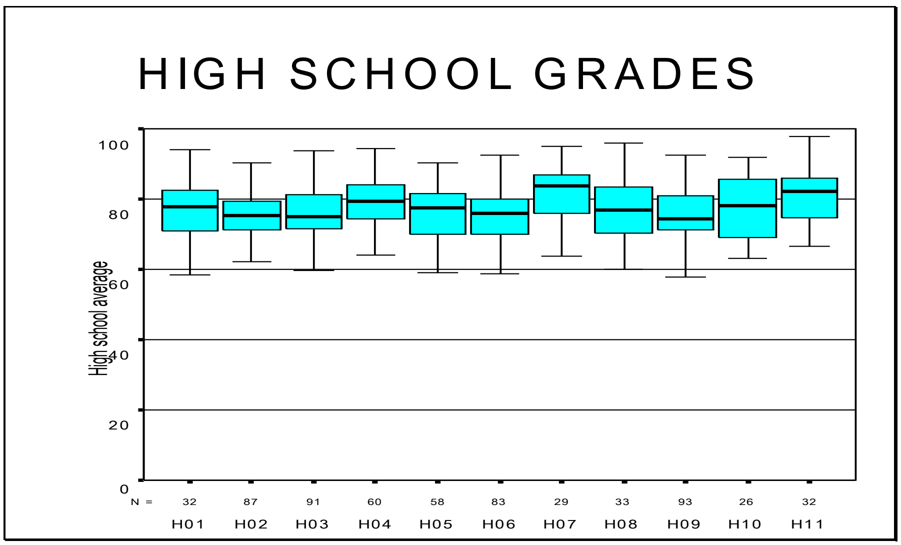
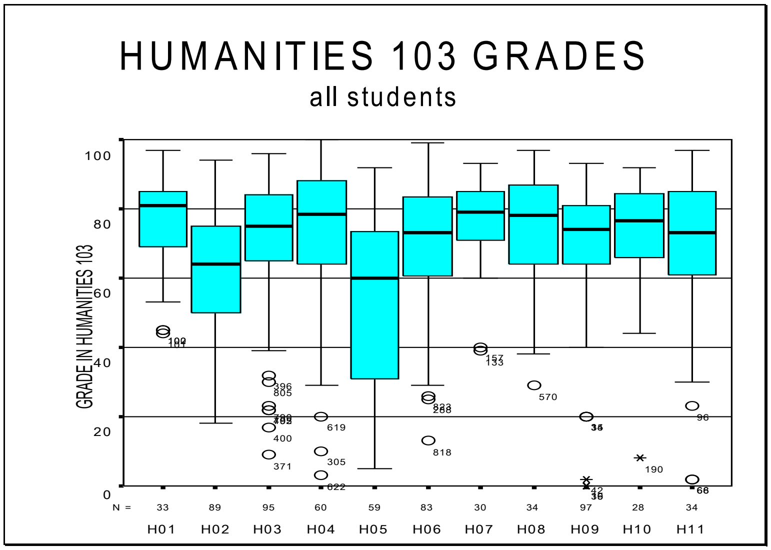


Figure 7.16 shows the distribution of the student grades for the same teachers at the end of the semester.

Figure 7.16

STUDENT RESULTS – FALL 2006



Unfortunately, comparing this graph with Figure 7.2, it is obvious that there is still a wide variation in the final mark distribution across the sections, with some sections having rather high failure rates. The Humanities teachers are currently thinking about explanations for this pattern and addressing some of the other factors that may be causing this. In the meantime they have already analyzed their second course Humanities 102 which focuses on world views, and are in the process of revising it.

REFLECTION

Diversity and individual freedom of thought and expression are values of the teachers of the Humanities Department. Through their participation in the project these teachers realized that the unrestrained expression of their individual freedoms could ultimately lead to such wide spread variation across the sections of the Humanities 103 course that there was inequity in the opportunity for students to learn and to be successful on the assessment tasks that measured their learning.

This new awareness led to the realignment of the 103 curriculum along with an attempt to make implicit learning goals, such as metacognition, explicit. Although the initial analysis of assessment items showed few tasks requiring metacognitive knowledge, these teachers became interested in this aspect and realized that one of their major roles was the development of metacognition within their students. They also realized that their teaching should focus on the development of intellectual and scholarly skills, while using individual course content as the vehicle to teach these skills. As a result, the department has formulated a much more coherent approach to their Humanities 103 Course, as shown in the comparison of the Fall 2004 and Fall 2006 semesters, while providing the individual teachers with the opportunity of teaching their special course content in individual ways.

Through the process of implementing these modifications to their curriculum, this department has developed a much stronger sense of community and has become more cognizant of the requirements for new teachers and how to best support them when they join the department. Subsequently the department has some new measures for teacher evaluation. With the completion of the second round of the curriculum review process for Humanities 103, they have acquired a real sense of accomplishment in aligning their course on the basis of the objectives, the types of knowledge and the levels of cognitive complexity expected of the students. While it is awkward that their students have not shown better results as an outcome of all the work, the department members are involved in investigating the situation further, in order to improve the student marks and pass rates.

Through the leadership and commitment of the coding team and the department coordinator, the department has embraced the process and been motivated from within to continue it through the investigation of their other courses.

SUPPORTING DOCUMENT A

103 COURSES: KNOWLEDGE

DESCRIPTION

The 103 course is the first in the sequence of three Humanities courses. The focus of this course is knowledge. Students analyze knowledge claims and the reasons behind such claims. They also acquire college-level critical thinking, research, note-taking and communication skills. The underlying goal is to increase students' metacognitive awareness, understood as both their knowledge about knowledge and their comprehension of their own learning process. The title-specific content of a course is the vehicle for teaching these concepts and skills.

SUMMARY OF MINISTERIAL STANDARDS

At the conclusion of this course, students will be able to define and describe the organization, uses and limitations of knowledge within a multidisciplinary context. Students will also be able to apply, analyze and evaluate the relevance of historical context and the uses and limitations of a selected form of knowledge.

Throughout the course students will be expected to use correct terminology and appropriate reference material in a series of assignments, including a significant written component.

EVALUATION GUIDELINES

1. The percentage ranges for different kinds of assignments are as follows:

library assignment	5%
oral presentation	10-20%
tests	30-45%
essay assignments	30-45%
other	maximum of 20%

2. The percentage ranges for the different course components are as follows:

knowledge concepts	10-15%
critical thinking skills	15-25%
specific course content	25%
research	library assignment plus major essay
integrated assignments (including knowledge concepts)	30%

3. The types of knowledge assessed should follow these guidelines:

factual	10-20%
conceptual	30-50%
procedural	30-50%
metacognitive	10-35%

4. The levels of cognitive complexity should follow these guidelines:

remember	10-20%
understand / apply / analyze	60-70%
evaluate / create	15-20%

5. The maximum value of any one assignment or form of evaluation is 20%.

6. A maximum of 20% of the value of an essay-style assignment may be for the assessment of correct use of the English language.

7. The required library assignment should be given within the first 5 weeks of class.

8. The maximum length of a major summative essay assignment is 1000 words. Only one essay of this length may be required in a course. If an additional non-test summative essay is required, its maximum length should not exceed 500 words.

9. There are no marks awarded for participation. Participation in a class activity can be evaluated in the form of quizzes, reports or other concrete tasks.

10. As the term progresses, assessment tasks should integrate various course components rather than focus on memorizing terms or applying concepts in a limited context.

Course Planning Sheets
Blank charts are available to help teachers plan their assessments according to the recommended percentage ranges.

KNOWLEDGE COMPONENT: FOUNDATION OF 103 COURSES

The first two objectives of the 103 course concern knowledge. Thus this component can be considered the foundation of the 103 courses. Of the 60 hours allotted to this course, 45 of them are to be devoted to the knowledge component and the title-specific content of the course. The knowledge concepts may be introduced as a separate subject, but the goal is ultimately to integrate them with the specific content of the course.

The required and optional elements of this course component follow.

	Required	*Optional*
THEORIES OF TRUTH	Correspondence Coherence Constructivist	Correspondence + constructivist
THEORIES OF KNOWLEDGE AND THEIR CRITIQUES	Scepticism Relativism Rationalism Empiricism	Pragmatism Positivism Postmodernism Feminisms
SOURCES OF JUSTIFICATION AND THEIR CRITIQUES	Reason Coherence Perception a. Sense perception (personal observation and eyewitness accounts) b. Introspection (intuition/insight) Memory (both personal memory and cultural memory, i.e. history) Scientific method Expert authorities	Tradition/habit/socialization Embodied experience Faith/spiritual Revelation Education New science
TERMS AND ADDITIONAL CONCEPTS	Truth Knowledge Belief Reality Culture Role of language	Nonpropositional knowledge (e.g. knowledge by acquaintance versus by description; art as knowledge) Ideology Dominant ideology/dominant culture/ominant knowledge system Cultural paradigm Paradigm shift

CRITICAL THINKING COMPONENT

Fifteen of the 60 hours are designated for teaching and practicing critical thinking skills.

Two or more specific evaluation tasks representing 15-25% of the final grade must be related to the acquisition of critical thinking skills.

The following are the goals and required elements for this component of the course.

DESIRED LEARNING OUTCOMES

Our students should be able to:

- identify the conclusion, supporting reasons (premises) and unstated assumptions when reading a paragraph
- construct a logical, cohesive and unified argument
- identify the most common informal fallacies
- assess the quality of evidence and arguments.

REQUIRED CONCEPTS

1. Distinction between fact and opinion, or between objective and subjective beliefs (related concepts: truth, rationality, role of emotions, scientific method)

2. Difference between an argument and a claim
   a. Know that an argument should have
      - a conclusion
      - premises (supporting reasons)
      - unstated assumptions that lead the premises to the conclusion

   b. Understand that a claim is a mere statement, assertion or proposition

   c. Discern what is not an argument
      - series of facts without a defended conclusion
      - expression of emotions
      - series of questions
      - description

3. Identification of the main types of fallacies

   a. Slippery slope (exaggeration of the consequences when the outcome is not actually known)

   b. Appeal to popularity ("getting on the bandwagon" because "everyone says so")

   c. Begging the question (presupposing in the premises the conclusion that has to be demonstrated from the premises)

   d. Appeal to inappropriate authority

   e. Attacking the person rather than the idea

CRITICAL THINKING CONCEPTS, CONT.

f. False dilemma (suggesting "either…or" when other options exist)

g. Red herring (changing the subject)

h. Argument from ignorance ("since X has not been proved false, it is therefore true")

i. Hasty generalization (forming a general proposition from insufficient or flawed evidence)

4. Identification of assumptions (premises or conclusions for which no evidence is given)
   a. recognition of how unstated assumptions underlie reasoning and though not proven, are taken as true
   b. introduction to the difference between normative and descriptive assumptions (optional)

5. Evaluation of evidence
   a. recognition of different sources of evidence, e.g. authority, personal observation, intuition, research studies, etc.
   b. criteria for accepting or rejecting claims (distinction between reliable and unreliable information)

6. Distinction between inductive and deductive reasoning
   a. Inductive: method of reasoning that proceeds from particular instances to forming a general, universal proposition
   b. Deductive: method of proof that derives a particular conclusion from a general proposition. Teachers may decide to include distinction between formal validity and soundness.

7. Introduction to misleading statistics
   a. faulty charts
   b. bad polls (poorly designed survey questions)
   c. biased sample
   d. inappropriate sample size
   e. dated sample
   f. bias in gathering and interpretation

8. Consistent use and clarity of terminology

SKILLS COMPONENT

In this first Humanities course students are expected to learn college-level academic skills. Thus teachers need to teach, foster and assess the following abilities.

NOTE TAKING

Good note taking is critical to students' academic success. The 103 course introduces students to effective techniques and evaluates them (either directly or indirectly) on their note-taking ability. Learning this skill should be emphasized in the first month of classes. See the note-taking section in the binder for ideas on how to teach and assess it.

RESEARCH

Research is required for the final or major essay assignment of the course. The goal is that students become familiar with using basic research tools and with properly crediting sources in a major written assignment.

Students are required to

- Use material from 2-5 peer-reviewed or academic research sources. These include:
    a. books
    b. reputable websites
    c. databases
    d. published articles
    e. reports
    f. government documents
    g. textbook from another course
    h. interview
    i. film, performance, artwork, musical composition, television or radio program
    j. peer-reviewed encyclopedias (Philosophy, Religion, Social Science)

    Non-credited sources for consultation include:
    a. general encyclopedias
    b. course text or material
    c. dictionaries

- integrate materials from the approved sources in the assignment
- cite properly in the text of the assignment
- prepare a bibliography
- use either APA or MLA style consistently and correctly

EFFECTIVE WRITTEN AND ORAL COMMUNICATION

Students need feedback to improve their writing and presenting skills. Criteria should be distributed that lists the abilities students are aiming to achieve. The section in the binder on marking criteria includes ideas on how to provide effective feedback.

SUPPORTING DOCUMENT B

EDUCATION AND SOCIAL CHANGE

ALL 103 COURSES	1. Reflect on the concept of knowledge and your development as a "knower" 2. Describe basic criteria for knowledge and truth claims 3. Understand and use appropriate terminology
SKILLS FOR ALL 103 COURSES	4. Communicate effectively through • correct and coherent writing • clear oral communication 5. Demonstrate critical thinking skills through • reading critically • analyzing arguments • formulating good arguments 6. Develop effective note-taking skills 7. Demonstrate reliable research skills
SPECIFIC TO "EDUCATION AND SOCIAL CHANGE"	8. Analyze key educational theories and movements 9. Gain broader understanding of the effectiveness of educational practices 10. Gain broader understanding of the wider social implications of educational practices

KNOWLEDGE AND MEDIA

ALL 103 COURSES	1. Reflect on the concept of knowledge and your development as a "knower" 2. Describe basic criteria for knowledge and truth claims 3. Understand and use appropriate terminology
SKILLS FOR ALL 103 COURSES	4. Communicate effectively through • correct and coherent writing • clear oral communication 5. Demonstrate critical thinking skills through • reading critically • analysing arguments • formulating good arguments 6. Develop effective note-taking skills 7. Demonstrate reliable research skills
SPECIFIC TO "KNOWLEDGE AND MEDIA"	8. Explore the strengths and weaknesses of various media as sources of knowledge 9. Develop visual literacy 10. Describe how changes in media throughout history have shaped the way we communicate 11. Address important media issues that challenge our times 12. Recognize various critical perspectives used to analyse the media 13. Examine ways individuals can use the media to create social change

KNOWLEDGE AND CONSPIRACY THEORIES

ALL 103 COURSES	1. Reflect on the concept of knowledge and your development as a "knower" 2. Describe basic criteria for knowledge and truth claims 3. Understand and use appropriate terminology
SKILLS FOR ALL 103 COURSES	4. Communicate effectively through • correct and coherent writing • clear oral communication 5. Demonstrate critical thinking skills through • reading critically • analysing arguments • formulating good arguments 6. Develop effective note-taking skills 7. Demonstrate reliable research skills
SPECIFIC TO "KNOWLEDGE AND CONSPIRACY THEORIES"	8. Explain the history, beliefs and key concepts of several conspiracies and secret societies. 9. Examine various approaches to the study of conspiracies and secret societies. 10. Analyse and evaluate types and instances of truth claims made by conspiracy theories and secret societies. 11. Compare and contrast normative theories of knowledge maintained by established institutions versus atypical theories of knowledge held by fringe groups. 12. Examine the manipulation of knowledge to achieve various social, political, scientific, and religious goals in the past and the present time.

KNOWLEDGE, SCIENCE AND PHILOSOPHY

ALL 103 COURSES	1. Reflect on the concept of knowledge and your development as a “knower” 2. Describe basic criteria for knowledge and truth claims 3. Understand and use appropriate terminology
SKILLS FOR ALL 103 COURSES	4. Communicate effectively through • correct and coherent writing • clear oral communication 5. Demonstrate critical thinking skills through • reading critically • analysing arguments • formulating good arguments 6. Develop effective note-taking skills 7. Demonstrate reliable research skills
SPECIFIC TO “KNOWLEDGE, SCIENCE, AND PHILOSOPHY”	8. Identify the different factors influencing the development of knowledge 9. Understand the historical and social development of different forms of knowledge 10. Differentiate between knowledge and pseudo-knowledge 11. Distinguish between science and philosophy 12. Identify limits on the quantity and kinds of knowledge provided by science and philosophy 13. Explore various theories and methods of inquiry related to cosmology

RELIGION AND KNOWLEDGE

ALL 103 COURSES	1. Reflect on the concept of knowledge and your development as a "knower" 2. Describe basic criteria for knowledge and truth claims 3. Understand and use appropriate terminology
SKILLS FOR ALL 103 COURSES	4. Communicate effectively through • correct and coherent writing • clear oral communication 5. Demonstrate critical thinking skills through • reading critically • analysing arguments • formulating good arguments 6. Develop effective note-taking skills 7. Demonstrate reliable research skills
SPECIFIC TO "RELIGION AND KNOWLEDGE"	8. Study various approaches to religion as a constant human pursuit. 9. Examine the history, beliefs and practices of several world religions. 10. Examine and evaluate religious claims to knowledge. 11. Compare and contrast scientific and social scientific knowledge with religious knowledge. 12. Examine some key concepts in philosophy of religion. 13. Examine how religion affects us and our society.

SCIENCE AND HISTORY

<table>
<tr><td>ALL 103 COURSES</td><td>1. Reflect on the concept of knowledge and your development as a “knower”
2. Describe basic criteria for knowledge and truth claims
3. Understand and use appropriate terminology</td></tr>
<tr><td>SKILLS FOR ALL 103 COURSES</td><td>4. Communicate effectively through
• correct and coherent writing
• clear oral communication
5. Demonstrate critical thinking skills through
• reading critically
• analysing arguments
• formulating good arguments
6. Develop effective note-taking skills
7. Demonstrate reliable research skills</td></tr>
<tr><td>SPECIFIC TO “SCIENCE AND HISTORY”</td><td>8. Examine how one comes to know in science
9. Recognize how science’s way of knowing has revolutionized our way of life
10. Understand the historical context of the development of scientific knowledge
11. Recognize uses and possible limitations of science and history</td></tr>
</table>

THE VISION OF ART

ALL 103 COURSES	1. Reflect on the concept of knowledge and your development as a "knower" 2. Describe basic criteria for knowledge and truth claims 3. Understand and use appropriate terminology
SKILLS FOR ALL 103 COURSES	4. Communicate effectively through • correct and coherent writing • clear oral communication 5. Demonstrate critical thinking skills through • reading critically • analysing arguments • formulating good arguments 6. Develop effective note-taking skills 7. Demonstrate reliable research skills
SPECIFIC TO "THE VISION OF ART"	8. Identify how visual works of art are created 9. Develop visual literacy 10. Analyze how knowledge is constructed by the artist 11. Analyze how the artist's construction of knowledge is understood by the viewer 12. Understand how and why art can be a persuasive and controversial form of information 13. Assess the value and accuracy of the knowledge gained from art 14. Understand historical context

KNOWLEDGE IN THE ANCIENT WORLD

ALL 103 COURSES	1. Reflect on the concept of knowledge and your development as a "knower" 2. Describe basic criteria for knowledge and truth claims 3. Understand and use appropriate terminology
SKILLS FOR ALL 103 COURSES	4. Communicate effectively through • correct and coherent writing • clear oral communication 5. Demonstrate critical thinking skills through • reading critically • analysing arguments • formulating good arguments 6. Develop effective note-taking skills 7. Demonstrate reliable research skills
SPECIFIC TO "KNOWLEDGE IN THE ANCIENT WORLD"	8. Understand theories of knowledge from the classical age 9. Understand the historical context of this period 10. Explain the application of knowledge in the ancient world

GENDER AND KNOWLEDGE

ALL 103 COURSES	1. Reflect on the concept of knowledge and your development as a "knower" 2. Describe basic criteria for knowledge and truth claims 3. Understand and use appropriate terminology
SKILLS FOR ALL 103 COURSES	4. Communicate effectively through • correct and coherent writing • clear oral communication 5. Demonstrate critical thinking skills through • reading critically • analysing arguments • formulating good arguments 6. Develop effective note-taking skills 7. Demonstrate reliable research skills
SPECIFIC TO "GENDER AND KNOWLEDGE"	8. Understand the relationship between gender and learning, thinking and knowledge 9. Understand how society influences the ways gender is experienced and expressed 10. Determine whether men and women produce different kinds of knowledge at different times in history

DEVELOPMENT OF KNOWLEDGE

ALL 103 COURSES	1. Reflect on the concept of knowledge and your development as a "knower" 2. Describe basic criteria for knowledge and truth claims 3. Understand and use appropriate terminology
SKILLS FOR ALL 103 COURSES	4. Communicate effectively through • correct and coherent writing • clear oral communication 5. Demonstrate critical thinking skills through • reading critically • analysing arguments • formulating good arguments 6. Develop effective note-taking skills 7. Demonstrate reliable research skills
SPECIFIC TO "DEVELOPMENT OF KNOWLEDGE"	8. Explore the development of knowledge in a particular field. 9. Understand the application of this knowledge in a particular field. 10. Understand the limitations of a particular field of knowledge. 11. Gain a broader understanding of the wider implications resulting from the development of a particular field of knowledge.

SUPPORTING DOCUMENT C

HUMANITIES ASSIGNMENTS LEXICON

The following are some of the definitions developed during the PAREA research to code course assessments. Department members are asked to follow these guidelines when naming class assignments. Some of the more critical distinctions are between the following:

- a quiz versus a test
- a final test versus a test
- a test versus an exam
- an essay versus an extended response
- a research essay versus an essay.

TESTING	
Quiz	An in-class evaluation which is worth less than 10%, takes no more than 30 minutes to complete, and does not require the student to study more than about two weeks of material.
Test	An in-class evaluation that is worth 10% or more and requires the student to study more than one month of material.
Final Test	A test given at the end of the term during class time that requires students to synthesize course content and skills.
Exam	A final test given during the exam period that requires students to synthesize course content and skills.
WRITING TASKS	
Essay	A written assignment of 750 words or more, requiring an introduction and a conclusion. It may be written either in class or at home.
Research Essay	An essay written at home that requires students to integrate ideas from between 2 and 5 academic sources, cite them correctly, and submit a bibliography following MLA or APA formats.
Test Essay	An essay written as part of a test that is between 500 and 750 words and follows proper essay format. The topic may be given beforehand.
Extended Response	An answer under 500 words requiring one or two paragraphs but not requiring an introduction or conclusion.
Paragraph	A written assignment of less than 300 words having a topic sentence and a unifying idea.
Short Answer	A written answer that is approximately 1 to 5 lines, or up to 2 sentences long.
Annotated Bibliography	Usually part of the preparation of a major essay. The references are briefly summarized and are correctly formatted.
Outline	This is a preparatory step in writing an essay. The thesis, main points and structure of the argument are summarized. The bibliography is normally included.
Journal	A written assignment extended over the semester that requires students to write personal responses to issues raised in the course.
Portfolio Assignment	Students perfect previously marked assignment so that it demonstrates their best work.
Reflection Paper	A short essay of less than 700 words, not requiring special research that involves critically discussing a controversial issue examined in class.
Report	A written summary of a field trip or guest speaker’s presentation.
Summary	A written summary of a longer piece of writing.

OTHER ASSESSMENTS	
Argument Analysis	The student is provided with a reading passage and must identify elements of an argument and any logical fallacies within it.
Bonus Question	A question allotted marks over and above the test total.
Class Activity	Any form of group or individual work (for example a workshop) that is limited to the class period and is graded.
Concept Map	A diagrammatic representation of the relationship between concepts.
Creative Project	A major assignment that requires students to apply or synthesize concepts in a new context.
Group Writing Task	A writing task completed by more than one person in which all participants are evaluated in the same way.
Library Assignment	A 103 assignment created to introduce students to searching techniques in an academic library.
Note-Taking Assignment	An assignment targeted at improving students' note-taking ability.
Oral Presentation	An assignment presented orally to the class and assessed for both content and oral presentation skills. The presentation may be delivered by an individual or a group.
Self-Assessment	Students complete assignments' criteria sheets to develop their metacognitive ability. Normally graded as satisfactory/unsatisfactory or done/not done.

CHAPTER 8

PHYSICS

CONTENTS

The Physics Department of Champlain St-Lambert consisted of six full-time tenured teachers and two non-permanent faculty members in the fall semester of 2003. The department primarily offers courses for students enrolled in the science program and these courses are generally basic introductions to the discipline. Students enter this program with some background as a result of their high school science and physics courses but only have a limited knowledge of the subject matter. Ministerial guidelines suggest that practical applications of physics should be the focus of the three courses that are required of all science program students: Physics NYA, NYB and NYC.

A number of issues were raised about the teaching of physics during the Science Program Evaluation that was completed during the winter of 2003. For example, the survey of graduates and teachers indicated that the teaching methods used were generally well adapted to serve the needs of good students, but they did not necessarily address some of the difficulties encountered by average or weaker students. In addition, the perception of many students was that different sections of the same course had different emphasis and content. There was variety in the marking schemes used to assess students in these multi-section courses. The number of tests and quizzes were different, as was the relative weight of each. Also, a few teachers gave final exams, while most teachers did not. Students thought that the various assessment tasks were at different levels of difficulty and were graded differently by different teachers. There were also variations in the number of lab exercises completed in each section.

In the years preceding the evaluation, the culture of the department was individualistic and, as a consequence, all curriculum and pedagogical decisions were made by each teacher separately. The department had come to accommodate the diversity of individuals who did not seem to share a common vision about the goals of the course or philosophy of teaching. This resulted in a wide variation among sections, a situation that was acceptable to the department members. However, the variation and lack of coherence appeared to have a negative impact on the results of the students in the first semester course, Physics NYA.

Data compiled for the Science Program Evaluation about the Physics NYA final marks at the end of the 2001 and 2002 fall semesters illustrated that there were large differences between sections taught by different teachers. When the final course marks were compared with the student's incoming high school marks dramatic differences were seen. The students entering these courses were among the best students in high school and were selected because of their high achievement. At the end of the first semester, many of these high achieving students failed Physics NYA. Statistical analysis indicated that while there was no significant difference between the sections at entry, but there was a significant difference in the outcomes. In many sections the failure rate was between 25 and 50%. This type of data was shown to the physics teachers as part of the student success initiative in 2001 and again was presented as part of the follow up of the Science Program Evaluation. Student results for fall 2004, seen in Figures 8.15 and 8.16 at the end of this chapter, illustrate this problem. One of the recommendations of the Science Program Evaluation Committee was that they address this lack of coherence by becoming involved in the PAREA project on curriculum alignment. Thus, this department joined this research project in the fall semester of 2004.

THE RESEARCH PROCESS

After the Physics Department decided to join our project in the fall of 2004, they chose two members to represent them as subject-matter experts, a role referred to in this project as "the coders." These two faculty members joined individuals from other departments at a training workshop given by the PAREA team in January 2005. The purpose of this training workshop was to familiarize the coders with the Curriculum Review Process and to educate them in how to apply Bloom's Taxonomy to the types of questions asked on assessment tasks. All course outlines and assessment tasks for Physics NYA sections taught during fall 2004 semester were collected. These documents were compiled and prepared for analysis by the PAREA team. Each section was assigned a code and all identifying information that connected the particular teacher and the section was removed to ensure anonymity and reduce the possibility of bias.

As a first step, the coders perused the course outlines to determine the general degree to which they were coherent across the various sections of the same course. In the case of Physics NYA, the stated objectives and topics to be covered were identical, for all sections. However, there was considerable variation in the assessment schemes. Each course had a laboratory component that provided 10%-15% of the final course grade and, in conformity with the science program requirements, an Integrative Activity that provided 5%. Beyond that agreement there were many variations in how the final mark was assessed. While a few teachers opted for a final exam, most teachers based most of the final mark on the results of class tests. Some teachers gave quizzes that counted toward the final mark, others did not.

The coders then began the task of numbering the items in each assessment task. In many cases it was necessary to assign more than one item value to a particular question as it was made up of several sub-questions. Both coders worked together on this task. They were then ready to start to apply Bloom's taxonomy to analyze the assessment tasks for type of knowledge and level of cognitive complexity required by each item. As well they determined the grade value of each item and the course objective addressed. Each coder analyzed the items independently and, then, they met together with one member of the PAREA research team to compare their coding. This comparison of the codes provided them with opportunity to discuss the application of the taxonomy and to improve the inter-rater reliability. Initially, there were strong disagreements between the two coders. The main reason the coders gave for their disagreement was that the conceptual and procedural categories of Bloom's taxonomy are too broad and cannot be easily applied in physics. They then agreed to define conceptual questions as the ones that addressed principles and laws, theories, graphical interpretations and diagram construction. Essentially, questions that do not require calculations were coded as conceptual questions. Procedural questions were defined as those that require the use of an algorithm and/or a mathematical solution. These questions usually require more than one step. The coders realized that it was necessary to differentiate the level of computational complexity (apparent difficulty of the required algebraic solution) in procedural questions. The coders devised a four-level scale to indicate computational complexity:

Level 1: One equation with one unknown

Level 2: Two equations with two unknowns or a sequence of several Level 1steps

Level 3: Three equations with three unknowns or a sequence of any type of Level 2 steps

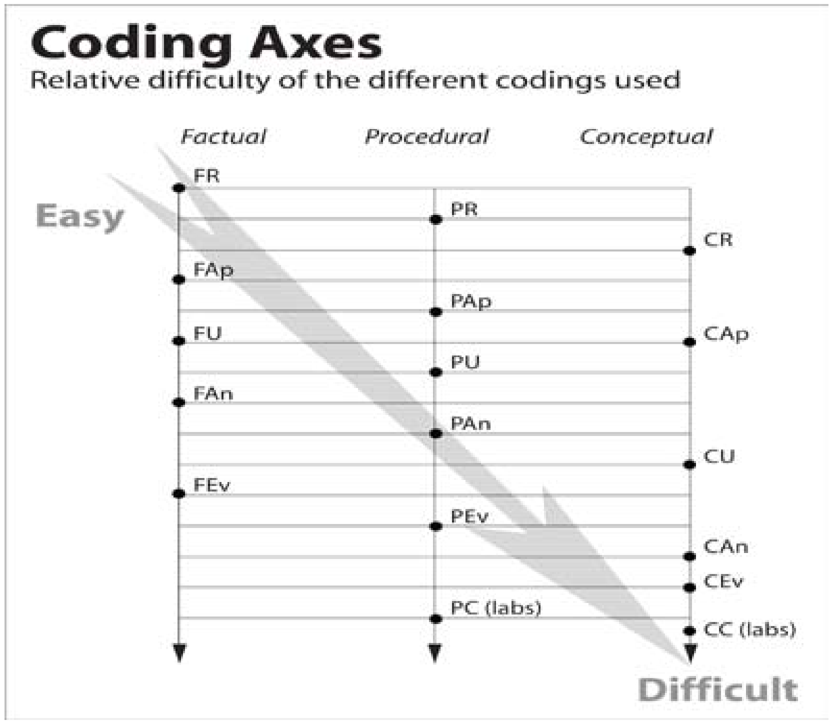
Level 4: Anything beyond level 3

The coders continued coding individually over the summer of 2005 using this scale and then met to compare their results in the fall. There were still unresolved disagreements. After much discussion, it was decided to develop an adjusted taxonomy for this discipline. Using Bloom's taxonomy required the separation of types of knowledge from cognitive complexity and it did not take into account the inherent difficulty of topics that become progressively more sophisticated as the course progresses. In addition, their computational complexity scale seemed to be inadequate. These realizations led the coding team to develop a discipline-specific taxonomy for physics.

This unique taxonomy merges their four levels of computational complexity with Bloom's types of knowledge and levels of cognitive complexity creating a taxonomy which represents the thinking processes that students use as they learn introductory physics. It also reorganizes the positioning of *understanding* in Bloom's taxonomy and treating it as a much more complex level of thinking, when compared to *apply*, in terms of learning Physics. For example, most students can learn to apply a formula in physics, but that does not prove that they have understood the principles underlying that formula.

Figure 8.1 provides a graphic representation of how the levels of thinking progress from easy to difficult; Table 8.1 provides a definition for each level of thinking; and in *Supporting Document A* the reader can find a definition of each of level of thinking with an accompanying example.

Figure 8.1



Coding Axes
Relative difficulty of the different codings used
Factual
Procedural
Conceptual
Easy
FR
PR
CR
FAp
PAp
FU
CAp
PU
FAn
PAn
CU
FEv
PEv
CAn
CEv
PC (labs)
CC (labs)
Difficult

Table 8.1 -

PHYSICS TAXONOMY OF THINKING SKILLS

SYMBOL	CODE	DEFINITION
FR	Factual/Remember	Recollection of information; easiest type of question
FAp	Factual/Application	Uses only one equation and the solution can be found by applying a single computation, plugging-into formula type questions. It requires applying a definition to a specific situation.
FU	Factual/Understand	Requires a verbal or drawn component and often contains student misconceptions about a phenomenon.
FAn	Factual/Analyze	Definition is under discussion.
FEv	Factual/Evaluate	Requires that students evaluate collected data and determine its reliability. Used primarily in lab-exercises or lab-quiz contexts.
PR	Procedural/Remember	Remembering a set of steps to solve a problem without actually solving the problem.
PAp	Procedural/Application	Requires a sequence of steps. Questions at this level can usually be broken down into a sequence of factual steps.
PU	Procedural/Understand	Do not have a numerical solution but require several steps to solve.
PAn	Procedural/Analysis	Requires two or more concepts to be applied in order to solve. may also require a combination of two or more concepts in a non-trivial way, which may generate two or more possible solutions.
PEv	Procedural/Evaluate	Using simple rule of propagation of uncertainties to evaluate the uncertainty on a calculated result.
PC (labs)	Procedural/Create	Writing a lab report or recording information in a logbook requires procedural/create thought processes.
CR	Conceptual/Remember	Requires problem solving that involves recalling a concept instead of a fact.
CAp	Conceptual/Application	Require the application of a concept such as Newton's Third Law, the conservation of energy or the conservation of momentum. If the question requires the drawing of a free body diagram, showing the external forces on the body, before solving it, it is coded in this category.
CU	Conceptual/Understand	Difficult in nature because there is no procedure to determine the solution since these problems usually don't have numbers or representation by symbols
CAn	Conceptual/Analyze	Requires that the learner sets up the problem before proceeding to find a solution; unguided questions.
CEv	Conceptual/Evaluate	Used in lab reports. Building a hypothesis, discussing results using uncertainties, or evaluating the sources of errors would fall in this category.
CC (labs)	Conceptual/Create	Used in lab reports. The labs where the students are asked to create their own procedure would fall into this category.

ANALYSIS OF ASSESSMENT TASKS

In February 2006 the Physics department met to consider the results of the study. During the first meeting the coders explained how the taxonomy had been derived and applied. Examples of different assessment items were presented. At the second meeting, the statistical analysis of the coded data was presented. This data resulted from the information collected from seven teachers representing eight sections and required the coding of a total of 672 individual assessment tasks from the Physics NYA courses offered in fall 2004. Lab activities were not included in the study.

Distribution of items coded and their contribution to final grades across sections

The first thing noted by the coders was a large discrepancy in the number of assessment items being used to measure student learning in each section. Table 8.2 indicates that at the extremes a student with teacher P021 answered 171 items, while a student in the section taught by P051 only had 29 items to answer to achieve a final grade. As a result of further analysis, the coders realized that teachers who presented a large number of items most often used test questions made up of several graded sub–questions. These questions lead students towards a solution to an over-all problem, while providing the opportunity for students to accumulate marks for the intermediate steps needed for the solution.

Table 8.2

THE NUMBER OF ASSESSMENT ITEMS IN EACH SECTION

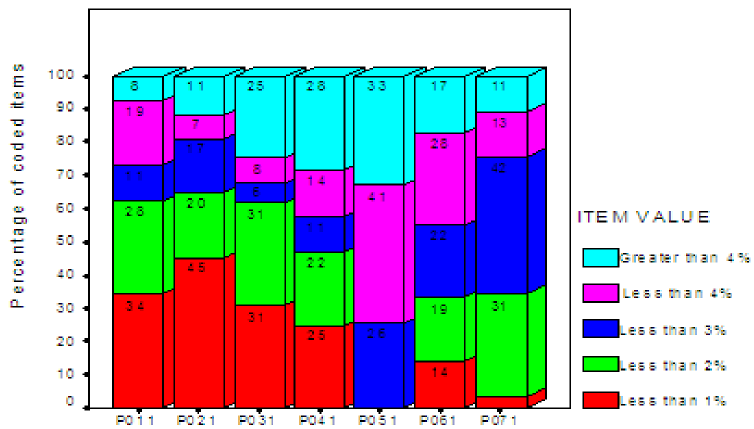
COURSE	NO OF ITEMS	RELATIVE MARK VALUE PER ITEM
P011	106	0.94
P021	171	0.58
P031	122	0.82
P041	110	0.91
P051	29	3.45
P061	77	1.30
P071	57	1.75
Total	672	

Figure 8.2 illustrates the same issue from another perspective. In this case the relative value of each assessment item's contribution to the final mark is shown by teacher. Again taking the extremes, most items presented to students in the section taught by teacher P021 were worth less than one course mark, whereas most of the items presented to students in the section taught by teacher P051, were worth more than three course marks. Thus the students in one section had

more chances to score marks than in the other. In addition, the students exposed to more assessment items spent more time on task and consequently had more opportunity to learn (Doyle, 1983). In these cases, the assessment task simultaneously served as a learning activity.

Figure 8.2

RELATIVE VALUE OF ASSESSMENT ITEMS

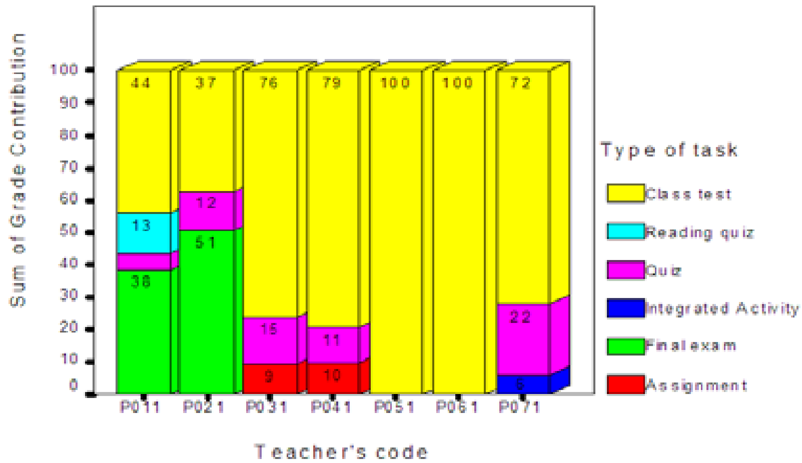


Comparison of Types of Tasks Used in Physics NYA

Figure 8.3 indicates that there were considerable differences in the types of tasks used to measure student learning in Physics NYA. It appears that two teachers base their grades on class tests only, while two other teachers have between 38% and 50% of the final grades based on a final exam. Further investigation revealed that Teachers P051 and P061 do use quizzes but they are not graded or were not available to be coded. Only one teacher uses a reading quiz. No consensus was reached to have final exams or to give graded assignments, but it was suggested that creating a common set of problems, reflecting the way each teacher poses physics questions might be beneficial. Hopefully, students would recognize the core concepts underlying the problems and practice standard problem solving approaches.

Figure 8.3

TYPES OF TASK USED IN PHYSICS NYA

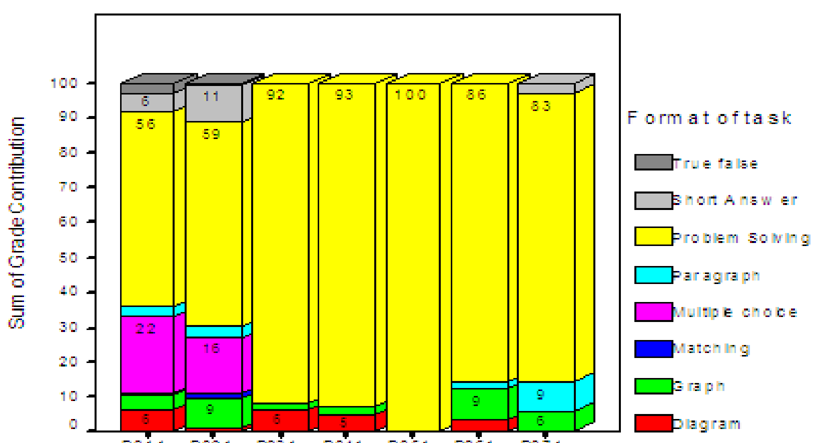


Comparison of Formats of Tasks Used in Physics NYA

There is an emphasis on problem solving in all sections of this course with most of the variation showing in the sections taught by teachers P011 and P021. The differences shown in Figure 8.4 were attributed to the International Baccalaureate (IB) section (P011) which has special requirements and the format of items that were used on a common final exam given by teachers P011 and P021. It was suggested by some members that, given the differences seen in these graphics, the IB specific material (including preparation for the IB exams) should be taught in a course given later in the IB Science Program.

Figure 8.4

TYPES OF FORMAT USED IN PHYSICS NYA



Comparison of the Types of Knowledge Assessed by Different Teachers

Figures 8.5 and 8.6 address the types of knowledge assessed by the different teachers of the course. Figure 8.5 shows the differences among the sections of the course and as might be expected it shows that there is a strong emphasis on procedural knowledge which is consistent with the use of the problem solving formats shown in Figure 8.4. In addition, there is a requirement for knowing the concepts on which the problems are based. The department decided that the mark value placed on procedural and conceptual knowledge across sections were consistent and acceptable. The small number of items requiring factual knowledge was not considered to be important. The second illustration, Figure 8.6 relates the types of knowledge required to the formats of the assessment tasks. This view confirms the previous connection of problem solving to conceptual and procedural knowledge. It also indicates that graph and diagram items require conceptual knowledge. As might be expected, true-false, and matching items, are more likely to test factual knowledge.

Figure 8.5

TYPE OF KNOWLEDGE ASSESSED BY SECTION

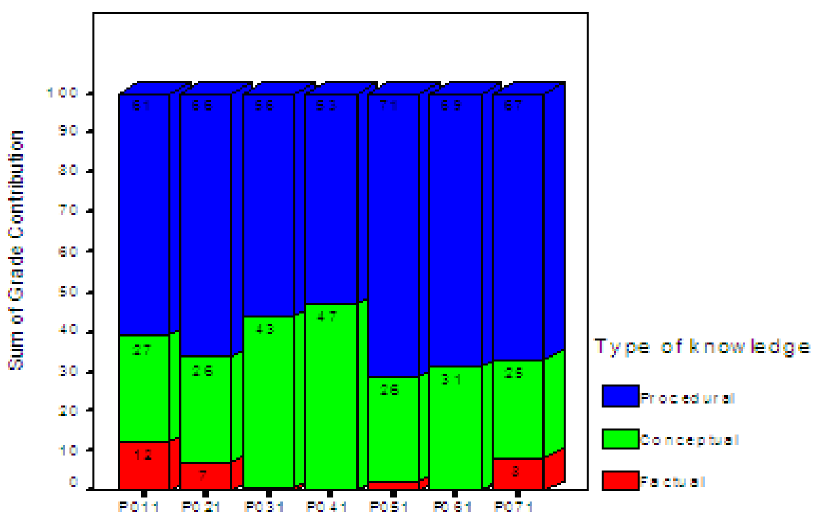
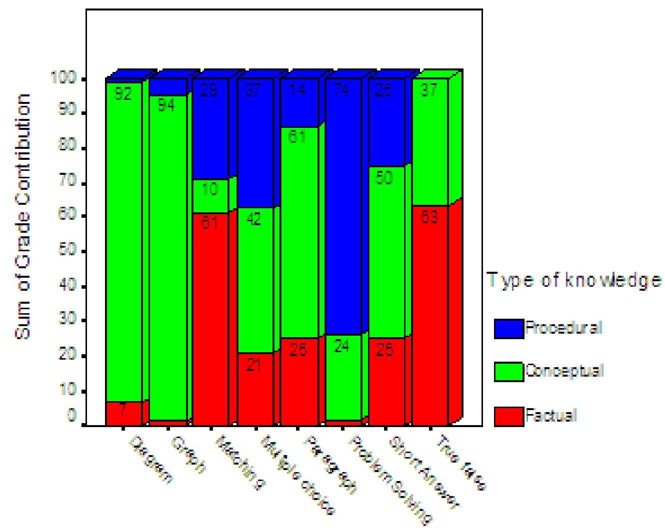


Figure 8.6

THE RELATION OF TASK FORMAT TO THE TYPE OF KNOWLEDGE ASSESSED

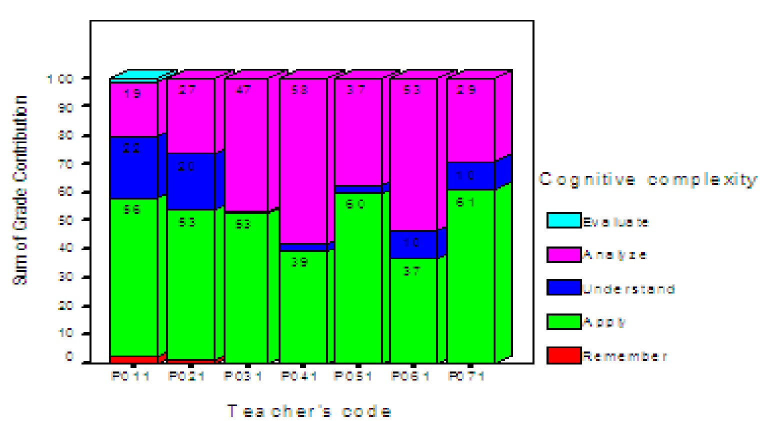


Comparison of the Levels of Cognitive Complexity Required by Different Teachers

Figure 8.7 illustrates the differences in the cognitive complexity of the different assessment items used across the NYA sections. Again, the data is consistent given the emphasis on problem solving within the course as shown in Figure 8.4. While most sections focused primarily on application and analysis questions, the grades allotted to these questions ranged from 37% - 60% for application items and 19% - 58% for analytical items. The department speculated that the incoherence across sections on the levels of cognitive complexity assessed may be due to a variation in the sequencing of topics presented in particular sections.

Figure 8.7

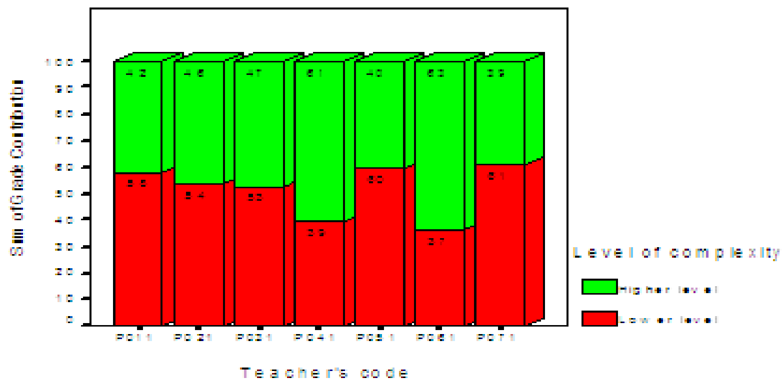
LEVELS OF COGNITIVE COMPLEXITY REQUIRED BY DIFFERENT TEACHERS



Teachers P041 and P061 place more emphasis on items requiring analysis. This required further examination because the Physics taxonomy distinguishes between analysis questions that require conceptual knowledge (most difficult) and analysis questions that require procedural knowledge (slightly less difficult). The taxonomy also distinguishes between application questions that require conceptual or procedural knowledge (both are at the easier end of the taxonomy). Figure 8.8 shows a comparison of the use of easier and more difficult questions. There is a substantial difference between teachers P041 and P061 and their colleagues.

Figure 8.8

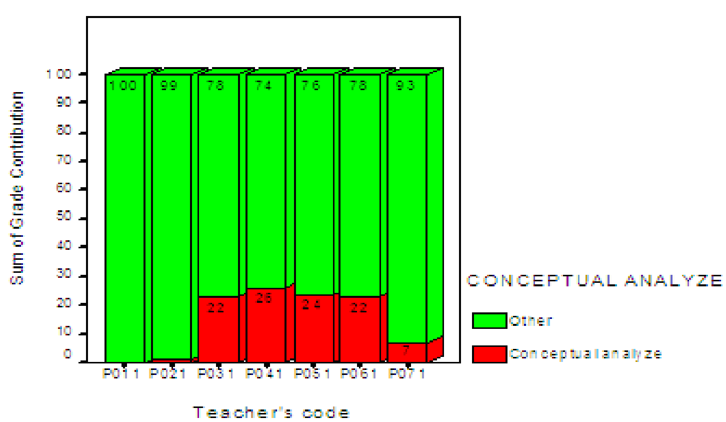
TEACHERS USE OF QUESTIONS OF LOWER AND HIGHER COGNITIVE COMPLEXITY



The study continued by examining how conceptual/analyze questions, questions which are considered to be the most difficult, are used. Figure 8.9 shows this comparison and indicates a considerable difference across the sections.

Figure 8.9

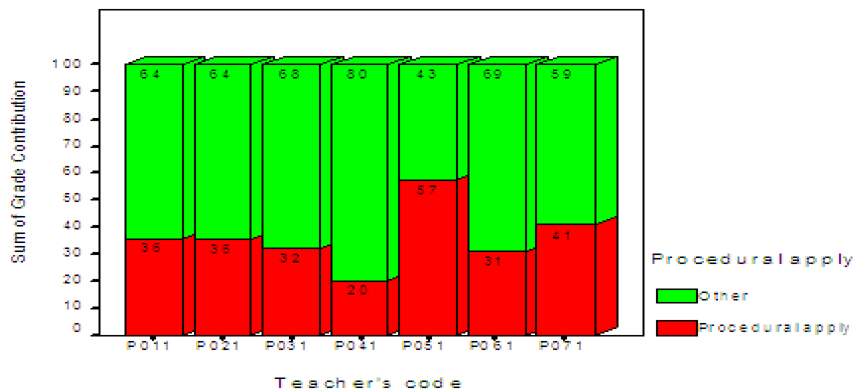
COMPARISON OF THE USE OF CONCEPTUAL-ANALYZE QUESTIONS



Procedural/apply questions, questions that are also at a high level, were examined. The contribution of these questions to the students' grades ranged from 20% to 57%. The section taught by teacher P051 had a considerably higher distribution of these questions while teacher P041 had a considerably lower distribution of these questions.

Figure 8.10

COMPARISON OF THE USE OF PROCEDURAL - APPLY QUESTIONS

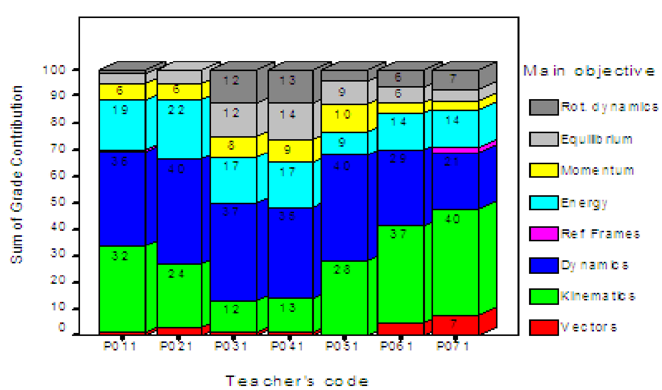


Comparison of Grade Allocations to Course Objectives and Topics

The graph shown in Figure 8.11 illustrates how marks were allocated to each instructional objective and related topic/s in the different sections. The complete list of objectives and topics can be found in *Supporting Document B*. The results indicate considerable differences across sections in the distribution of marks allotted to the different objectives. For example, grades given for assessments dealing with *kinematics* range from 12% to 40%, while in certain sections, some objectives are not addressed at all.

Figure 8.11

COMPARISON OF GRADE ALLOCATIONS TO OBJECTIVES BY TEACHERS

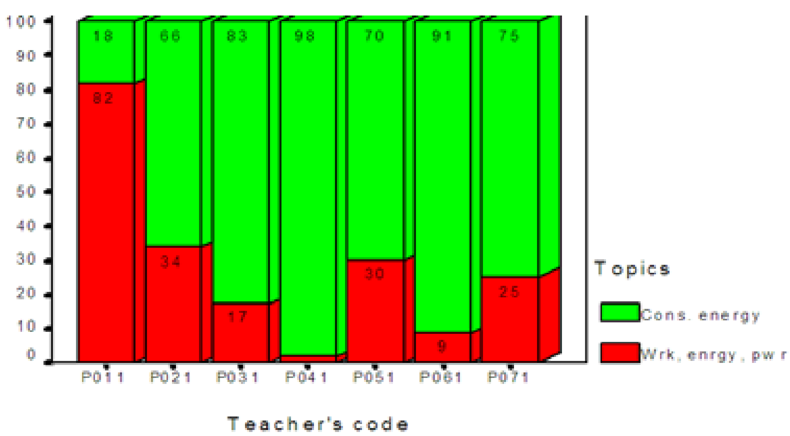


Concern was also expressed about the sequencing of objectives and topics and that some topics were either not covered or were not given sufficient time in some sections. A major question was whether difficult topics should be introduced earlier in the course or postponed until later. Although the topics are ordered by the textbook currently in use, there was general agreement that the chapters are self-contained units and can be taught in any order. However, it was suggested that organizing the topic sequence to be similar in all sections would be fairer to the students. Such a plan could allow students from different sections to study together, and would reduce the student perception that some sections are easier than others. There was also a discussion about how the marks allocated to different objectives and topics could be made more similar across the sections. The teachers viewed these issues as further evidence for developing a common set of problems.

The discussion of instructional objectives, topics and topic sequences was further enhanced by an in-depth discussion about how each teacher allocated marks on assessments to items testing particular subtopics under a topic heading. For example, Figure 8.12 shows how the marks allocated to the objective dealing with energy were distributed between two topics. In the section taught by Teacher P011, 82% of the marks were allocated to items testing about work, energy and power and only 18% were spent on items dealing with the conservation of energy. Comparing this distribution to other teachers, one sees considerable diversity and in the case of Teacher P031 there is a complete opposite case. This graphic also raised the issue of treating different types of students differently.

Figure 8.12

COMPARISON OF MARKS ALLOCATED TO TWO TOPICS RELATED TO ENERGY



Types of Knowledge and Levels of Cognitive Complexity Required by Course Objectives and Topics

As might be expected, the assessment items related to course objectives and different topics require different types of knowledge and are at different levels of cognitive complexity. This data, shown in Figures 8.13 and 8.14, further confirms the variety of difficulty encountered by students in different sections. This data spurred on the conversation about developing a common sequence of topics, which the department subsequently agreed upon and followed during the fall 2006 semester.

Figure 8.13

TYPES OF KNOWLEDGE REQUIRED BY ASSESSMENTS OF COURSE OBJECTIVES

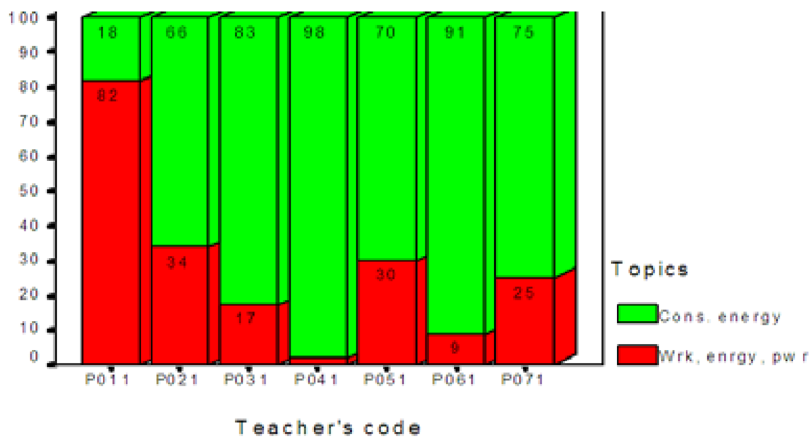
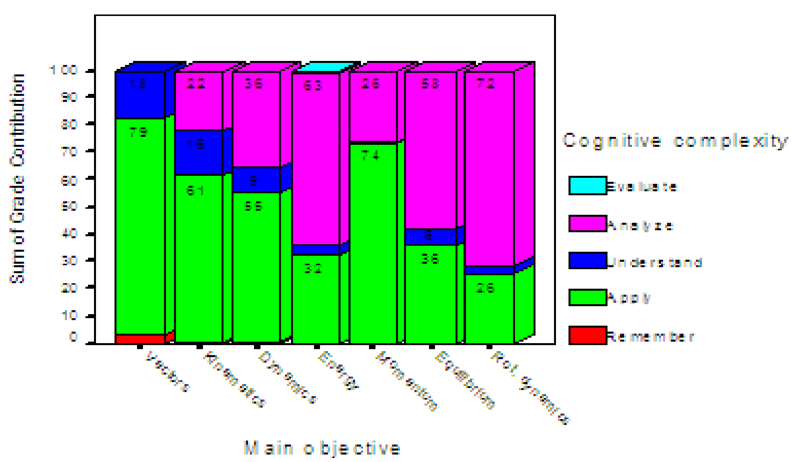


Figure 8.14

LEVELS OF COGNITIVE COMPLEXITY REQUIRED BY ASSESSMENTS OF COURSE OBJECTIVES



Student Results for Physics NYA in Fall 2004

The students entering Physics NYA are usually first semester students in the science program. These students have been selected based on their achievement of high marks in high school. Very few students enter this program with an average less than 75% and all of these students have completed high level science and mathematics courses before entering college. Figure 8.15 shows box plots of the students' overall high school averages when they entered Physics NYA in fall 2004. These plots show that the sections were fairly coherent despite three special groups. The students in the section taught by Teacher P011 belonged to the International Baccalaureate Science Program (IB) and thus were an even more select group than those in the regular science program. Many of the students in the section taught by Teacher P071 were repeating the course and those in the section taught by teacher P031 were provided with an extra hour and a half of instruction per week as they were considered to be weaker students. Figure 8.16 shows the distribution of the final Physics grades for the same semester. These box plots contain only the results for students who received a grade of more than 30% as those with a lower grade probably left the course early but after the official date to drop it. The comparison shows that, although these are select groups of students possessing many of the characteristics necessary to succeed in college, many of the grades are below the passing grade and more than half the group has achieved a mark considerably lower than their high school average would predict. The plots show that there are considerable differences among the sections which would indicate that the differences in the assessments shown above do have a major impact on student achievement. In spite of these differential student results, the Physics Department is quite comfortable with the distribution of final course marks.

Issues and Resolutions Resulting from the Curriculum Review

Table 8.3 summarizes the issues identified and resolutions made by the department after reviewing the analysis of Physics NYA as given in fall 2004. The analysis was presented to the department in the winter of 2006 and the resolutions have been implemented in the fall of 2006.

Figure 8.15

INCOMING HIGH SCHOOL AVERAGES IN PHYSICS NYA SECTIONS FALL 2004

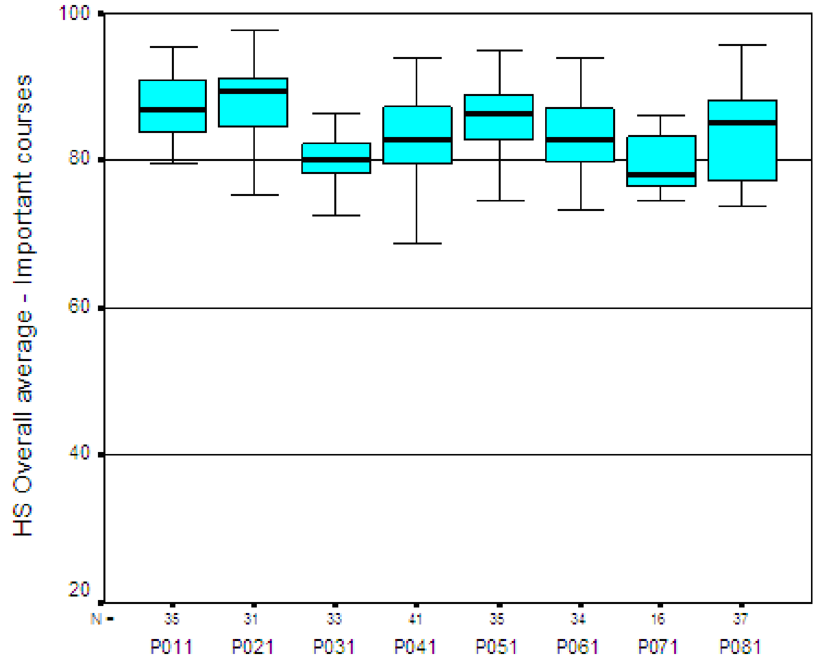


Figure 8.16

STUDENT RESULTS PHYSICS NYA FALL 2004

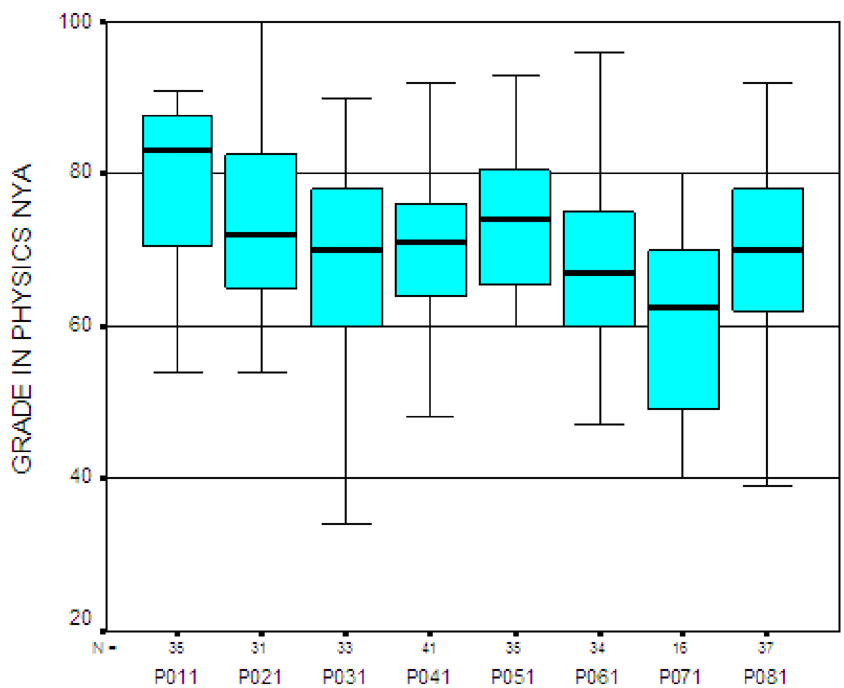


Table 8.3

PHYSICS NYA - FALL 2004 ISSUES AND RESOLUTIONS		
ISSUE	**DESCRIPTION OF THE PROBLEM**	**RESOLUTION**
1. There were considerable differences across sections in the number of assessment items to which a student is exposed.	Number of assessment items in each section ranged from 29 - 171. Closer analysis revealed that some teachers ask shorter questions that lead students through multiple steps to the solution of a complex problem. These questions were labeled as "guided questions. Guided questions were usually coded at the **procedural/apply** level while unguided questions were coded as **conceptual/analysis**. The latter is considered to be more difficult. Using different styles of questioning was not necessarily intentional on the teacher's part.	Not resolved, however, the concept of a "guided question" emerged from the discussion and an understanding that the way a question is posed affects its level of cognitive complexity began to develop.
2. There were considerable variations across sections in the types and formats of assessment tasks being used.	Although class tests are the primary method of evaluation, most teachers also use quizzes and a few other types of assessment. Only two teachers gave a final examination. Results indicated that two teachers only use class tests but one of these teachers actually put their quizzes on the board and therefore, the quizzes were not coded.	All quizzes are now given in print form. The department considers the administration of a final exam to be optional. However, the newer members of the department are choosing this option.
3. Variation in lab work	Although the labs were not analyzed in this study, during the discussion of the results it became clear that different teachers were doing different experiments and had varied requirements for lab reports.	Understanding the concept of curriculum coherence has allowed the department members to seek more coherence in terms of the labs that are being offered and to create a method of reporting that minimizes the opportunity to plagiarize.
4. Type of knowledge and cognitive complexity of test items.	Considerable differences exist between the percentages of the grade allocated to higher and lower level questions. Fig 8.7 - 8.9	The department resolved to move towards a 50-50 balance between higher and lower level questions.

PHYSICS NYA - FALL 2004 ISSUES AND RESOLUTIONS		
ISSUE	**DESCRIPTION OF THE PROBLEM**	**RESOLUTION**
5. Differential coverage of the course objectives and the sequence of the course topics.	One reason given for the differences across sections in levels of cognitive complexity was that each teacher followed their own sequence of topics. As a consequence, certain course objectives and their corresponding topics were not assessed.	Consensus was reached on a common sequence of topics. Following this sequence is mandatory.
6. Student perception is that the Physic NYA sections are different.	This perception is supported by the data in the study.	The development of a common sequence of topics should begin to change these perceptions.
7. Students from different sections would like to study together.	Because different sections have been at different points in the curriculum at different times in the semester, students have not been able to support each other's learning.	Following the common sequence of topics should provide students with the opportunity to study together. There is also a proposal to assemble a problem set for all students so that they can practice a wide variety of problem types.
8. Integration of the IB program with the course requirements.	There were inconsistencies in the assessment tasks used in the IB class when compared to the other sections.	The IB students will follow the same course as everyone else.

REFLECTION

The Physics Department was very interested in the results of the data analysis presented by their two subject-matter experts (SMEs) in February 2006. As they did not have a recent history of working collegially to make curriculum decisions, they were surprised by the extent to which the course content and levels of difficulty were similar in the different sections taught by seven out of the eight physics teachers in the fall 2004 semester. The data stimulated discussions about pedagogy within the department bringing the department together and prompting a movement away from individuals working separately to one which recognized the wisdom and instructional power of working collectively to make curriculum decisions and to share their practice. In fact, renovations to the building have been made and all physics teachers now share one large office. This encourages conversation among the teachers and has provided the students of any section with more general access to a physics teacher during the day.

It seemed that the interest of the Physics Department was ignited when they were introduced to the discipline-specific taxonomy for analyzing Physics assessment items which was constructed by their coders (SMEs). This taxonomy evolved as the coders became more and more aware of the types of knowledge and levels of cognitive complexity inherent in their first semester Physics course. The taxonomy translates the topics and objectives of the curriculum into a common language that considers content knowledge and the intellectual abilities needed to apply, understand and solve physics problems using that content knowledge. Using Bloom's Taxonomy as a base, they combined the four kinds of knowledge with the different levels of cognitive complexity and added four levels of computational complexity. They also reordered the sequence of the levels of cognitive complexity arguing that 'understanding' is much harder than 'applying' when grappling with Physics problems. The taxonomy has been credited with providing a fresh approach for pedagogical decision making and changing the way the department talks about curriculum. It is also one of the most important outcomes of this research project.

Another contribution to the project was the validation of an observation made by the primary research team that departmental leadership plays a major role in a department's ability to achieve an aligned curriculum. As each participating department progressed, it became quite clear that recommendations emanating from curriculum discussions stood a greater chance of being implemented if the department chairperson understood and valued the process underlying their formation. The progress made in the Physics department reflects the meaningful analysis conducted by the coders being met with enthusiastic, committed support from their department chair. A simple, yet important change is the fact that the department now records the resolutions and agreements made at department meeting. They have been discussing ways of reducing the differences across the sections, and have developed a common topic sequence which is binding on all teachers. This new sequence should address some of the student perceptions about the coherence of the different sections, and students from any section can now study with their friends who are in other sections. The department still intends to develop a compendium of test-level physics problems which will contain problems from all teachers.

The department clearly values the Curriculum Alignment Process and has begun to work collectively, while appreciating and valuing the individuality of each teacher. The coding team is currently analyzing the assessment items collected from the teachers involved in the course during the fall of 2006 to determine if and how the curriculum changes have been implemented. They recognize that this process is iterative and that there is a continuing need to examine how pedagogical and assessment policies of the department and of individual teachers impacts on student results.

SUPPORTING DOCUMENT A

PHYSICS TAXONOMY

DEFINITIONS & EXAMPLES

FR Factual/Remember

This level of difficulty requires the recollection of information. It is the easiest type of question.

Example:
The average speed is the magnitude of the average velocity. True or False?
How many significant figures do the following numbers have?

FAp Factual/Application

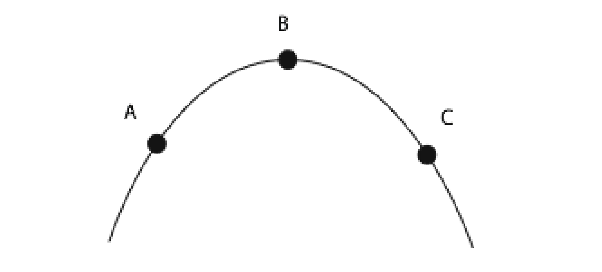
These questions will generally use only one equation and usually the solution can be found by applying a single computation, plugging-into formula type questions. It requires applying a definition to a specific situation.

Example:
If you are 32 km from school and class starts in 30 min, how fast must you travel in order to arrive on time?

FU Factual/Understand

These questions usually require a verbal or drawn component and often contain student misconceptions about a phenomenon.

Example:
At each of the points below, sketch the direction and magnitude of the velocity and acceleration vectors. No air resistance.



FEv Factual/Evaluate

This level of difficulty requires that students evaluate collected data and determine its reliability. FEv occurs primarily in lab-exercises or lab-quiz contexts.

Example:
A student is asked to measure position as a function of time for an air puck sliding down an incline plane. They then give the data to his or her partner to analyze. The partner is asked to determine if the data was measured correctly or not.

PR Procedural/Remember

Remembering a set of steps to solve a problem without actually solving the problem.

Example:
Asking a student to write a brief description of the steps to be carried out in a specific experiment to measure a specific quantity.

(Not used in this study)

PAp Procedural/Application

These questions require a sequence of steps. Questions at this level can usually be broken down into a sequence of factual steps.

Example:
A ball is tossed from an upper-story window of a building. The ball is given an initial velocity of 8 m/sec at an angle of 20˚ below the horizontal. It strikes the ground 3 sec later.How far horizontally from the base of the building does the ball strike the ground?

PU Procedural/Understand

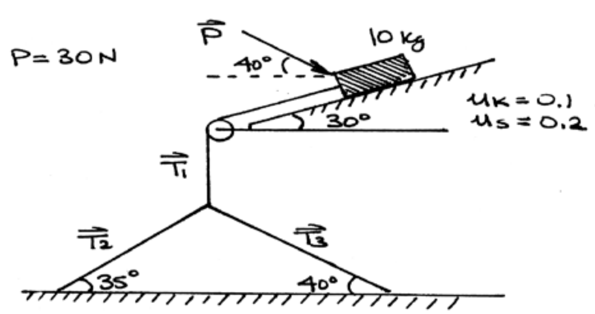
These questions do not necessarily have a numerical solution but require several steps to solve.

Example:
"Explain with the proper equations"

PAn Procedural/Analysis

These questions require two or more concepts to be applied in order to solve. These questions may also require a combination of two or more concepts in a non-trivial way, which may generate two or more possible solutions.

Example:
The block (weight = 100 N) shown in figure above "just about" to slide down the incline (μs=0.2, μk=0.1). Find T1.



PEv Procedural/Evaluate

These questions involve using simple rule of propagation of uncertainties to evaluate the uncertainty on a calculated result.

(not used in Physics NYA)

PC Procedural/Create

Writing a lab report or recording information in a logbook requires procedural/create thought processes.

(labs were not coded as part of this research project)

CR Conceptual/Remember

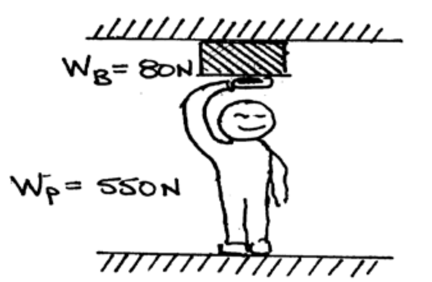
This level of difficulty requires problem solving that involves recalling a concept instead of a fact.

Example:

A small automobile and a large truck collide during an accident. Which one is subjected to the largest force?

CAp Conceptual/Application

These questions require the application of a concept such as Newton's Third Law, the conservation of energy or the conservation of momentum. If the question requires the drawing of a free body diagram, showing the external forces on the body, before solving it, it is coded in this category.



Example:

A person (weight Wp = 550 N) pushes on a box (WB = 80 N) The force of the box on the ceiling (fig 4) is Nc = 0.70 j N. Draw separate force diagrams of the box and the person showing all forces with names.

CU Conceptual/Understand

These questions tend to be difficult in nature because there is no procedure to determine the solution; these problems usually do not have numbers or representation by symbols.

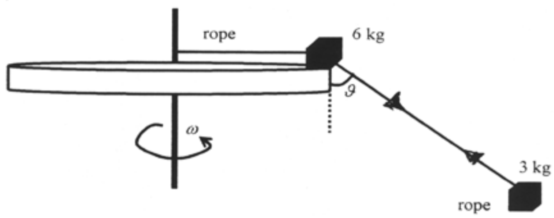
Example:

Questions that deal with the abstract interaction between space, time and matter.

CAn Conceptual/Analyze

In questions that require analysis, the student must initially set-up the problem before proceeding to find a solution, unguided questions.

Example:



A 6 kg block is attached by a rope of length 4 m to the center of circular table at the central shaft. At the other end of the block is attached another block of mass 3 kg by a rope of length 5 m. The circular table is set to rotate at an angular speed of 4 rads/sec and the system assumes the configuration shown with $\theta = 47^{\circ}$.Find the tension on each rope.

CEv Conceptual/Evaluate

This level of thinking would be used in lab reports. Building a hypothesis, discussing results using uncertainties, or evaluating the sources of errors would fall in this category.

(code not used in this study)

CC Conceptual/Create

This type of coding would be used in lab reports. The labs where the students are asked to create their own procedure would fall into this category.

(code not used in this study)

SUPPORTING DOCUMENT B

PHYSICS NYA: LIST OF OBJECTIVES AND TOPICS

Objective 1: Understand and identify vector quantities, and use vector algebra in appropriate situations

Vectors and scalars

1.1 Properties of vectors: addition, subtraction, multiplication.
1.2 Co-ordinate systems, vector components, unit vectors, rectangular and polar notation
1.3 Addition of vectors by the tip-to-tail and the component method

Objective 2: Understand and analyze one-dimensional and two-dimensional motion using kinematics equations.

One-dimensional motion

2.1 Position, displacement, distance
2.2 Average velocity and average speed, instantaneous velocity
2.3 Acceleration
2.4 Motion diagrams
2.5 Motion along a straight line with constant accelerations, and corresponding equations.
2.6 Free fall and Earth's gravitational field.

Two-dimensional motion

3.1 Position, displacement, velocity and acceleration vectors
3.2 2d motion, projectile motion
3.3 Rotation: angular displacement, velocity and acceleration, rotation with constant angular acceleration
3.4 Uniform and non-uniform motion, radial and tangential acceleration.

Objective 3: Understand and apply Newton's laws both to linear and circular motion

Dynamics: Newton's laws

4.1 First law and inertia, mass
4.2 second law, force, gravity, weight
4.3 third law, action-reaction
4.4 Normal force, friction force
4.5 tensions
4.6 Free body diagrams
4.7 Newton's law of gravitation

Circular motion and centripetal forces

5.1 centripetal force and applications
5.2 Circular orbits and satellite motion
5.3 Non-uniform circular motion

Objective 4: Understand and analyze Galilean relativity situations

Reference frames

6.1 Inertial frames of reference: relative position, velocity and acceleration
6.2 Non-inertial frames of reference: Apparent forces and apparent weight.

Objective 5: Understand and apply the principle of conservation of energy

Work, energy and power

7.1 Dot product
7.2 Work and kinetic energy
7.3 Work done by a variable force
7.4 Spring forces and Hooke's law
7.5 Power

Conservation of energy

8.1 Work done by the force of gravity
8.2 Gravitational potential energy
8.3 Conservation of mechanical energy
8.4 Elastic potential energy
8.5 Conservative and non-conservative forces
8.6 Energy diagrams

Objective 6: Understand and apply the principle of conservation of linear momentum

Impulse and momentum

9.1 Linear momentum
9.2 Newton's 2^{nd} law with momentum
9.3 Impulse and momentum
9.4 Conservation of linear momentum
9.5 Collisions: Inelastic and elastic collisions

Objective 7: Understand and analyze the static equilibrium of rigid objects

Static equilibrium of a rigid object

10.1 Definition of torque
10.2 First and second condition of equilibrium
10.3 Center of mass, center of gravity

Objective 8: Understand and analyze the rotational motion of rigid objects

Rotational dynamics of rigid objects

11.1 Moments of inertia
11.2 Parallel axis theorem
11.3 rotational kinetic energy
11.4 torque and angular acceleration

Objective 9: Understand and apply the principle of conservation of angular momentum

11.5 Angular momentum and its conservation

CHAPTER 9

PSYCHOLOGY

CONTENTS

In the two years preceding the launching of this research project, the Student Success Committee, which was formed in the Fall of 2000 as an ad hoc committee of the Academic Council, began to bring student results to departments that had a first semester course which served a large number of students. *Psychology 102* or *Introduction to Psychology* is a required course taken by all Social Science and Commerce students and was therefore selected as one of the departments to visit. The information was presented in boxplots which provided a pictorial representation of student results across multiple sections of the same course allowing each teacher to see their own class results in relation to the overall results in their department[1].

When the Psychology department was presented with student results in from the Fall semester of 2002, they found the variance across sections to be unacceptable. Consequently, they began to examine how they were individually and collectively assessing student learning. An informal study of what teachers were asking students to be successful at revealed two interesting findings: (1) about 75% of the students' grades were based on class tests which everyone referred to as quizzes, and (2) classes with the higher failure rates assigned formal writing tasks which many students found difficult to complete in a meaningful way. These tasks were often worth 20-30% of the students' overall grade.

These findings prompted a discussion about assessment task terminology and whether or not a formal academic paper was an appropriate task for a first semester student. An increased awareness on current research which focuses on the power of the assessment task to control how a student approaches their learning, led to a decision to change the work "quiz" to class test, a title that denotes the importance of the task (Crooks, 1988; Ramsden, 1992; Walvoord & Anderson, 1998; Wiggins, 1993). In addition, two of the teachers agreed to work with two members of the English department to construct a common writing task that was appropriate for an introductory Psychology course.

At that time, an assignment that requires reading and understanding basic psychological research was designed. In this task, students are asked to summarize four scholarly articles, selected by a committee, on a topic that is chosen by the department. The topic changes each term. The students also construct an outline for an academic paper that could emerge from the assigned readings. They do not actually construct the paper. The summaries and outline taken together comprise 20% of the students' overall grade.

1 At department meetings when this step in the process was in progress, names were removed from the boxplot to maintain confidentiality. However, each teacher received their own file number so they could reflect, in private, about their practice.

THE REARCH PROCESS

This initial sojourn of the Psychology Department into the world of curriculum coherence and assessment prompted the PAREA Research Team to invite them to be one of our lead departments making it possible to proceed with a much more in depth analysis of their assessment practices. In the Fall of 2003 they agreed and two department members were chosen to act as the subject-matter experts (SMEs) or coders. These two faculty members joined individuals from three other lead departments at a training workshop given by the PAREA team in January 2004. The purpose of this training workshop was to familiarize the coders with the Curriculum Review Process and to educate them in how to apply Bloom's Taxonomy to the types of questions asked on assessment tasks.

As the training progressed, all course outlines and assessment tasks for Psychology 102 sections taught during Fall 2003 semester were collected. These documents were compiled and prepared for analysis by the PAREA team. Each section was assigned a code and all identifying information that connected the particular teacher and the section was removed to ensure anonymity and reduce the possibility of bias.

As a first step, the coders examined the course outlines to determine the general degree to which there was coherence across sections on the instructional objectives and topics to be addressed. It was a surprise to find that despite the reforms of the previous decade, a common understanding of what the instructional goals of the course were or which topics to address did not exist. Serious differences existed across sections (Supporting Document A). The coding could not proceed until some level of consensus within the department was reached. Using the Ministry of Education's stated competencies for this course, (Supporting Document B), an initial set of instructional objectives and topics were agreed on and used to analyze the data (Supporting Document C). These objectives and topics were adjusted for a second time, after the results from the PAREA analysis were presented. Therefore, there was a unique set of instructional objectives before, during and after the analysis was done.

In the meantime, the SMEs practiced coding using general psychology questions taken from a course that was not going to be analyzed. They used Bloom's Revised Taxonomy (2002). Initially, there was strong disagreement between the coders. The main reason the coders gave for their disagreement was that the conceptual and procedural categories of Bloom's taxonomy were broad and time was needed to determine how to apply them to psychology. Once an acceptable level of inter-rater reliability was reached on the practice items, official coding began. Each coder proceeded to analyze the items independently and, then, they met together with one member of the PAREA research team to compare their coding. This comparison of the codes provided them with an opportunity to discuss the application of the taxonomy and to continue to improve their inter-rater reliability.

Results were presented to the department in late November, 2005. It was clear to the members of the department that decisions and compromises had to occur in order to improve the coherence across sections of Psychology 102. In an effort to facilitate that process, an extensive questionnaire, designed to secure additional feedback on the instructional goals of the course, the topics to be addressed, the kinds of knowledge to focus on and the appropriate level of cognitive complexity of all assessment items, was constructed. This *Curriculum Review Survey*, designed especially for the Psychology Department, paid specific attention to the format, level of difficulty and mark value of classroom tests (Supporting Document D). Each teacher completed the survey and the results were used to guide a consensus reaching process which culminated in departmental assessment guidelines being formulated and necessary supports and structures for implementation being identified.

After a term of preparation, the newly aligned *Introduction to Psychology* was offered in the Fall of 2006. At the end of the term, data was once again collected, coded and analyzed. Results were presented collectively and individually to all department members. The coders reported that the process resulted in clear assessment guidelines, structures to support implementation and an increased awareness among department members that through collaboration an increase in curriculum coherence can be achieved.

ANALYSIS OF ASSESSMENT TASKS - FALL 2003

Five teachers, representing 10 sections of Psychology 102, submitted their course objectives and all assignments and/or tests that contributed to the students' overall grades for sections that they taught in the fall of 2003; 948 items were coded. Each assessment item was analyzed according to its type and format of task, type of knowledge required, level of cognitive complexity, the main instructional objective that it measures, the topic it addresses and its contribution to the student's overall grade.

Comparison of type of tasks & format of tasks used in Psychology 102

There were nine different types of assessment tasks and nine different formats being used in the twelve sections of Psychology 102 in the Fall 2003 semester. All teachers assigned the department's common writing task which is referred to in Figure 9.1 as "Term Task." In Figure 9.2 this common task is represented across sections as the outline (8%) and summary (12%). One teacher used a take-home assignment.

Class tests were the main type of assessment used accounting for 50% to 60% of each student's overall grade. Class tests were primarily comprised of selected response items, that is, items where students can select an answer as opposed to constructing an answer. The primary format used in class tests was multiple choice; however, three teachers also used short answer questions. In one case these questions accounted for 35% of a student's overall grade. Three teachers used the study guide, a supplement to the textbook, which was not coded.

Figure 9.1

MEAN GRADE ALLOCATED TO TYPE OF TASK

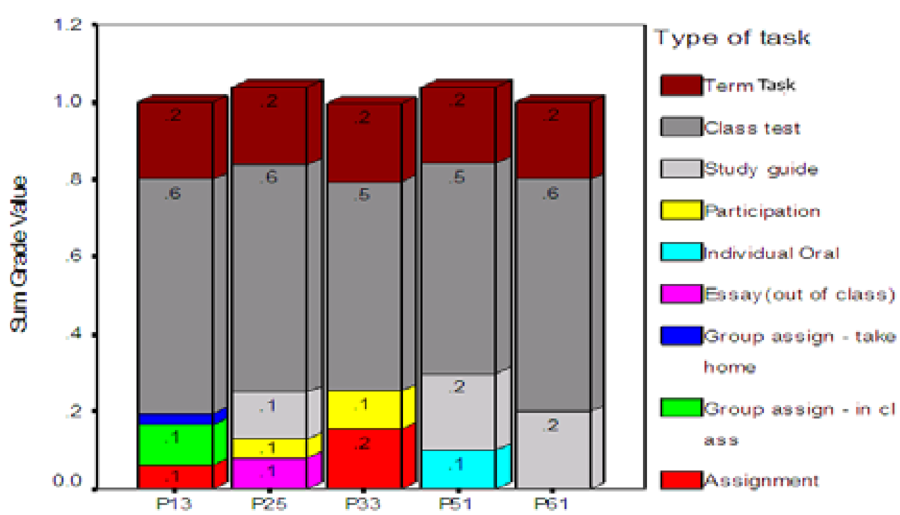
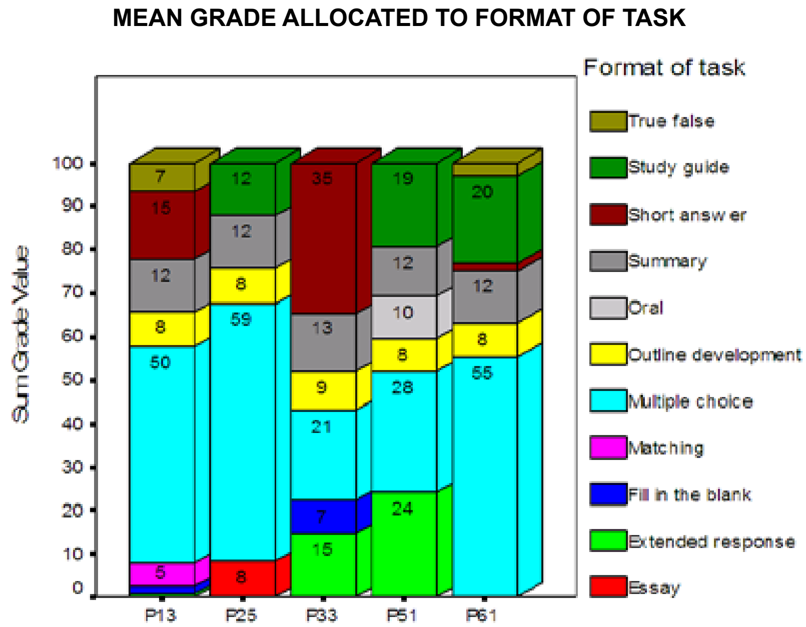


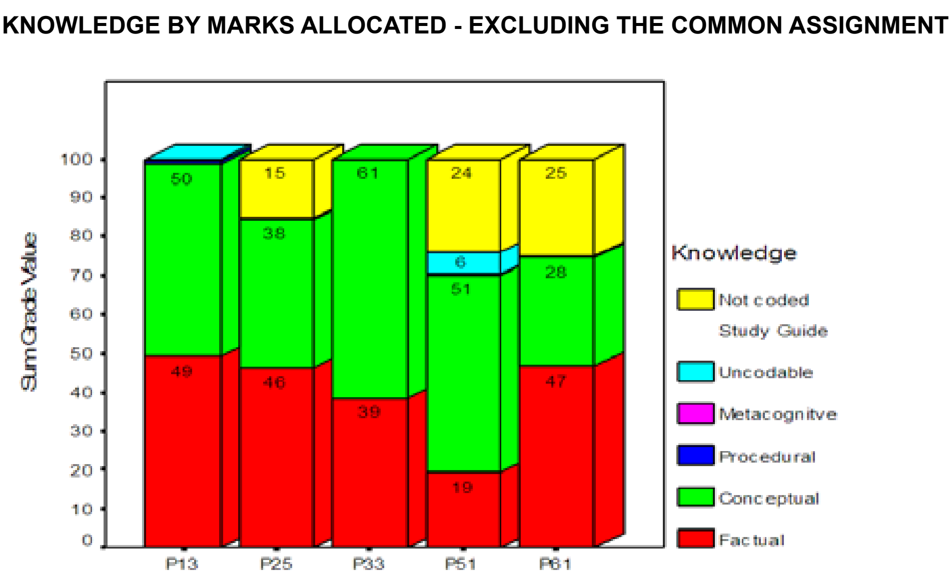
Figure 9.2



Comparison of the types of knowledge required by different teachers

Figure 9.3 indicates an emphasis on factual and conceptual knowledge. Grades allotted for factual knowledge ranged from 19% to 49%, while grades for conceptual knowledge ranged from 28% to 61%.

Figure 9.3

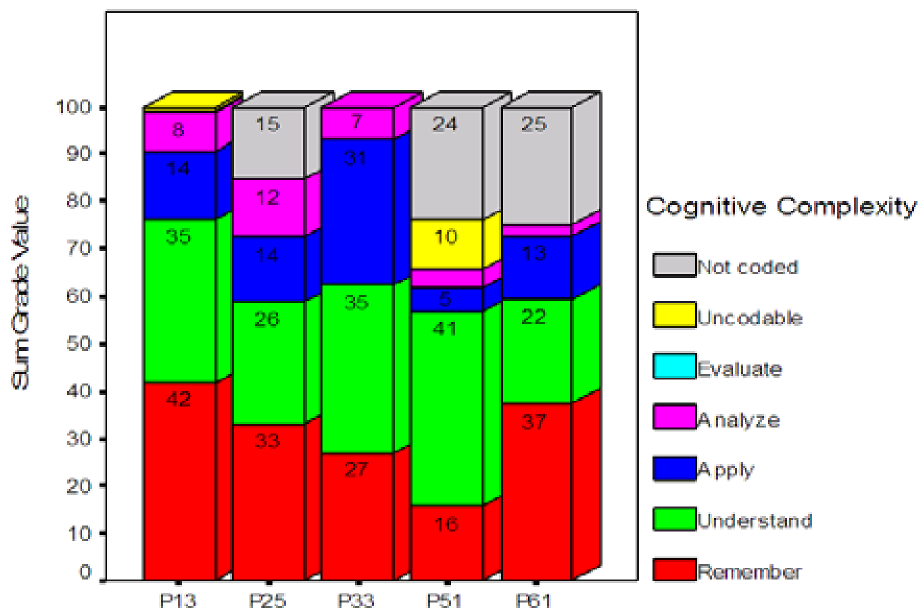


Comparison of the levels of cognitive complexity required by different teachers

Table 9.4 indicates that although there is a difference in emphasis across the five teachers of this course in terms of cognitive complexity, the major thinking skills required appear to be the ability to remember, understand and apply knowledge. Questions that required analytical thinking were rare, accounting for less than 7% when they did appear.

Figure 9.4

COGNITIVE COMPLEXITY BY MARKS ALLOCATED - EXCLUDING THE COMMON ASSIGNMENT



An analysis of class tests

Given the fact that class tests were the most common means of assessing student learning, the coders decided to carry out an in depth analysis of the format, type of knowledge and level of cognitive complexity demanded by these tests.

Multiple choice was the preferred format for three teachers. One of the remaining teachers (P33) favored short answer questions, while the other teacher (P51) favored questions where the student is required to write several sentences to justify their answer. These questions became known as extended response items. Class tests primarily measured factual and conceptual knowledge with the corresponding levels of cognitive complexity being remember and understand. See Figures 9.5, 9.6 and 9.9.

Figure 9.5

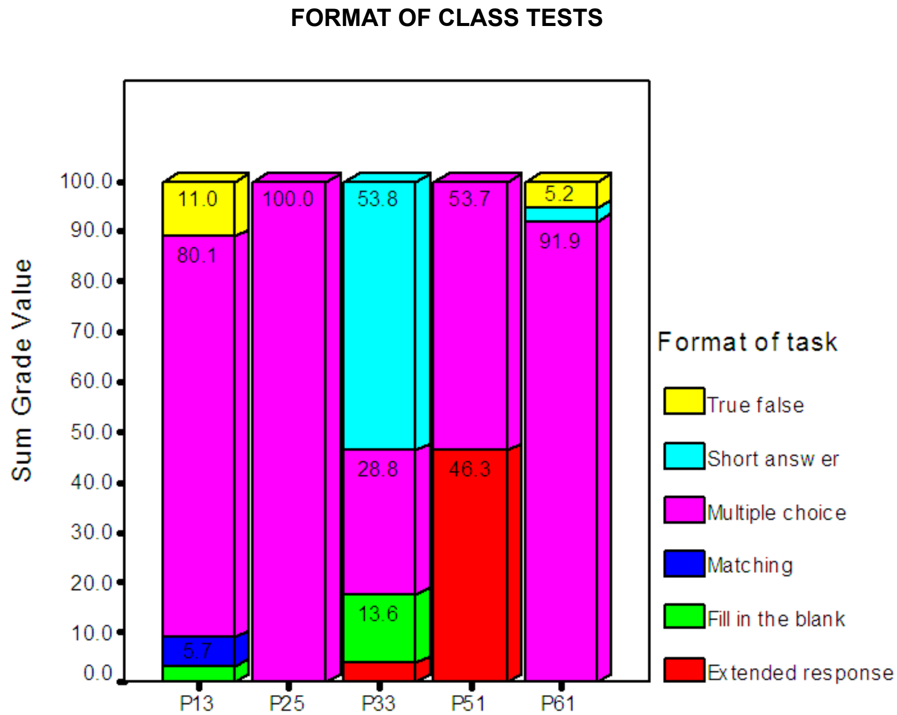


Figure 9.6

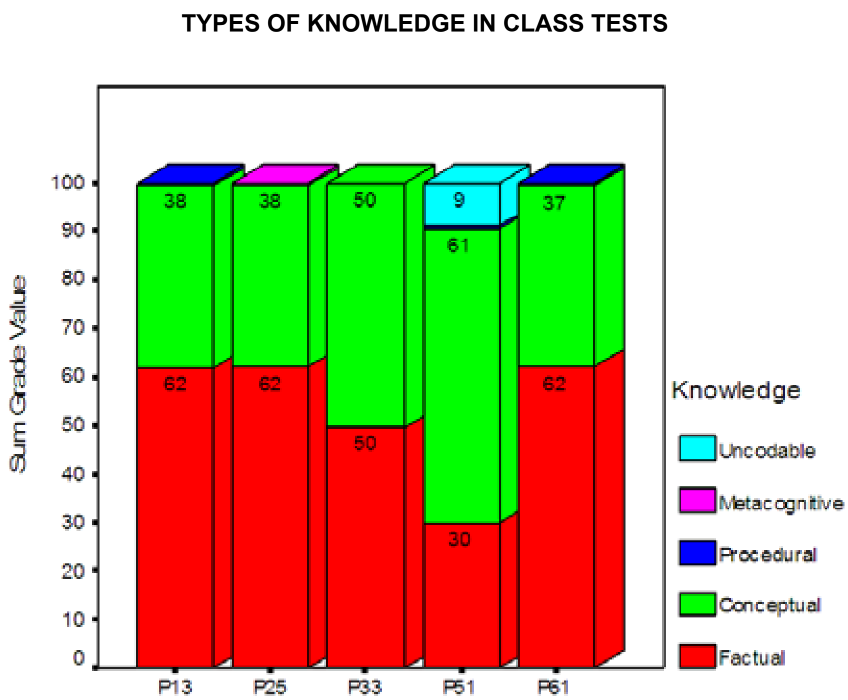
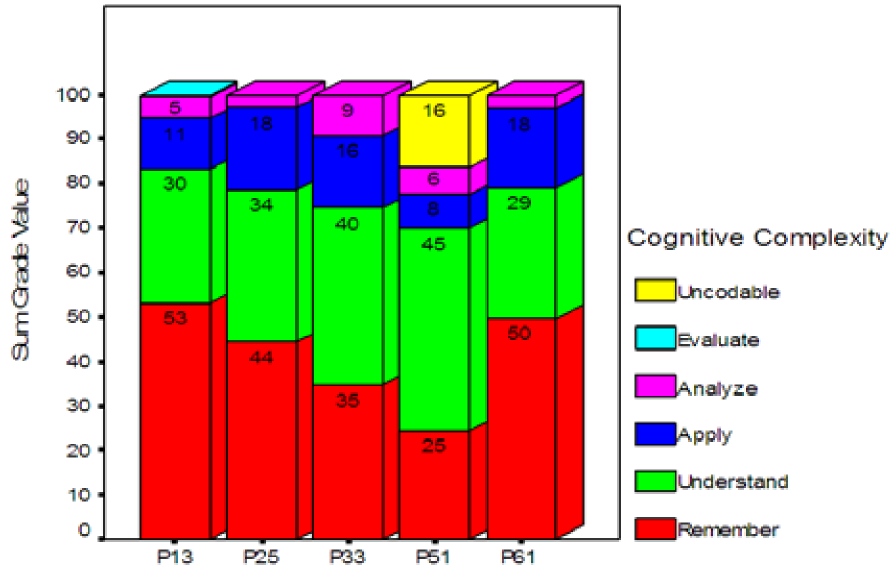


Figure 9.7

COGNITIVE COMPLEXITY IN CLASS TESTS



Because of the emphasis on multiple choice items, a decision was reached to conduct further analysis on these items. Figures 9.8 and 9.9 indicate that the multiple choice items used in class tests measured factual and conceptual knowledge which asked students to remember, understand or apply concepts and principles learned in the course.

Figure 9.8

TYPE OF KNOWLEDGE MEASURED BY MULTIPLE CHOICE ITEMS

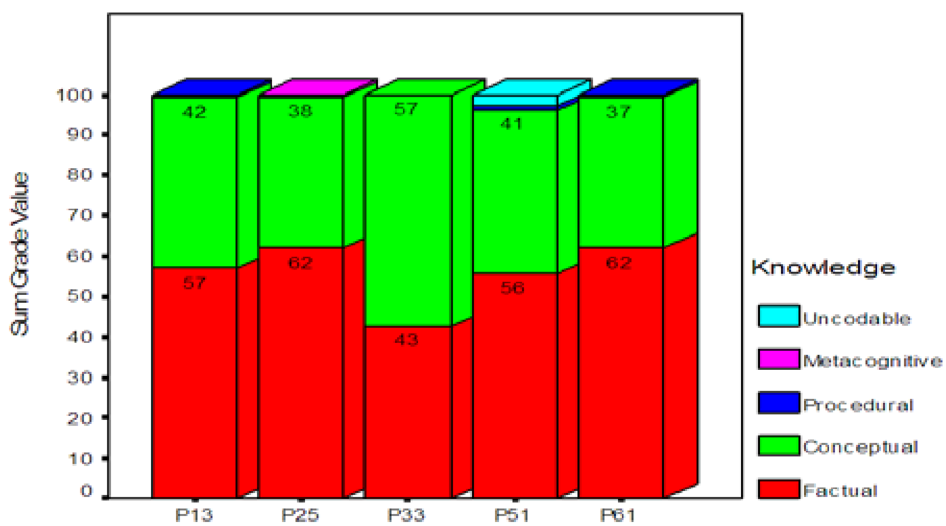
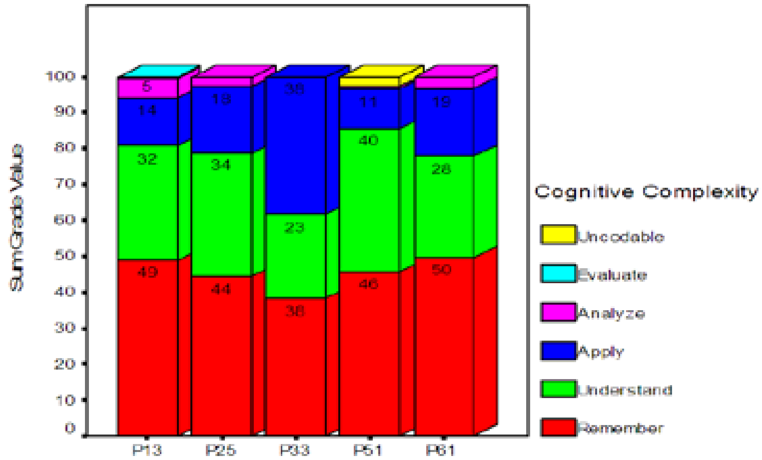


Figure 9.9

COGNITIVE COMPLEXITY MEASURED BY MULTIPLE CHOICE ITEMS



Analysis of objectives measured - all sections combined

The data was analyzed using the following course objectives:

1. Know, understand and use the main concepts and vocabulary in the field of Psychology
2. Identify the main perspectives and related theories that are predominant within Psychology
3. Know and understand the methodology used in Psychology and some of the major research findings that are based on this methodology
4. Describe the biological, cognitive and affective processes that underlie human behaviour
5. Use the approaches, theories, concepts and processes described above to explain patterns of human behaviour
6. Use appropriate learning strategies to study psychology
7. Read, understand and analyze articles in the field of psychology

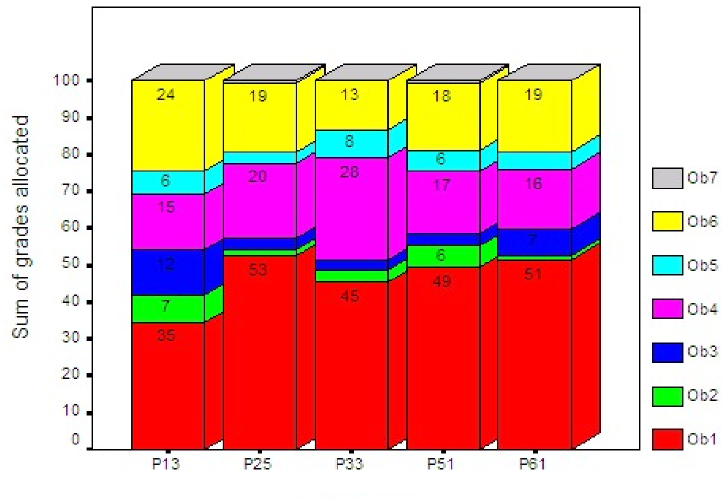
Figure 9.10 illustrates the results. An examination across sections indicated that the achievement of objectives 2, 3 and 5 was seldom measured. These results concerned the department and initiated a lengthy discussion which focused on three questions raised by the coders:

(1) Are the objectives that are not being measured difficult to teach or difficult to measure?
(2) Are the objectives that are not being measured valued by the department?
(3) Should objectives not being measured be removed from the course objectives?

The final decision was to delete Objective #6 as this competency is addressed and measured in Objective #7 through the common writing assignment. It was also decided to change the word “Identify” in Objective #2 to “Understand.”

Figure 9.10

OBJECTIVES MEASURED



Analysis of topics measured - all sections combined

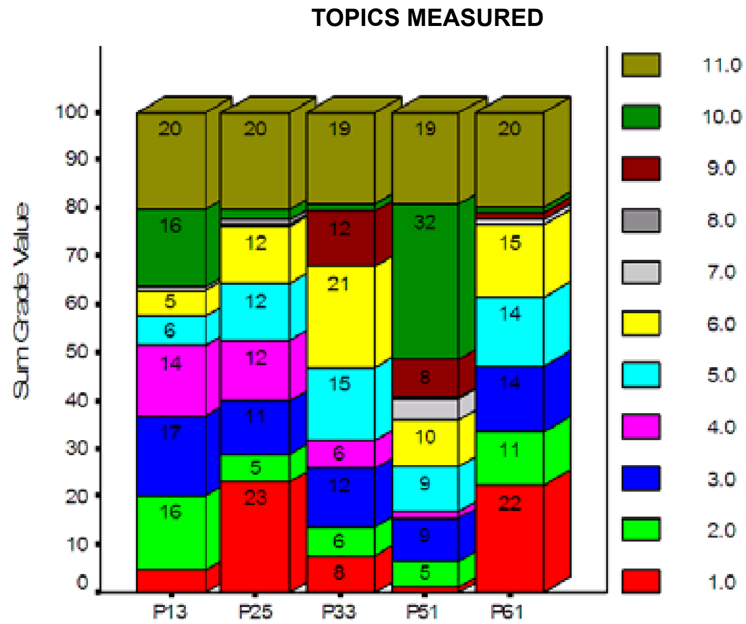
The topics at the time the research was done included:

1. Overviews of Modern Perspectives
2. Research Methods in Psychology
3. Biological Foundations of Psychology (brain and behavior)
4. Perception
5. Learning (classical and operant conditioning)
6. Memory and Forgetting
7. Historical Perspectives
8. Study Skills
9. Consciousness (sleep, drugs, altered states, hypnosis)
10. Other
11. Common Assignment

An analysis of which objectives were being measured revealed a fair amount of variance across the sections (Figure 9.11). Two teachers did not address topic #4 at all, while one teacher allotted 32% of the students' grades' to the topic "other." The department found this unsettling and spent a good deal of time discussing the problem.

It was noted that there was previous agreement that Perspectives and Research Methods, Biological Foundations, Perception, Learning, and Memory and Forgetting should be addressed in all Psychology 102 courses. Many teachers, however, did not feel comfortable about teaching Perception. Perception was removed from the required list. It was proposed that teachers teach all four topics and add at least one, to a maximum of two optional topics. The optional topic(s) would take up the same amount of teaching time and assessment as the other topics.

Figure 9.11



Student Results

Figures 9.12 and 9.13 show grades for those students for whom we had high school grades and who received 30% or more as their Psychology grade. Extreme outliers were removed for clarity. These grades are grouped by teacher. Figure 9.12 illustrates the distribution of students' high school averages when they entered college in the fall of 2003. There is considerable coherence across teachers; all groups show a median of approximately 75%.

Figure 9.13 indicates that, many of the grades in Psychology 102 are below the passing grade and more than half the group has achieved a mark considerably lower than their high school average would predict. The box plots show that there are considerable differences across teachers which would indicate that the differences in the assessments shown above do have an impact on student achievement. In two sections, all students pass the course; in three other sections, a large proportion of students do not pass the course.

Figures 9.14 and 9.15 show results for all 10 sections separately. For example, teacher P25, has four sections: P25A, P25B, P25C and P25D.

Figure 9.12

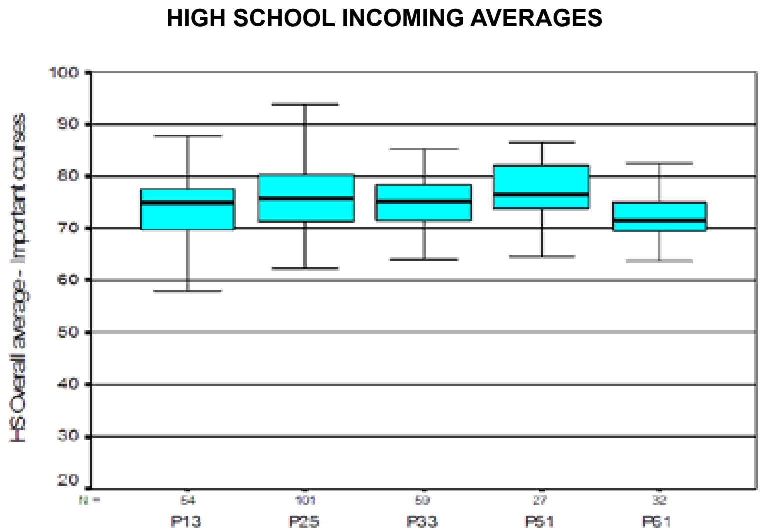


Figure 9.13

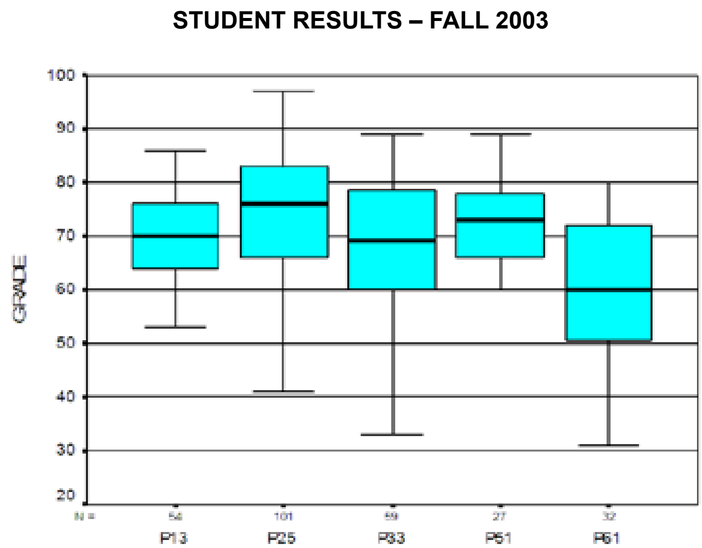


Figure 9.14

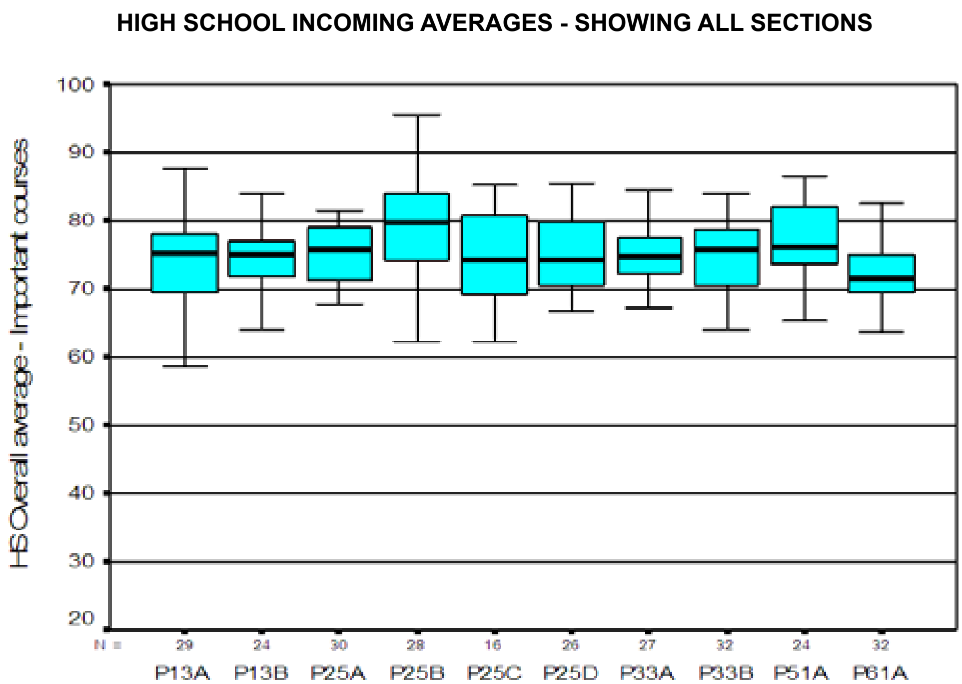


Figure 9.15

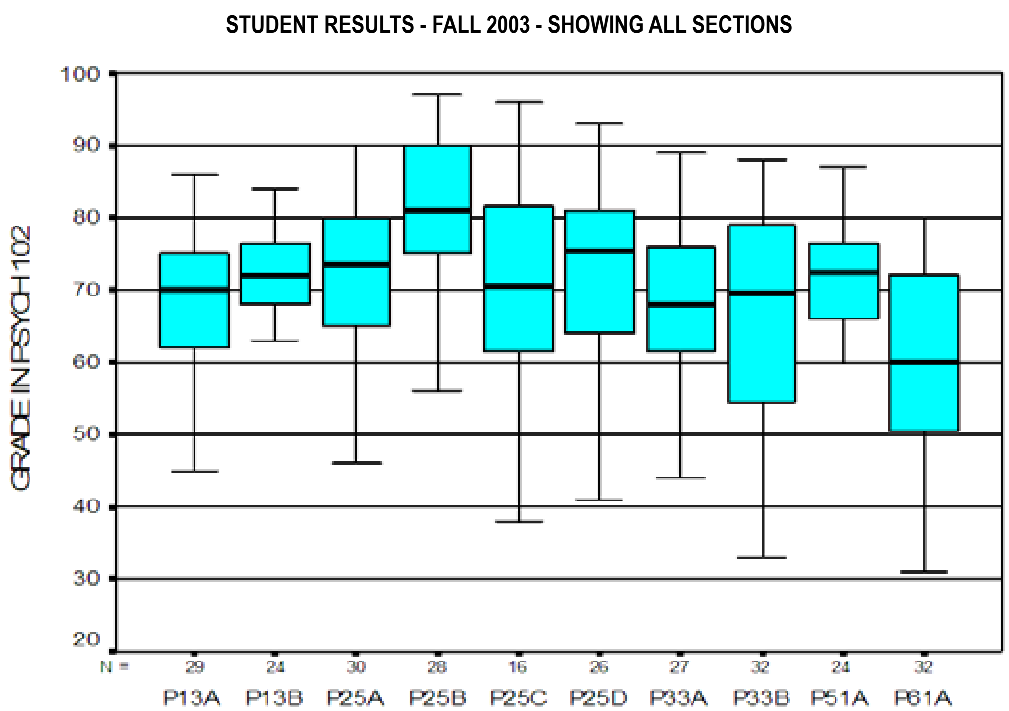


Table 9.1

INTRODUCTION TO PSYCHOLOGY - FALL 2003 ISSUES AND RESOLUTIONS		
ISSUE	**DESCRIPTION OF THE PROBLEM**	**RESOLUTION**
Instructional goals of the course.	Despite the work done during the reforms, there was a lack of consensus regarding the instructional goals of the course.	Preliminary agreement was reached in the Spring of 2004 (Supporting Document C).
Topics addressed in the course.	There was a lack of consensus regarding which topics to include in the course.	Preliminary agreement was reached in the Fall of 2004 (Supporting Document C).
Measuring student achievement of the instructional objectives.	The achievement of objectives 2, 3 and 5 was seldom measured.	Guidelines and coded question bank will help to measure objectives 2, 3, & 5 in the future.
Types of assessments used.	Over- reliance on class tests. Over-reliance on multiple choice (MC) questions. There was a need to increase the number of extended-response and short-answer questions.	In November 2005 the department agreed that class tests should constitute 50 – 60% of each student's overall grade. MC, true-false, fill-in-the blank and/or matching items can only be worth between 50 - 60% of any test. The remaining percentage should be allocated to extended-response and short- answer questions. A bank of short-answer and extended-response questions from the material that was coded in the Fall 2003 was assembled. In addition, each teacher was asked to choose a topic and to submit 10 short-answer questions on that topic. A bank of MC, short-answer and extended-response questions, coded for Type of Knowledge and Cognitive Complexity would be created.

RECODING OF ASSESSMENT TASKS
FALL OF 2006

The newly aligned Psychology 102 course was offered in the Fall of 2006. The main objective of the recoding was to establish whether or not two major curriculum alignment goals were achieved: (1) a decrease in the use of multiple choice questions, and (2) an increase in the use of extended-response questions that require higher level thinking skills. Given the department's focus on class tests and, in particular, the use of extended response questions on class tests, it was decided that ALL extended response items would be coded. However, recoding approximately 900 additional items was not feasible. Therefore a random sample consisting of 10% of the non-extended response items, that is, multiple choice, true false, matching and short answer questions were coded.

An analysis of class tests

Figure 9.16 shows items on class tests by teacher, with grades for non extended-response items weighted by 10 to compensate for sampling. The extended response items have been left as originally coded. Results indicate that the class tests administered by teachers P2, P4, P5 and P6, fall within the department guidelines which state that objective questions such as multiple-choice, matching, and true-false should be worth between 50-60% of the student's overall grade. P1 and P3 need to increase their use of extended response items to fall within the department guidelines.

Figure 9.16

MEAN GRADE ALLOCATED TO DIFFERENT FORMATS ON CLASS TESTS

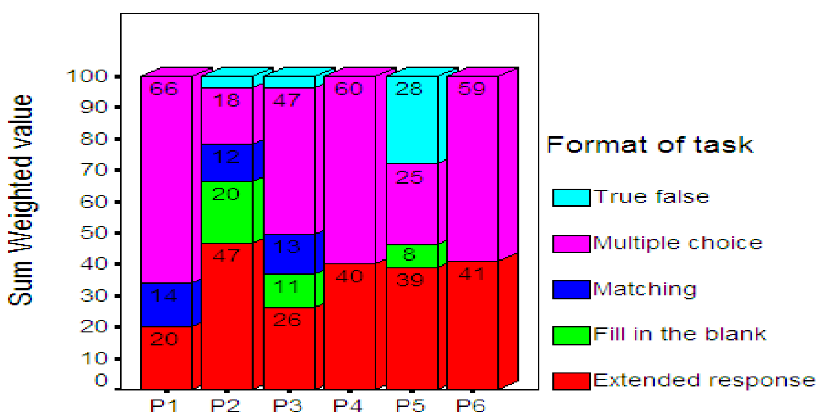


Figure 9.17 indicates the kind of knowledge demanded by items on class tests organized by teacher. Grades for non extended-response items are weighted by 10 to compensate for sampling; extended-response items have been left as originally coded. Not surprisingly, there is an anticipated focus on conceptual knowledge; however, the focus ranges from 37 - 80%. The emphasis on factual knowledge ranges from 19 - 49%.

The correlation between factual knowledge and remember, as the level of cognitive complexity, is apparent when one compares Figures 9.17 and 9.18. Differences across sections, however, begin to emerge when one examines the cognitive complexity of the remaining test items. P3, P4, P5 and P6 seem to be asking an appropriate number of questions demanding that students understand the material at a fundamental level. There seems to be a discrepancy, however, when it comes to asking students to apply their knowledge. P1 and P2 devote 37 - 38% of the students' grades on the ability to apply information. This contrasts with the four other teachers where application questions range from 9% to 18%.

Figure 9.17

KIND OF KNOWLEDGE ON CLASS TESTS

ALL ITEMS INCLUDED

FALL 2006

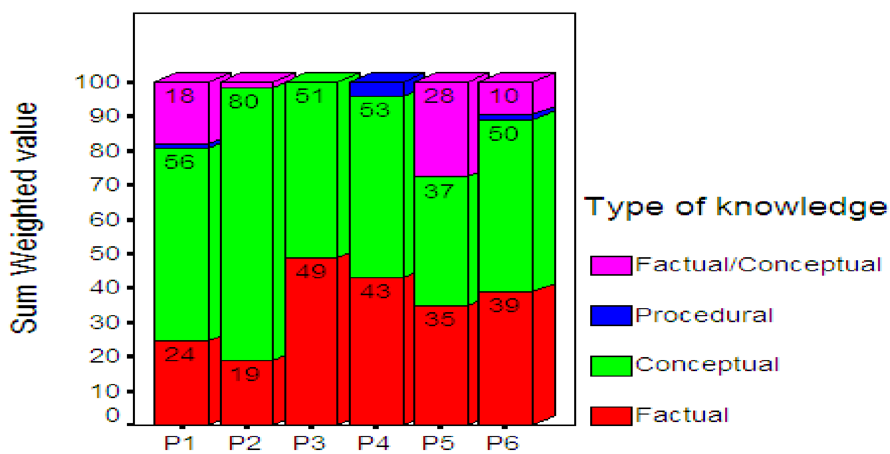
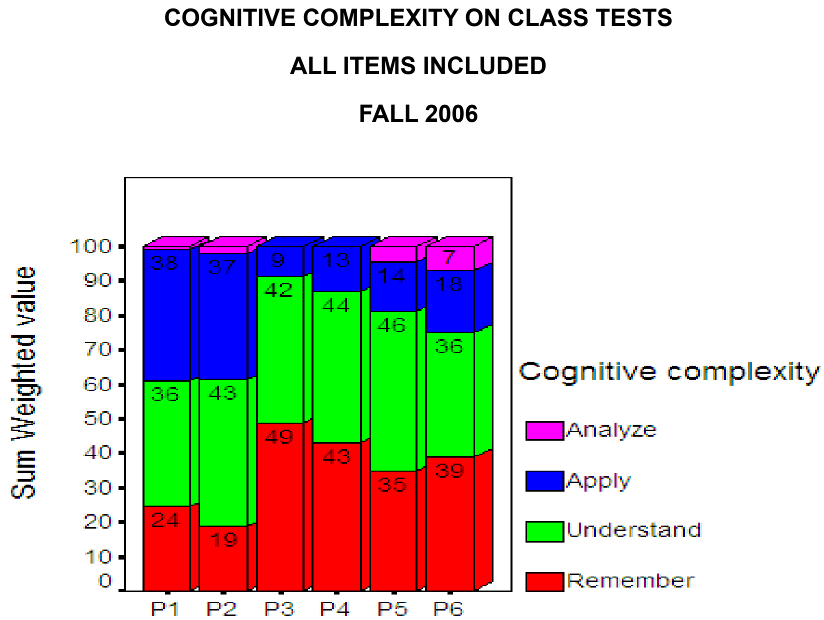


Figure 9.18



An analysis of extended response and selected response items

The exact correlation between factual knowledge and remember, as the level of cognitive complexity, continues to be evident in extended response items when one compares Figures 9.19 and 9.20. It is interesting to note, however, that extended response items do not necessarily increase the cognitive complexity of the question. Most of these questions represent conceptual knowledge and demand that the learner remember or understand the material. A small number of questions used, require that the learner apply their knowledge or analyze information.

An examination of the selected response items, that is multiple choice, fill-in-the-blank, matching and true-false items reveal a fair number of items that ask students to apply their knowledge, although the largest proportion requires factual knowledge. Therefore, teachers cannot assume that asking students to respond in writing automatically makes the cognitive demand more challenging intellectually. Extended response questions do require that the student draws their knowledge from memory as opposed to only having to recognize the correct answer. They also provide an opportunity to practice writing skills.

Figure 9.19

TYPE OF KNOWLEDGE IN EXTENDED RESPONSE ITEMS

MARKS ALLOCATED BY TEACHER

FALL 2006

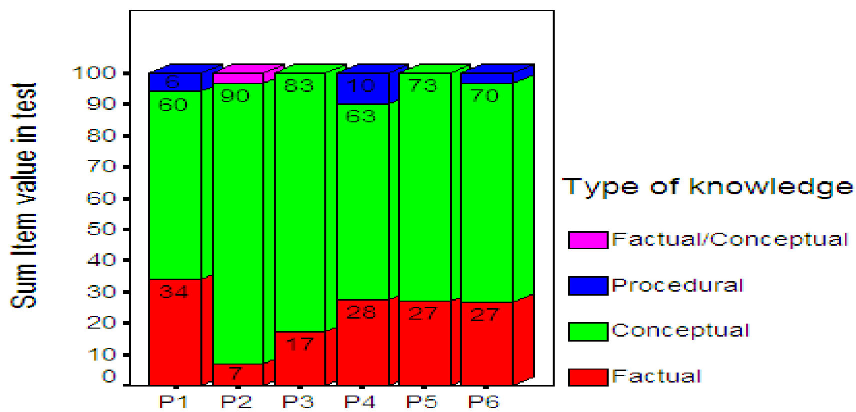


Figure 9.20

COGNITIVE COMPLEXITY IN EXTENDED-RESPONSE ITEMS

MARKS ALLOCATED BY TEACHER

FALL 2006

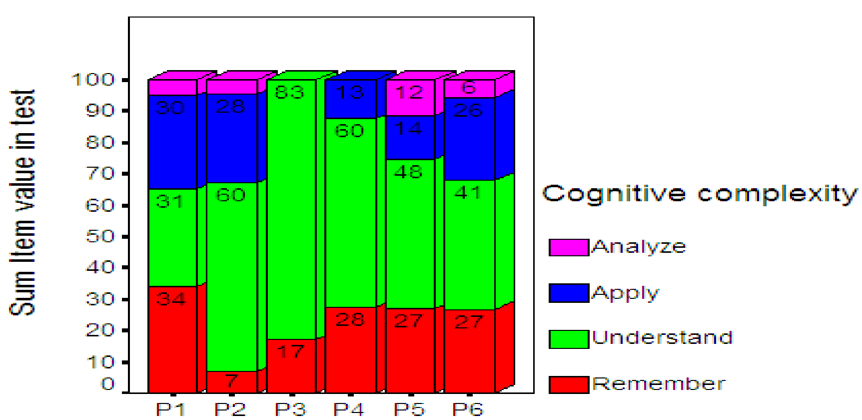


Figure 9.21

TYPE OF KNOWLEDGE

MULTIPLE-CHOICE /FILL-IN-THE-BLANK/MATCHING/ TRUE-FALSE

FALL 2006

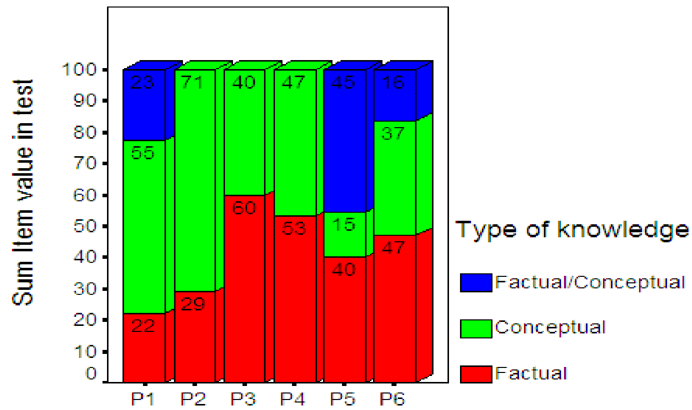
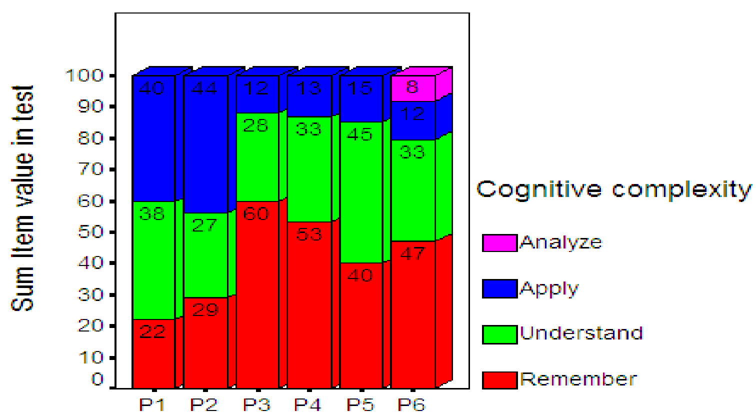


Figure 9.22

COGNITIVE COMPLEXITY

MULTIPLE-CHOICE /FILL-IN-THE-BLANK/MATCHING/ TRUE-FALSE

FALL 2006



REFLECTION

Curriculum collaboration does not represent a new way of working for Champlain St-Lambert's Psychology Department. Their efforts to examine and understand if students are learning comparable intellectual skills and abilities, in the multiple sections of Psychology 101, began in the Fall of 2000. At that time they were surprised to learn that in some sections students were not required to write at all, while in other sections a 1,200 word research paper was required. They proceeded to design a doable meaningful, writing task that connects to, and reinforces the enormous amount of content knowledge students are required to learn. The task consists of having students read and summarize five articles chosen by the department on a topic of popular interest. Students create an outline for an academic paper based on the articles, but do not actually write the paper. The task of constructing the paper is left for a subsequent course. These efforts to align the curriculum of Psychology 101 made them one of the lead departments when the PAREA proposal was granted.

The PAREA research project provided them with an opportunity and a framework to closely examine class tests, the most common form of assessment used by teachers in the department. In the end, 948 items were coded. The coding process provided definitive information about the types of knowledge and levels of cognitive complexity required by these tests. This information was combined with the results of a survey which the department designed to help them reach a consensus about how to adjust the curriculum and set standards for measuring student learning.

An important issue that emerged when the results of the analysis were presented was what the department perceived to be an overemphasis on class tests which consisted primarily of multiple choice items that did not require students to apply the concepts and principles that they were learning. Although the department had established a common writing assignment worth 20%, there was a general consensus that allowing 80% of the student's grade to rest on responses to multiple choice items, that primarily represented lower levels of thinking, was still too high. To remedy this situation, assessment guidelines were established which stipulate that class tests can account for 50 - 60% of the student's overall grade, and multiple choice items can only account for a maximum of 60% on each test. The remaining percentage is now based on extended response items which ask students to construct their answers in a written format. To help teachers design these tests, the department created a bank of coded extended response items.

The decisions and recommendations that were made in response to this issue reconfirmed this department's philosophy that students should be asked to demonstrate their understanding in writing more frequently. This represents this department's understanding that the acquisition of subject-matter knowledge is enhanced when the learner is asked to demonstrate their knowledge in a constructed, written format as well as their commitment to intentionally contribute to the reading, writing and thinking development of their students.

The two people elected to code the data (subject-matter experts, SMEs or coders) chose to focus attention on curriculum alignment through two departmental workshops and in private consultations with each teacher. The leadership skill demonstrated by the coders was exemplary. They prodded, cajoled, supported and showed, through their own efforts and example that increased coherence could be achieved. The goal now is to sustain the curriculum collaboration effort exhibited by all department members.

SUPPORTING DOCUMENT A

COURSE OBJECTIVES PRE-PAREA - 2003

Teachers P13 & P61

By the end of this course, students are expected to:

- know, understand and correctly use the main concepts and vocabulary in the field of Psychology
- identify the main approaches or perspectives and the related theories that are predominant within Psychology
- know and understand the methodology used in Psychology and some of the major research findings that are linked to this methodology
- use the approaches, theories, concepts and processes described above to begin to interpret patterns of human behaviour and to begin to demonstrate how individuals interact with their environment
- use appropriate learning strategies to meet educational goals

Teacher P27

By the end of this course, students are expected to:

- have learned about some of the basic topics, concepts and vocabulary in psychology
- understand the basic perspectives in psychology and how they apply to most areas of psychology
- have a basic understanding of scientific method and its application and importance in all areas of the social sciences
- have an awareness of the biological, cognitive and affective foundations of human behaviour
- learn how to locate resources, prepare an annotated bibliography and organize material
- apply some of what you've learned to real life settings
- use appropriate learning strategies to meet educational goals

Teacher P51

Through this course you will learn to:

- identify the major methodological and historical basis of psychology as well as the principal fields of application and research
- describe the biological foundations and processes related to human behaviour
- identify and state the major concepts and theories in developmental, perceptual, cognitive and affective functioning
- explain how these concepts and theories interact to explain human behaviour
- study and describe the applications of these concepts and theories
- think about and write about issues related to topics discussed in class
- apply basic principles of psychology

Teacher P33

By the end of this course, students are expected to:

- know, understand and correctly use the main concepts and vocabulary in the field of Psychology
- identify the main approaches or perspectives and the related theories that are predominant within Psychology
- know and understand the methodology used in Psychology and some of the major research findings that are linked to this methodology
- be aware of some of the ethical issues involved in conducting research
- describe the biological foundations and processes related to human behavior
- recognize and locate psychology's place among the social sciences
- begin to distinguish 'real' psychology from 'fake' psychology
- apply some of what you've learned to real world settings and situations

SUPPORTING DOCUMENT B

CHAMPLAIN
ST-LAMBERT
CEGEP

CODE: 022K

GOVERNMENT OBJECTIVES

OBJECTIVE	STANDARD
Statement of the competency	
To explain the foundations of human behaviour and mental processes.	
Elements	**Performance criteria**
1. To demonstrate the contribution of psychology to the understanding of human beings.	Correct use of the concepts and vocabulary related to the field of psychology.
2. To distinguish the main perspectives, the main schools of thought and their proponents, and the methodology used in the field of psychology.	Clear identification of major perspectives, schools of thought and fields of intervention in the field of psychology.
	Explanation of the methodology used in psychology based on the main discoveries in the field of human behaviour.
3. To describe the biological, cognitive and affective processes that underlie human behaviour.	Description and interaction of the biological, cognitive and affective processes.
4. To demonstrate the adaptation process of individuals to their environment.	Satisfactory demonstration of the adaptation process of individuals to their environment.
5. To interpret various patterns of behaviour using concepts and theories related to the field of psychology.	Satisfactory interpretation of various patterns of human behaviour based on various psychological approaches.

DEPARTMENTAL OBJECTIVES

By the end of this course, students are expected to:

- Know, understand and correctly use the main concepts and vocabulary in the field of Psychology
- Identify the main approaches or perspectives and the related theories that are predominant within Psychology
- Know and understand the methodology used in Psychology and some of the major research findings that are linked to this methodology
- Know and understand the biological, cognitive and affective processes in Psychology and how they interact with each other
- Use the approaches, theories, concepts and processes described above to begin to interpret patterns of human behaviour and to begin to demonstrate how individuals interact witht heir environment
- Use appropriate learning strategies to meet educational goals

SUPPORTING DOCUMENT C

COURSE OBJECTIVES USED TO CODE THE DATA
SPRING 2004

1. Know, understand and use the main concepts and vocabulary in the field of Psychology
2. Identify the main perspectives and related theories that are predominant within Psychology
3. Know and understand the methodology used in Psychology and some of the major research findings that are based on this methodology
4. Describe the biological, cognitive and affective processes that underlie human behaviour
5. Use the approaches, theories, concepts and processes described above to explain patterns of human behaviour
6. Read, understand and analyze articles in the field of psychology
7. Use appropriate learning strategies to study psychology
8. Other

TOPICS USED TO CODE THE DATA
FALL 2004

1. Overviews of Modern Perspectives
2. Research Methods in Psychology
3. Biological Foundations of Psychology (brain and behavior)
4. Perception
5. Learning (classical and operant conditioning)
6. Memory and Forgetting
7. Historical Perspectives
8. Study Skills
9. Consciousness (sleep, drugs, altered states, hypnosis)
10. Other
11. Common Assignment

SUPPORTING DOCUMENT D

PSYCHOLOGY 102

TOPICS

1) On the list provided, check the topics you feel should be included in Psych 102.
    - ☐ Overview of Modern Perspectives
    - ☐ Research Methods in Psychology
    - ☐ Biological Foundations of Psychology (brain and behavior)
    - ☐ Perception
    - ☐ Learning (classical and operant conditioning)
    - ☐ Memory and Forgetting
    - ☐ Historical Perspectives
    - ☐ Study Skills
    - ☐ Consciousness (sleep, drugs, altered states, hypnosis)
    - ☐ Common Assignment

2) Identify any TOPICS that you would like to see **REMOVED** from the current list of instructional objectives.

    Your rationale for this suggestion:

3) Identify any TOPICS that you want **ADDED** to the list in this course, which do not appear on the current list of TOPICS.

    Your rationale for this suggestion:

4) Please review the list of TOPICS and identify which topics, if any, in terms of your course assessments, you believe should receive a higher or lower priority in Psychology 102.

5) Are there topics that you feel should be addressed in class, that appear on the list, and you feel should stay on the list, but are difficult to measure and/or evaluate in terms of student learning? Explain.

INSTRUCTIONAL OBJECTIVES / LEARNING OUTCOMES

6) On the list provided below, check the objectives which you feel are important to Psych 102.

    - ☐ Know, understand and use the main concepts and vocabulary in the field of Psychology
    - ☐ Identify the main perspectives and related theories that are predominant within Psychology
    - ☐ Know and understand the methodology used in Psychology and some of the major research findings that are based on this methodology
    - ☐ Describe the biological, cognitive and affective processes that underlie human behaviour
    - ☐ Use the approaches, theories, concepts and processes described above to explain patterns of human behaviour
    - ☐ Read, understand and analyze articles in the field of psychology
    - ☐ Use appropriate learning strategies to study psychology

7) Identify any OBJECTIVES that you would like to see **REMOVED** from the current list of instructional objectives.

Your rationale for this suggestion:

8) Identify any OBJECTIVES that you want **ADDED** to the list.

Your rationale for this suggestion:

9) Please review the list of OBJECTIVES and identity which ones, if any, should receive priority, in terms of your course assessments..

10) Are there objectives that you feel should be addressed in class ,that do appear on the list, that you feel should stay on the list, but are difficult to measure and/or evaluate in terms of student learning? Explain.

TYPE OF KNOWLEDGE

11) Suggest how much weight should be allotted in Psychology 102 to the types of knowledge listed below, given the nature of the course content and the kinds of intellectual abilities we are trying to develop in our first-term students. CIRCLE your response (it can be a range of percentages).

FACTUAL	0%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%
CONCEPTUAL	0%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%
PROCEDURAL	0%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%
METACOGNITIVE	0%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%

12) Are there other words that better describe the kinds of knowledge students are meant to acquire in this course?

COGNITIVE COMPLEXITY

13) Overall, how challenging should our tests assessments be? CIRCLE your response.

REMEMBER	0%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%
UNDERSTAND	0%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%
APPLY	0%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%
ANALYZE	0%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%
EVALUATE	0%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%
SYNTHESIZE/ CREATE	0%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%

TYPE OF ASSESSMENT TASKS

14) What percentage of the student's grade should be allotted to the following tasks?

CLASS TESTS	0%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%
ESSAYS	0%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%
ASSIGNMENTS	0%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%
INDIVIDUAL ORAL	0%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%
STUDY GUIDE	0%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%
PARTICIPATION	0%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%

15) Are there other kinds of assessment tasks that you would like to see in this course?

TYPE OF KNOWLEDGE IN CLASS TESTS

16) In general, how should the different kinds of knowledge be distributed on any given class test?

FACTUAL	0%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%
CONCEPTUAL	0%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%
PROCEDURAL	0%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%
METACOGNITIVE	0%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%

COGNITIVE COMPLEXITY IN CLASS TESTS

17) In general, how difficult should our class tests be?

REMEMBER	0%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%
UNDERSTAND	0%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%
APPLY	0%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%
ANALYZE	0%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%
EVALUATE	0%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%
SYNTHESIZE/ CREATE	0%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%

TOPICS

18) Assuming that the topic list remains unchanged, suggest how much of the course should be devoted to each topic.

Overview of Modern Perspectives

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

Research Methods in Psychology

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

Biological Foundations of Psychology (brain and behavior)

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

Perception

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

Learning (classical and operant conditioning)

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

Memory and Forgetting

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

Historical Perspectives

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

Study Skills

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

Consciousness (sleep, drugs, altered states, hypnosis)

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

Common Assignment

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

INSTRUCTIONAL OBJECTIVES / LEARNING OUTCOMES

19) Assuming that the OBJECTIVE list remains unchanged, suggest how much of the course should be devoted to each OBJECTIVE. CIRCLE YOUR RESPONSE

1. Know, understand and use the main concepts and vocabulary in the field of Psychology

   0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

2. Identify the main perspectives and related theories that are predominant within Psychology

   0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

3. Know and understand the methodology used in Psychology and some of the major research findings that are based on this methodology

   0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

4. Describe the biological, cognitive and affective processes that underlie human behaviour

   0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

5. Use the approaches, theories, concepts and processes described above to explain patterns of human behaviour

   0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

6. Read, understand and analyze articles in the field of psychology

   0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

7. Use appropriate learning strategies to study psychology

   0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

PARTICIPATION

20) Whether or not you award grades for “participation,” please suggest criteria that might be considered for this type of assessment task.

CHAPTER 10

SOCIAL SCIENCE METHODOLOGY

CONTENTS

Quantitative Methods (QM) is the first of three compulsory courses taught as part of the Social Science DEC. The other two courses are Introduction to Methodology (IM) and Integrated Seminar in the Social Sciences. The students typically take these three courses in the second, third and fourth semesters respectively. The overall objective of the courses is to introduce the students to the basic methodologies and approaches to knowledge in the various Social Science disciplines.

Curriculum and hiring decisions are generated via the Methodology Module. Any teacher who is currently teaching Social Science courses is eligible to teach the Methodology courses. Membership of the module, as decided by the Academic Council, consists of teachers who are projected to teach any of the three courses in the following semester, are currently teaching any of the courses, or taught any of them in the previous semester. The Chair of the Module is responsible for organizing Module meetings as necessary.

Because the membership of the Module is not defined a constant set of teachers, there is less cohesiveness in the group than in most academic departments. This is compounded by the fact that each teacher is also a member of his or her home department. Furthermore, there has been a tendency to use the hiring in the Methodology to fill out the teaching loads of junior part-time teachers whose position in the College is less permanent. All of these factors produced a challenge to the PAREA project in terms of generating the necessary collective vision needed to carry through the project.

THE RESEARCH PROCESS

In the fall of 2004, the Methodology Module met and agreed to join the research project, focusing on the Quantitative Methods course to be taught in the following semester. The two coders were Louise Labelle and Ann Logan. Louise came to the task with experience, having been involved with the coding for Psychology 102, while Ann is deeply involved with the project as SPSS analyst.

There were eleven sections of Quantitative Methods offered in Winter 2005, distributed among six teachers. One teacher left on sick leave a third of the way through the semester, and these sections were taken over by another teacher. Because of difficulties due to having to review the first portion of the course due to teacher absence, these sections were removed from the study. The remaining five teachers signed the consent forms and agreed to provide their course objectives and assessment items to the coders as they were produced.

In the Winter semester, 2005, the coders focused first on the course objectives. It was the general impression that all teachers are using a standardized form of course objectives with objectives and exit profile common to all sections. What the coders discovered as they began reviewing the data was a considerable lack of similarity in the stated objectives. Upon examination of the course outlines of the five courses being analyzed, a total of four quite different sets of objectives were discovered (Supporting Document A). The coders began a process of putting together those that were similar, and creating new objectives that seemed to incorporate the intent of the originals. The process was completed in conjunction with the competencies and performance criteria determined by the Ministry of Education. A final set of 13 objectives resulted and these were presented at a meeting of the Quantitative Methods module (Supporting Document B). Each objective was discussed individually, changes to wording were proposed, and the final set was agreed upon by all present. Not only would these be the objectives used to code the PAREA data, but also they were to be used by all teachers in the future. All who participated viewed this as a positive activity. The coders then began coding the course materials as they were provided.

In the fall of 2005, after coding the first few quizzes of the first section, it became apparent that the taxonomy required modification because of the large number of items that were coded “Apply” in terms of cognitive complexity. It was decided to refine these items by using an extra code that reflected the perceived difficulty of the item. Coding of the first two teachers was completed by the end of this semester, with a total of 224 items for one set of data and 183 items for the second. Because of the large number of items to be coded and discussed this task required the entire semester.

In order to complete some form of analysis as soon as possible with the objective of getting some data back to the module, it was decided to just code tests and quizzes for the remaining three teachers’ courses. This task was completed by the end of March, 2006, and at that point, analysis began.

The data presentation meeting took place on a pedagogical day (Wednesday, 15th November 2006), thus ensuring the best attendance. Past, present and future methodology teachers were invited.

After welcoming everyone, the module coordinator introduced the coders. Ann Logan began by describing the nature of the research, of particular interest since the audience is all teaching research courses. The differences between action research and the more traditional forms taught by the module were remarked upon. The project objectives, in terms of increasing horizontal and vertical alignment were also reviewed.

Louise Labelle reviewed the coding process and the application of Bloom’s taxonomy to the discipline. As well, she described how, as a result of discovering a large proportion of “apply” items, adding a three-point difficulty scale further refined these items. She also reminded the participants that the first task had been to meet to agree on a set of objectives that would appear on all course outlines and that any change could only be made with module agreement.

One important issue was raised for the benefit of the module at this point, in terms of the interpretation of the data. Participants were reminded again that only tests and quizzes were selected for analysis, and assignments and computer labs were not included. It was also mentioned that a further rationale for the selection of these tasks was that the student completes them individually. This is in contrast to the labs and assignments that are frequently completed in pairs or groups. As a consequence, some study participants may notice that objectives may not be met in the data, but could have been covered by these non-included tasks. As well, the audience was also reminded that the data was collected for courses completed *before* the objectives were aligned.

ANALYSIS OF ASSESSMENT TASKS

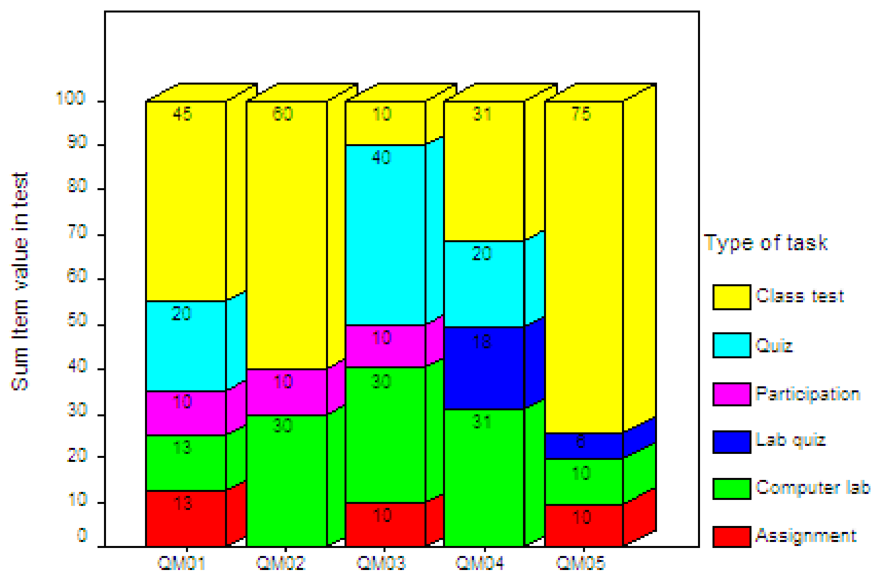
Comparison of type of tasks used in Quantitative Methods

The main discussion regarding this slide was in response to the appearance of “participation.” At the time the data was collected, assigning marks for class involvement was an acceptable practice. Since that time, it has been decided that assessment tasks must be clearly defined, and relate to specific performance criteria. The module agreed that it no longer uses this form of assessment. The coders elaborated on the definitions of the tasks, with particular reference to the difference between a test and a quiz.

All teachers give computer lab assignments, and since the data was collected, a collection of suitable exercises have been made available to all teachers to use in their courses. This suggests that further alignment that has occurred since the beginning of data collection. Two teachers also give quizzes in the use of SPSS software.

Figure 10.1

GRADES ALLOCATED TO TYPE OF TASK BY DIFFERENT QM TEACHERS

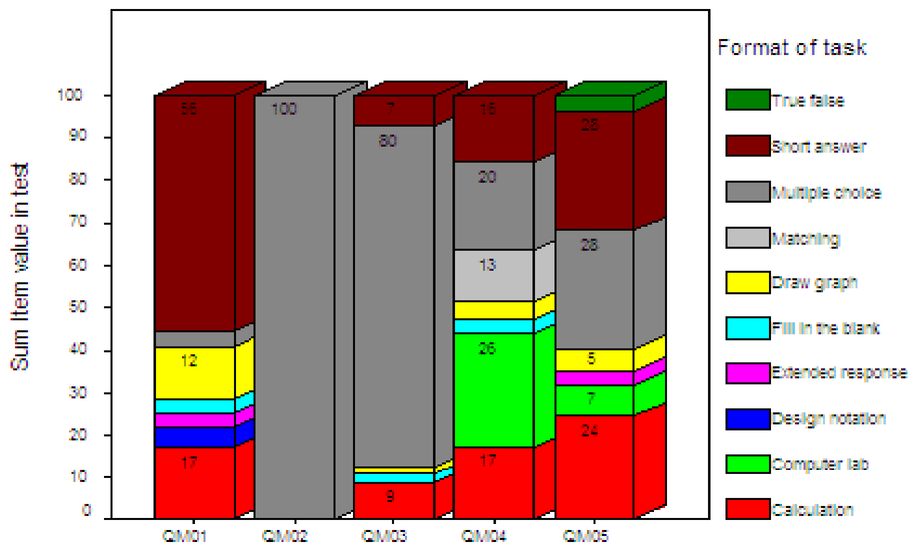


Comparison of format of tasks used in Quantitative Methods

It was surprising that there was no discussion on the preponderance of multiple- choice for some teachers (QM02 & QM03). However, it is possible that this lack of reaction occurs because the majority of Quantitative Methods teachers are Psychology teachers and this format is used frequently in that discipline. The coders mentioned that the questions asked in multiple-choice format may require some calculation, or interpretation of graphs, but the students were never asked explicitly to show their work, and for that reason these items were coded strictly as multiple-choice.

Figure 10.2

GRADES ALLOCATED TO FORMAT OF TASK BY DIFFERENT QM TEACHERS

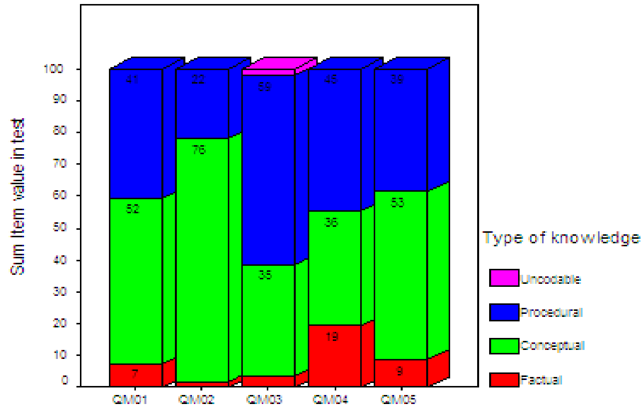


Comparison of the types of knowledge required by different QM teachers

It was noted that the amount of conceptual knowledge appeared to vary considerably across the sections (QM02 had 76% versus QM03 with 35%), as did factual knowledge. It was acknowledged that some degree of factual knowledge should be present since this is a first level course. The issue here is whether conceptual knowledge is more challenging to the students than procedural as it has been found to be in some other disciplines (Physics, Mathematics). This possibility was not addressed by the Methodology Module.

Figure 10.3

GRADES ALLOCATED TO TYPE OF KNOWLEDGE BY DIFFERENT QM TEACHERS



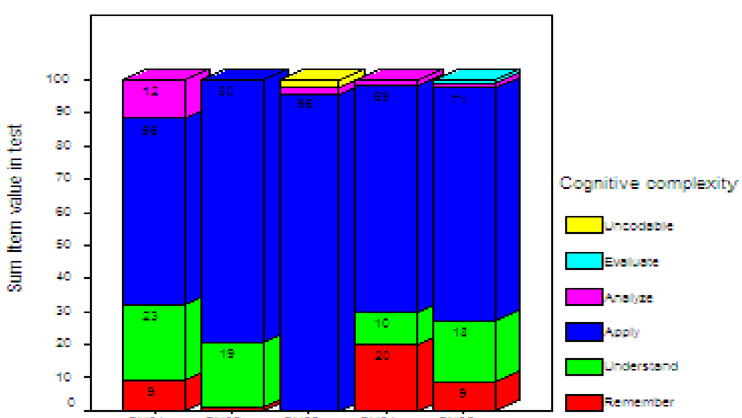
Comparison of cognitive complexity required by different teachers

The module acknowledged that application was the main cognitive skill required of the students in quantitative methods. The coders mentioned that the initial coding of the computer labs showed that analysis was required in these tasks and that analysis in QM is a high level skill that is usually only required in assignments.

A more detailed analysis of the relationship between type of knowledge and cognitive complexity revealed that 31% of items were coded Conceptual/Apply and 45% were coded Procedural/Apply, whereas only 7% were coded Factual/Remember. This is quite pronounced and supported the coder's decision to code the difficulty of application items.

Figure 10.4

GRADES ALLOCATED TO COGNITIVE COMPLEXITY BY DIFFERENT QM TEACHERS



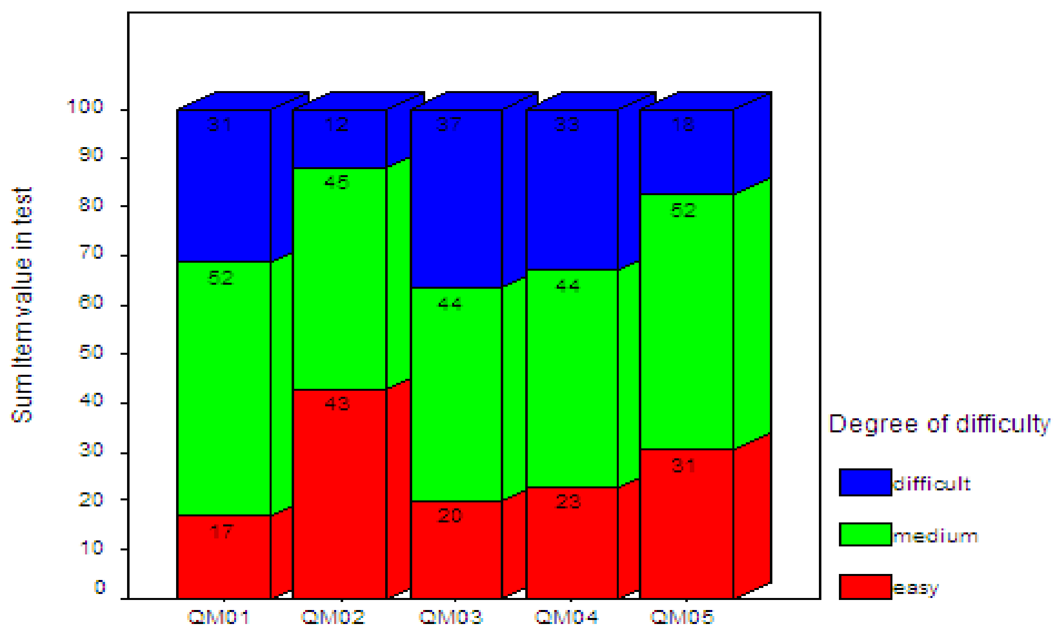
Analysis of difficulty between different teachers

Teachers in the Methodology Module seemed to feel that this variation between sections was acceptable. QM02 was identified as being the easiest course, based on this categorization. There was an agreement that for Quantitative Methods, the majority of the items should be in the medium range. At this point, participants were interested to see whether there was a link between difficulty and final grades, and as one group member observed "we still don't know how the teacher is grading."

These results address the issue of difficulty and type of knowledge. It is worth noting that the course judged easiest was the one with the largest proportion of conceptual knowledge. Further analysis of the data revealed that 26% of procedural items were judged to be difficult, as compared to a difficulty rate of 12% for conceptual items. This data suggests, then, that conceptual knowledge is not more difficult for this subject matter.

Figure 10.5

GRADES ALLOCATED TO LEVELS OF DIFFICULTY BY DIFFERENT QM TEACHERS



Analysis of grades allocated to objectives by QM teachers

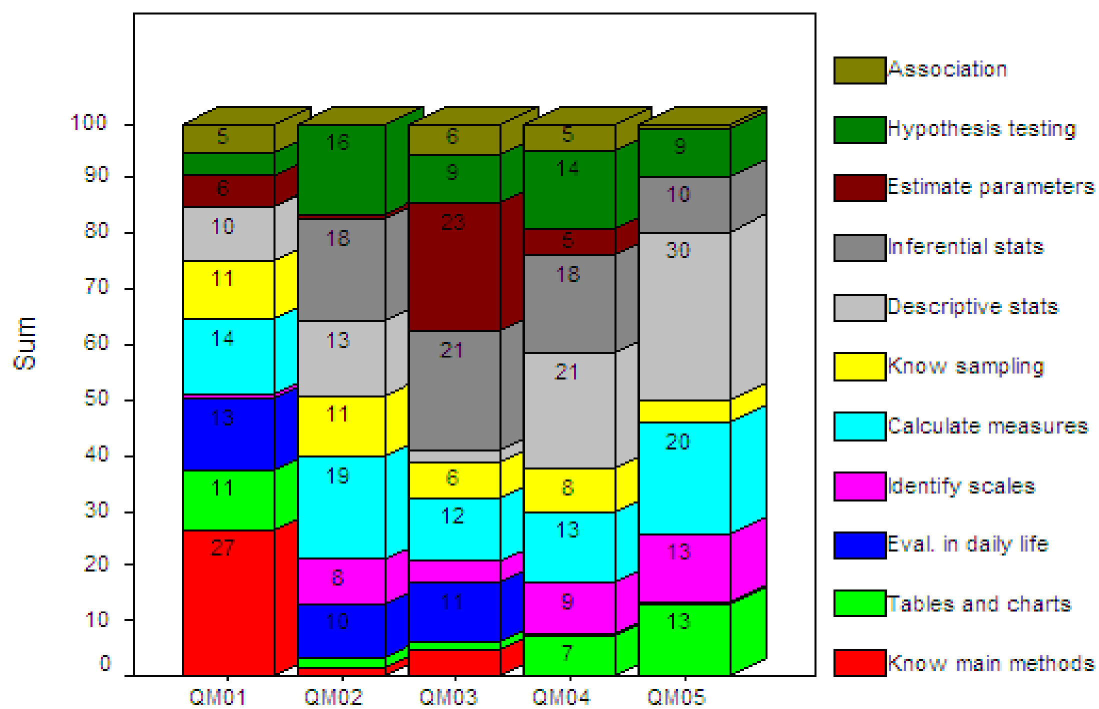
Objective 1, which refers to knowledge of concepts, was coded as present for almost every item coded, and so was excluded from the analysis, as was objective 13 which involved use of software. Clearly, at the point the data was collected, teachers were not teaching to the objectives, but ,as previously mentioned, everyone was teaching to different objectives (Supporting Document A).

As well, it was observed that teachers were addressing objectives but not necessarily assessing them. One teacher described bringing timely newspaper articles for informal discussion on the statistical concepts being applied.

While it is true that it is expected that the alignment of objectives should produce a more coherent picture, this will only be seen in a recoding of the data.

Figure 10.6

GRADES ALLOCATED TO OBJECTIVES BY DIFFERENT QM TEACHERS



Student results

In Figure 10.7, the extra teacher, QM06, represented the sections that were excluded from the study because of a teacher change partway though the semester. It was noted that while the medians of high school average for each group were similar, the degree of spread was different, with QM05 & QM06 having a wide spread, and QM01 & QM04 being quite tight in distribution.

Analysis of variance between the sections on high school grade resulted in an F value of .826 with a p value of 0.525.This indicates that the sections had no significant differences between them in terms of high school average.

Figure 10.8 shows the distribution of grades within the sections for those students achieving 30% or more in the course. At this point, a participant requested that the data be presented in a different way. First, it was requested that rather than showing data by teacher, the data should, instead, be separated by sections, since some teachers taught multiple sections. Second, it was requested that the cut-off be 45% rather than 30%. It was agreed that the requested data would be made available.

Analysis of variance carried out with the data resulted in an F ratio of 16.74, again with $p < .0001$. The larger F ratio indicated that the between section differences are even larger when below 30% students are excluded.

Figure 10.7

HIGH SCHOOL INCOMING AVERAGE

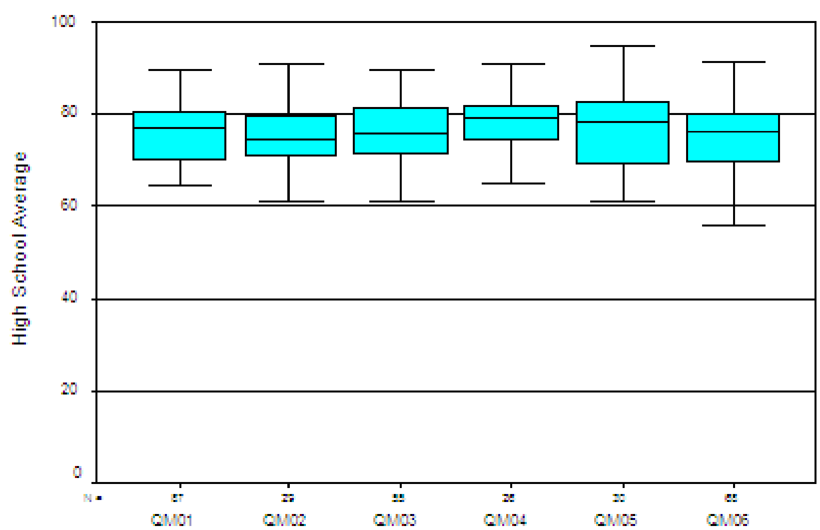
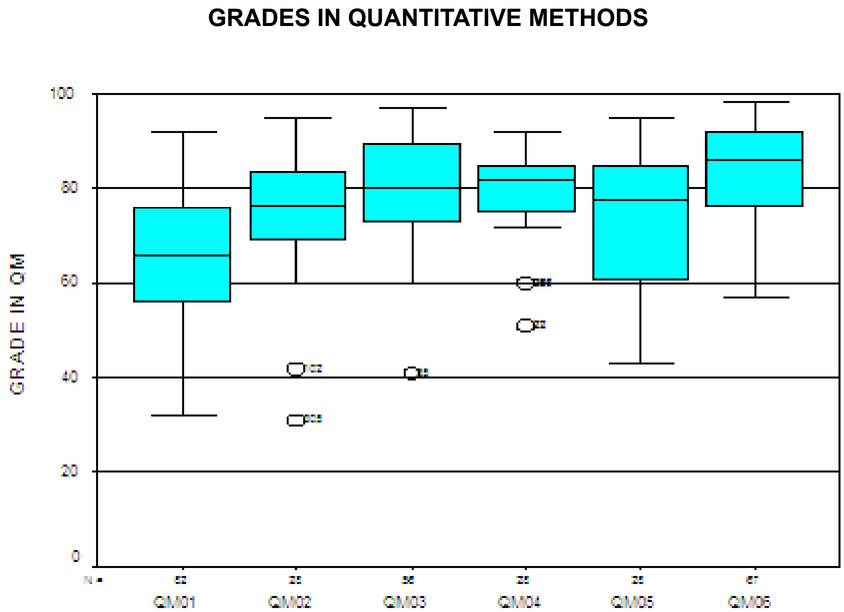


Figure 10.8



Analysis of pass/fail results

Figure 10.9 shows pass/fail rates for those students enrolled in a profile that includes mathematics course - specifically those students in the Commerce and World Studies with Math options. QM04 is excluded because that section included only one student taking mathematics.

The range is wide from 22% in QM01 to 0% for QM03 and QM06. Chi square analysis carried out with the data resulted in a chi square of 19.78, with $p < .001$, indicating that there is a significant relationship between passing and failing and the teacher's sections.

Figure 10.10 presents the pass/fail rates for students with no mathematics in their program. This includes students in the Choice, Psychology, Education and World Studies without Math options. Here again, the range is wide with 47% for QM01, down to 2% for QM03.

When the data is subjected to a Chi Square analysis, the resulting value of Chi Square is 36.359, with $p < .0001$, indicating that there is a significant relationship between passing and failing and the teacher's sections

Figure 10.9

PASS FAIL RATES DIFFERENT QM TEACHERS

STUDENTS TAKING MATHEMATICS

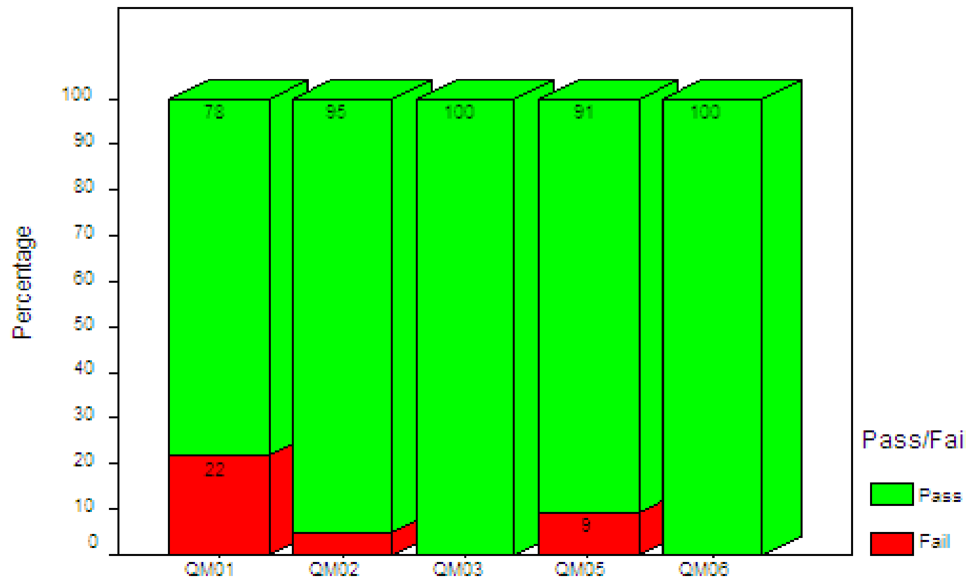
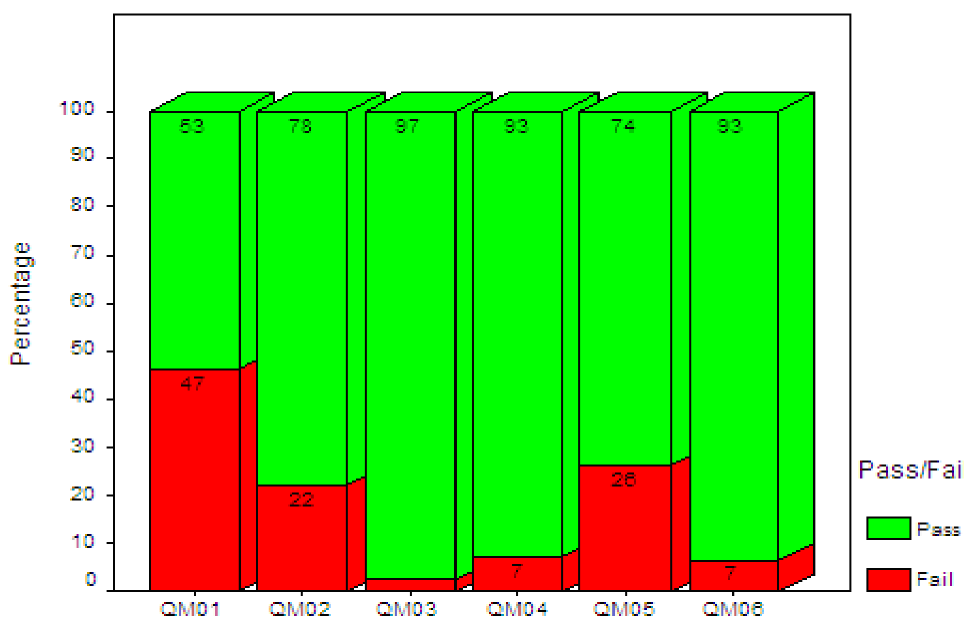


Figure 10.10

PASS FAIL RATES DIFFERENT QM TEACHERS

STUDENTS NOT TAKING MATHEMATICS



REFLECTION

Of all the results presented, the pass/fail rates between the math and no-math students provoked reaction from the Methodology Module. Social Science is the only program that contains students with two different incoming profiles. The Commerce students take three math courses as part of their DEC requirements, whereas there are no math courses for other Social Science students. This has considerable implication for the teachers of Quantitative Methods. Because of the mathematical nature of the subject, Commerce students find the course easier, but it is challenging for the students with no math, as clearly demonstrated by the pass/fail results.

Several participants raised the possibility of having separate sections, but others felt that the presence of the Commerce students raised the expectations of the class and provided great opportunities for peer tutoring and collaborative learning. Several useful teaching suggestions were provided that had been used by some teachers to try to alleviate the situation.

With respect to the results in general, it was felt that a test bank of coded questions would be most useful if the coders could provide it. As well, it was requested that an analysis be completed showing how well the students in these QM sections fare when they complete the IM course.

The possibility of having a common final as a means of increasing alignment was also discussed, but there was little agreement, with several teachers being strongly against.

In general, members of the Module indicated a wish to continue working on the project in the coming semesters.

SUPPORTING DOCUMENT A

QM OBJECTIVES AS PER OUTLINES

TEACHER 1

- Explain the meanings of the basic terms used in quantitative methods.
- Explain the difference between descriptive and inferential statistics and apply them appropriately.
- Explain the various stages of a quantitative analysis of data, and apply this knowledge.
- List the main methods used for quantitative data collection.
- Present quantitative data in an appropriate way, using tables and charts.
- Read and interpret results presented with tables, graphs, and figures.
- Understand how the basic statistical indicators of social activity are constructed using various forms of measurement.
- Perform elementary analyses of quantitative data related to social issues.
- Create an electronic data file with SPSS software and enter data correctly.
- Interpret and produce confidence statements, using estimation techniques.
- Perform simple hypothesis testing with SPSS and interpret the results.
- Know the basic issues that relate to sampling and to data gathering.

TEACHER 2

- Organize, analyze and interpret data and various graphs used in the social sciences and in everyday life.
- Differentiate among various descriptive measures and calculate them.
- Critique the statistical results of surveys, polls and other scientific studies.
- Use a computerized statistical program to organize and analyze data.

TEACHER 3

- Know what is a quantitative data file
- Know how to read it, that is, how to interpret its immediate meanings
- Know how to collect data for social research
- Know how to organize data files
- Know how to analyze data
- Know how to interpret the results of analysis
- Know how to present the results and their interpretations

TEACHERS 4 & 5

- Explain the various stages of a quantitative analysis, analyze and interpret data
- Understand different sampling methods and distributions
- Understand the difference between descriptive and inferential statistics and be able to apply them appropriately
- Present quantitative data in an appropriate way, using tables and charts
- Analyze data of different populations and samples using various forms of measurement
- Understand the nature and intensity of the link between variables
- Estimate the parameters of a given population based on sample statistics
- Create an electronic data file; using dedicated statistical software to perform the statistical operations learned in the course.

SUPPORTING DOCUMENT B

Minutes of Meeting and Agreed-Upon Objectives

MINUTES

Quantitative Methods Meeting – Wednesday May 11th

Present:	**G. Dohle**	**N. Korte**	**A. Said**
	M. Gottheil	**L. Labelle**	**B. Sissons**
	V. Haynes	**A. Logan**	**S. White**

Agenda:

1. Alignment of QM course objectives.

Louise Labelle reminded QM teachers that at our last meeting it was unanimously agreed to examine the content of the QM courses offered this term in the hopes improving the coherence of the course. This process was to be carried out via the PAREA research process currently being conducted.

During the discussion of this proposal, Aminu Said suggested that preliminary results should be communicated as soon as possible, especially if discrepancies were observed.

Louise and Ann Logan have begun the process. The first task was to examine the course outlines and review their content in terms of the course objectives listed. There was an assumption that all of us were using a standardized template and it was surprising to discover this was not the case.

Ann and Louise created a list of all the different objectives used in all the outlines, located a copy of the official government objectives, and created a list of new objectives that appeared to address all of those used by the teachers as well as the government. This list of objectives is currently being used in the PAREA coding.

Louise emphasized that the goal of the meeting was to review each of these objectives and determine whether they should be included. If it was felt that a particular objective should be included, there should be an agreement on the wording.

Once the process was completed there should be an agreement that all teachers will use the template as is and no changes could be made unless a meeting is called and agreement is reached.

The process began, and 13 objectives were agreed upon (see attached), four of them being reworded.

It was agreed that these objectives would be provided to the faculty secretaries for inclusion in all QM course objectives and a copy of the template be provided electronically to all QM teachers, and that no changes could be made without a prior agreement during a meeting of QM teachers.

Ann Logan May 16th, 2005

QUANTITATIVE METHODS OBJECTIVES

(As agreed at meeting on May 11th, 2005)

1. Understand the meanings of the basic terms used in quantitative methods as they relate to the Social Sciences;
2. Acquire a basic knowledge of the main research methods necessary for an understanding of QM course material;
3. Present quantitative data in an appropriate way, using tables and charts;
4. Understand and evaluate quantitative information presented in daily life (e. g., newspapers, polls, media) and published social science research.
5. Identify various types of variables and scales of measurement.
6. Calculate and interpret various measures of central tendency, dispersion, and position.
7. Know the basic issues that relate to sampling and to data gathering;
8. Understand descriptive statistics and be able to apply them appropriately;
9. Understand inferential statistics and be able to apply them appropriately;
10. Estimate the parameters of a given population based on the corresponding statistics obtained from a sample.
11. Perform hypothesis testing (using as a minimum, the Chi Square test of independence) and interpret the results;
12. Calculate and interpret measures of association using scatterplots, correlation coefficients, and make predictions using the regression equation;
13. Create an electronic data file, using SPSS, and perform the statistical operations learned in the course.

CHAPTER 11

BIOLOGY

CONTENTS

The Biology Department is one of the smallest departments at Champlain St-Lambert with only three permanent teachers and two other long term temporary or part time teachers. This group of teachers has had a long history of working together in the development of their various courses. The department offers about ten different specific courses for students in the Science Program, the Social Science Program, and the IB Commerce program as well as complementary courses that contribute to the general education component (CORE) of the college curriculum. For the purpose of this study the department has examined Biology 101-NYA, its first course for Science Program students. This was done in response to the Science Program Evaluation completed in the Spring of 2004 which required that all courses for science students should be examined and adjusted to ensure equity in terms of course content and assessment. In addition, the program evaluation stipulated particularly that the science departments should participate in the PAREA research project and use its developing processes to determine the coherence and alignment within their courses. Following the study of each course, the evaluators also stipulated that adjustments be made to improve its coherence and alignment.

Biology 101-NYA is the only biology course required for all students in the science program. It has no prerequisites and only about 30% of the entering students have taken a complete biology course in high school. This has presented a major challenge for the biology department. The course must introduce concepts of general biology, particularly, cellular organization, genetics, biological diversity, evolution and ecology. However, it is a one time event for about 55% of the students in the Pure and Applied stream, while providing for the needs of the 45% who will continue into the second and third level courses. For students in the Health Science stream the course is the beginning of their college level study of biology and all students are required to take the second level course, with less than 10% continuing to the third level course. A major concern for the department has been how to do so much for so many with so little time. As a number of local, national and international problems, such as global warming, pollution, and health care, dominate the news media, the department considers the need to expand its curriculum for science students, but is hampered by a lack of time in which to do this.

THE RESEARCH PROCESS

Three teachers, including the department coordinator joined the project in January of 2005 and attended a day long seminar about our process and how to implement it. The materials for the study had been collected by the three teachers who had taught the five sections of the course in the Fall of 2004. In contrast to other departments, the Biology Department has used a unified course plan for all teachers of Biology 101-NYA for the past twenty years. This means that the course objectives, textbook, topics and evaluation scheme are the same for all sections of the course. All sections of the course follow a similar schedule of classes and laboratories with slight adjustments due to individual class schedules and holidays. All sections of the course, including those in both fall and winter semesters and the summer session require that students complete a common final examination, which has been reviewed and updated by the department annually.

The coding team found that Bloom's taxonomy suited their needs as they determined the types of knowledge and levels of cognitive complexity found in the various assessment tasks. They did not have difficulty with the naming of the various assessment tasks as every teacher had used the same terminology to describe the tasks and their format. They did have difficulty correlating the assessment tasks to the course objectives and the topic list. Several modifications were made in the lists of objectives and topics before it became somewhat useful (Supporting Document A). The coders initially worked on the common final examination that had been administered in December of 2004. This led them to a discussion of the requirements for that examination and how it might be reformulated. They then moved on to the two class tests given by each teacher during the semester at intervals of approximately five weeks. Finally, they analyzed the laboratory quizzes. They did not cover the laboratory work or the class activities. The coders found that the analysis of assessment tasks was a time consuming and tedious process. The coding was only completed in the Spring of 2006 and the data was presented to the department at a meeting in October. However, based on their initial observations, the coders spent considerable time in the Fall of 2005 editing the questions of the common final examination which was to be given at the end of that term in December.

ANALYSIS OF ASSESSMENT TASKS - FALL 2004

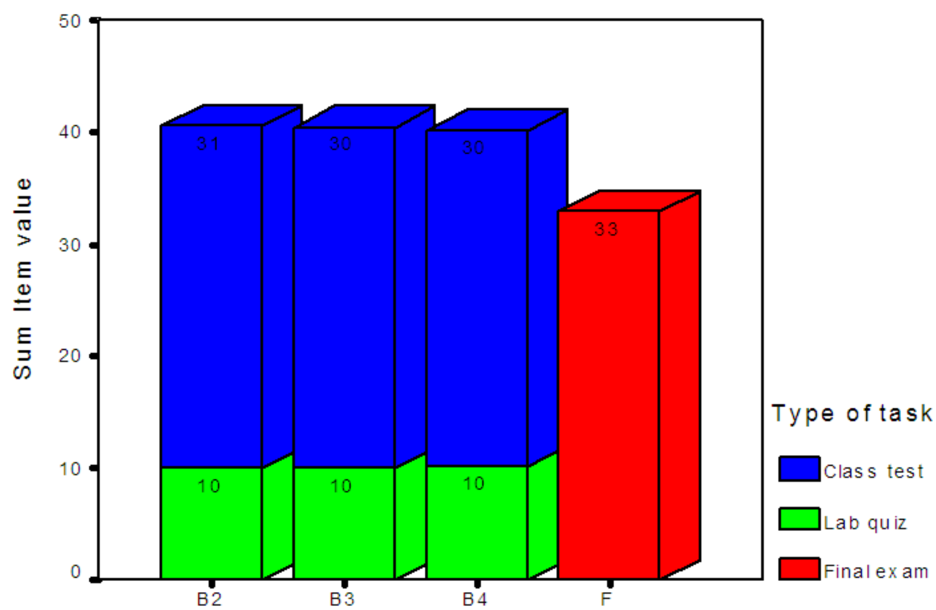
As previously stated, all teachers of this department use the same textbook and course plan which includes the general objectives, list of course topics, course schedule, and marking scheme. All teachers utilize the same laboratory exercises although there are slight differences in the work that must be handed in and in the grading of the laboratory work. Each teacher composes two intermediate class tests given at about the fifth and tenth week of the semester, and each teacher generates his/her own laboratory quizzes and class activities. A total of 681 items were coded. These items were theory and lab quizzes for the three teachers involved in teaching the five course sections in the fall semester of 2004. Each item was coded for the type and format of task, as well as for the type of knowledge and level of cognitive complexity, and the topic and objective addressed. This data is represented graphically on the following pages.

Comparisons of Type of Assessment Tasks Used in Biology NYA

Since all teachers use the same evaluation scheme, the types of task are completely coherent across the sections of the three teachers with all students writing a final examination of the same value. This is an expected outcome of the analysis. These items account for only about 70% of the assessment tasks. The remaining 30% of the course mark is dependent on the Virtual Genetics Laboratory exercise (10%) which is completed by all students in all sections of the course, other laboratory work (15%) and class activities that vary between teachers (5%). This comparison is shown graphically in Figure 11.1.

Figure 11.1

TYPES OF ASSESSMENT TASKS USED IN BIOLOGY NYA

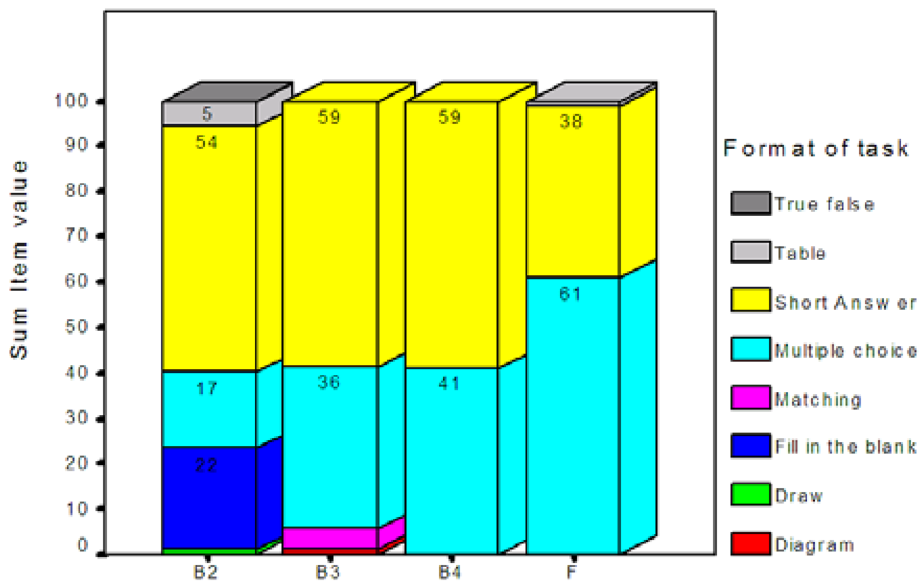


Comparisons of Format of Assessment Tasks Used in Biology NYA

On this aspect of the analysis as seen in Figure 11.2, there is more variety on the format of the assessment items across the sections of the three teachers and compared to the final examination, indicated by the letter **F**. Students in sections taught by teacher B2 have considerably less experience with multiple choice questions compared to those in sections taught by teachers B3 and B4. In those sections, students have no apparent experience with assessment items in the form of a table. An unexpected outcome is the minimal use of diagram assessment items, when biology students are expected to interpret and draw many diagrams during laboratory and class periods. Likewise table items do not show up as often as they seem to be used. These discrepancies may reflect a coding error or assignment of a different type of format such as short answer or fill in the blank.

Figure 11.2

TYPES OF FORMATS OF ASSESSMENT TASKS USED IN BIOLOGY NYA

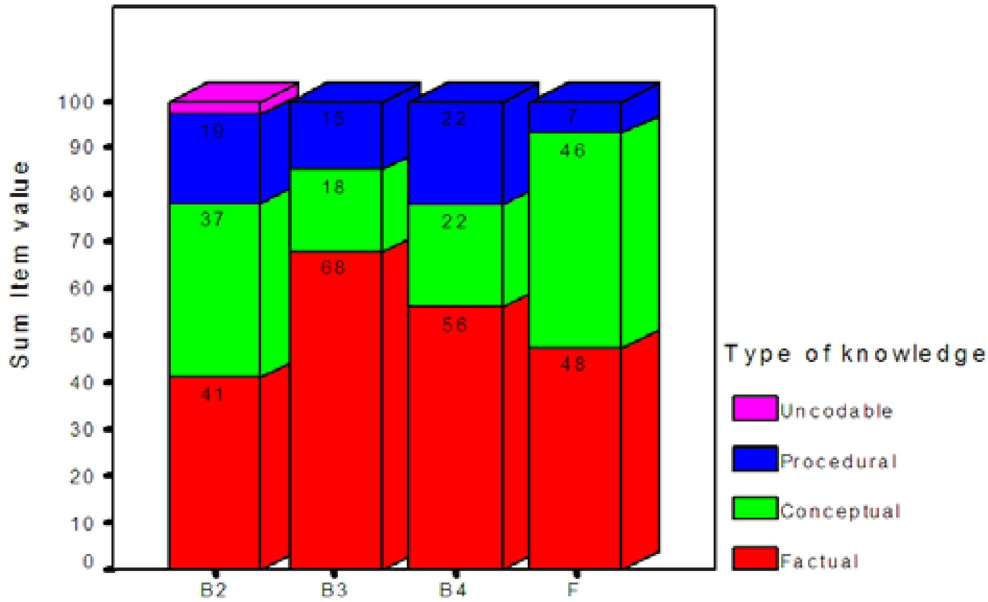


Comparisons of Types of Knowledge Required by Different Teachers

Figure 11.3 shows that there is some variation across the sections in regard to the type of knowledge required by the different assessment tasks. The uncodable items for teacher B2 are actually the result of questions that allowed students to choose a question from a list of options which reflected varying types of knowledge. The final examination, indicated by the letter **F,** asked more questions of a conceptual nature than any teacher asked during the semester assessments. Procedural questions most likely dealt with laboratory methods and genetic problem solving questions. The variation may also be a result of the weighting of the final examination to cover topics of ecology and evolution which are more conceptual by their nature.

Figure 11.3

TYPES OF KNOWLEDGE ACROSS SECTIONS & IN THE FINAL EXAMINATION

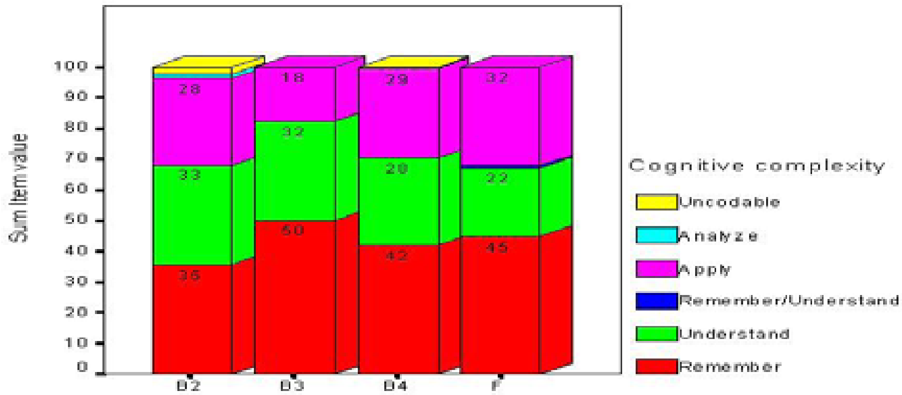


Comparison of the Levels of Cognitive Complexity Required by Different Teachers

Again there is variation among the teachers on this dimension as seen in Figure 11.4. The uncodable items reflect the questions where students may choose a question from several possible options and these differ in regard to the level of cognitive complexity required. There is only one teacher who is asking students to analyze knowledge on class or laboratory test items, and there are no questions of this type in the final examination. Another teacher is using considerably fewer tasks that require students to apply their knowledge than are presented in the final examination.

Figure 11.4

LEVELS OF COGNITIVE COMPLEXITY ACROSS SECTIONS & IN THE FINAL EXAMINATION



Comparison of Course Objectives and Topics Addressed in Biology NYA

Figure 11.5, illustrates a greater variety across the sections than any of the previous comparisons. Several factors contribute to this variety. For one there may be less agreement on the course objectives than was previously thought by the participating teachers. The set of objectives used by the coders are not well written or set down in a conventional format for learning objectives. There may also be little agreement about the weighting or emphasis of certain objectives. Certain objectives may well have been addressed during the class or laboratory teaching periods, but not presented in test, quiz or examination questions. As noted above, the test items on the final examination cover the topics presented in the last third of the course and may not be formally tested in the class tests or laboratory quizzes. This does not mean that students were not exposed to questions about these topics during the teaching periods and/or in various learning activities or short assignments. Similar problems exist with the course topics as presented by the three different teachers and shown in Figures 9.6, 9.7, and 9.8. Here again one sees a large amount of diversity and an apparent reduction of coherence across the course sections. The reasons given above for the objectives most likely apply to the situation seen in the topic comparisons for the three teachers and the final examination. As previously stated, ecology and evolution topics are presented at the end of the course and thus tested on the final examination, not during a class test.

Figure 11.5

OBJECTIVES ASSESSED ACROSS SECTIONS & IN THE FINAL EXAMINATION

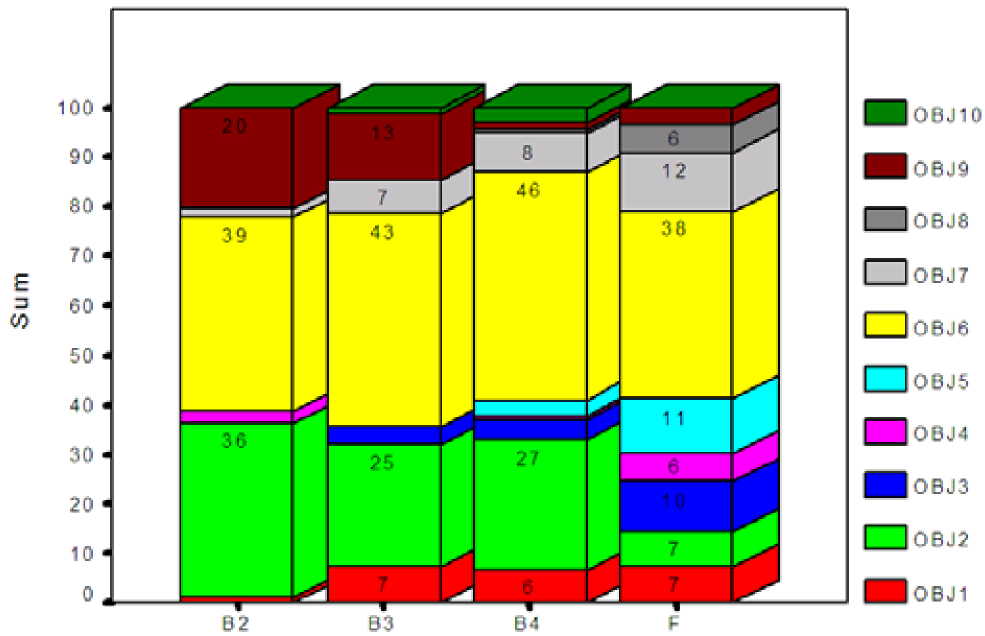


Figure 11.6

TOPICS ASSESSED BY TEACHER B2

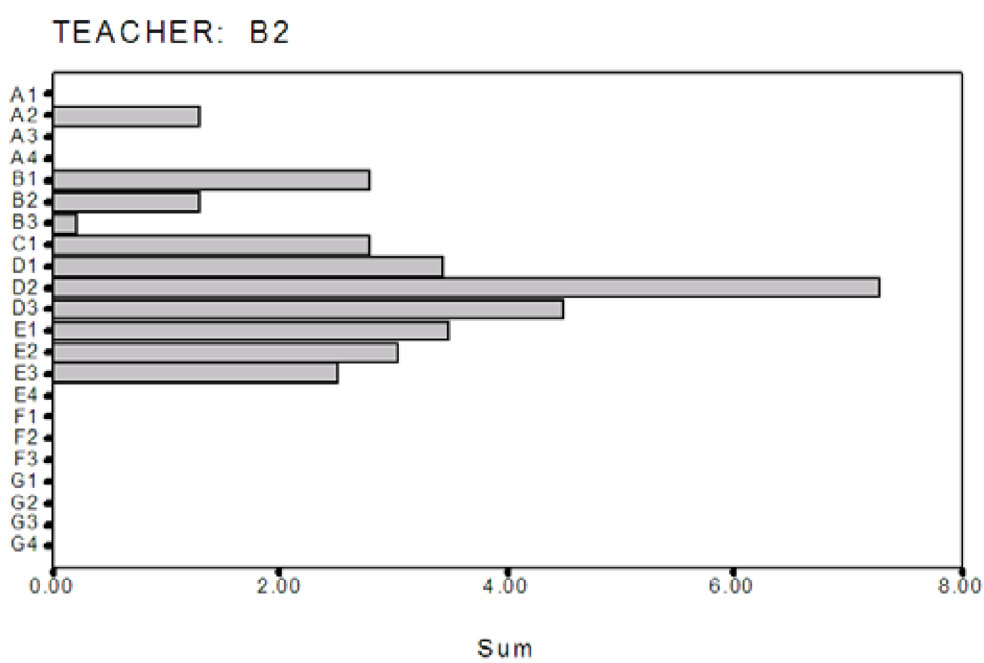


Figure 11.7

TOPICS ASSESSED BY TEACHER B3

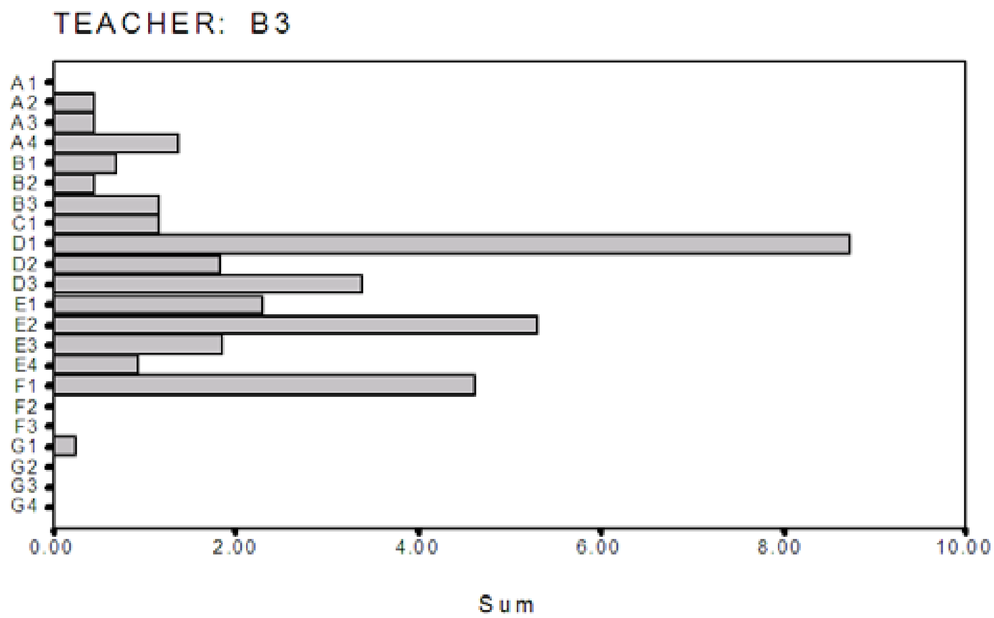


Figure 11.8

TOPICS ASSESSED BY TEACHER B4

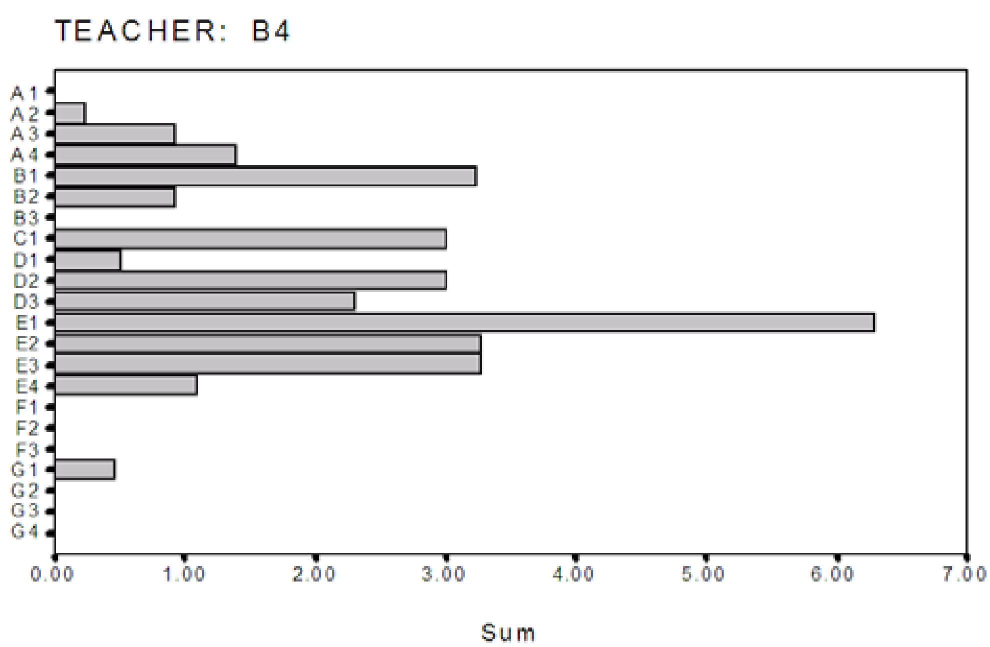
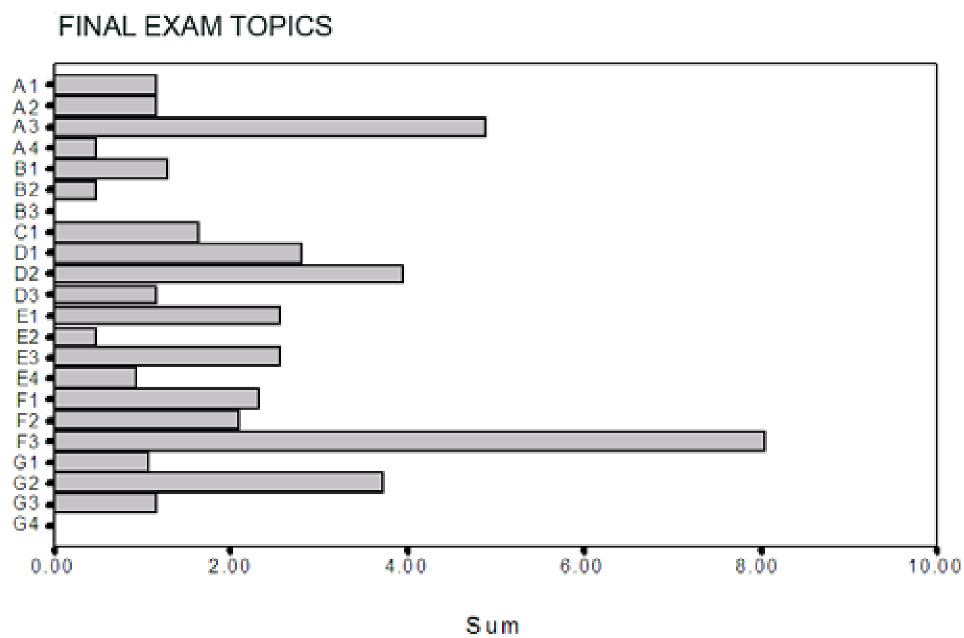


Figure 11.9

TOPICS ASSESSED BY THE FINAL EXAMINATION



Student Results

Perusing Figure 11.10 one sees the distribution of high school averages of the students who began their study of biology with each of the teachers in the fall semester of 2004. Teacher B2 taught one section in which most of the students belonged to the International Baccalaureate program but must take Biology 101-NYA to complete the requirements for their Quebec diploma in science. Although this double selection slightly reduced the variability of student abilities within the section taught by teacher B2, it appears that the three teachers started with students of similar ability distributed across the five sections of the course as given in that semester.

The final grades for the students also do not appear to be very different across the sections as illustrated in Figure 11.11. As the students entering this course in the section taught by Teacher B2 were more homogenous and at a slightly higher level, so they were at the completion of the course. The students taught by teacher B3 show a slightly more diverse pattern of marks compared with those taught by teacher B4, but they appear to be quite consistent. The overall pass rate is quite high compared to that of other introductory science courses, but is consistent with the history of the pass rate in this course. It should be noted that most of the students in this course were entering biology at the third semester and were only in their second year of the program. That has meant that many students who might have had difficulty with the biology course have been streamed out of the science program after their first or second semester.

Figure 11.10

INCOMING HIGH SCHOOL AVERAGES

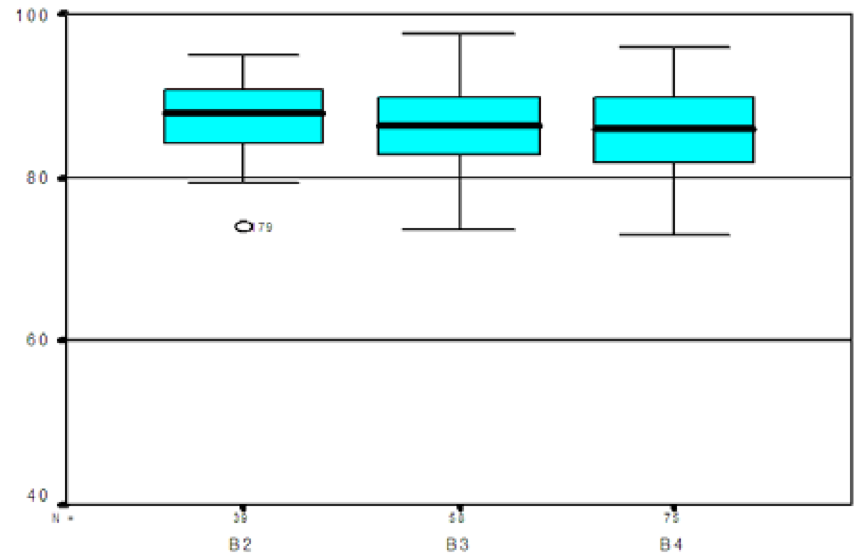


Figure 11.11

STUDENT RESULTS IN BIOLOGY NYA FALL 2004

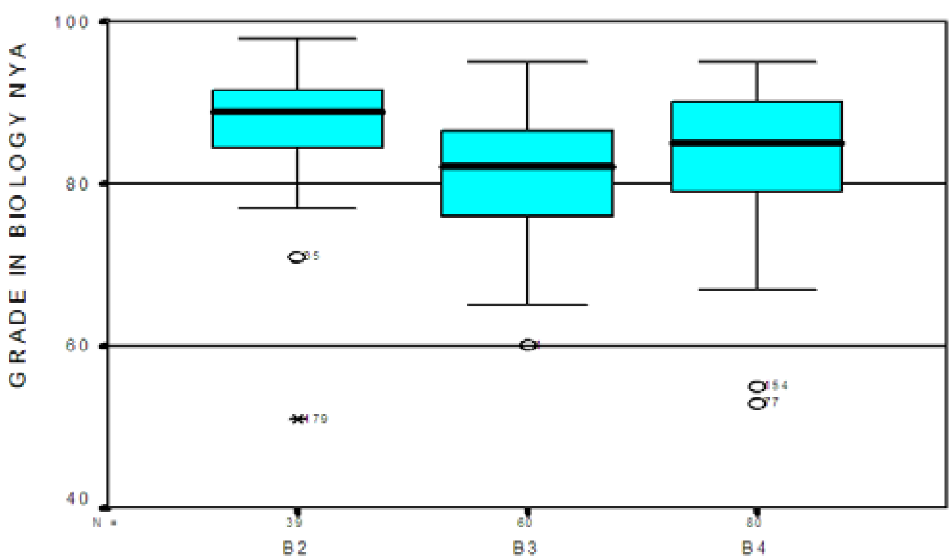


Table 11.1

BIOLOGY NYA - FALL 2004 ISSUES AND RESOLUTIONS		
ISSUE	**DESCRIPTION OF THE PROBLEM**	**RESOLUTION**
Course Objectives & Topics	There is a lack of agreement about the objectives and topics of the course.	Review and revise the course objectives in terms of the ministerial guidelines; redevelop an improved set of objectives.
Coherence between objectives, topics and assessments.	There is a lack of connection between the objectives and topics of the course with the assessment items.	Decide on the relative weighting of the objectives and the topics to better align them with their assessments.
Type of knowledge and cognitive complexity of test items.	There is a preponderance of factual-remember and conceptual-understand questions.	The department could explore ways of including higher level questions and tasks in class, labs and on evaluations of student learning. Design learning activities that would direct students' attention towards higher levels of thinking. Create a bank of coded questions to improve the course assessments.
Laboratories	This component contributes a substantial percentage of the final course mark (35%) but the kinds of knowledge and the level of cognitive complexity that is demanded has not been determined.	Determine the types of knowledge and levels of cognitive complexity developed and assessed in the laboratory component.
Course conclusion	The end of the course deals with the integration of evolution and ecology with previously learned concepts. This important final learning gets undermined because students are faced with the intellectual demand of finalizing all of their courses.	Design appropriate teaching and learning activities that will help students integrate what they have learned. These activities would ideally be completed during class time.
Final Exam	There was a lack of coherence between the questions on the final exam and the class tests.	Continue to monitor the coherence between the final exam and class tests. Discuss the development of variable forms of the final exam.

REFLECTION

The results of the study provide a view of a relatively coherent and fairly well aligned course. However, as always, there are aspects of the Biology 101-NYA curriculum that might be addressed by the Biology Department to improve their introductory science course. As the Biology Department joined our project in its second year, they have not completed the whole cycle of the curriculum review process. They need to review and discuss the data before the course is presented again and determine what their next steps should be.

It is generally felt among the three teachers involved in the course as presented in the Fall of 2004 that the course is presented at a satisfactory level relative to the type of knowledge and level cognitive complexity. Learning biology at the introductory level is to some degree similar to learning another language. Students need to learn vocabulary while learning about concepts, and principles. This tends to generate more questions of the factual-remember and conceptual-understand variety. There seems to be less opportunity for utilizing the higher level aspects of Bloom's taxonomy, although the department could explore ways of doing this while encouraging students to adopt a scientific mode of thought and developing strategies for learning about living systems. As previously stated this department needs to clarify the objectives and topics presented within the course. It may be useful for these teachers to start building a common test question bank with questions requiring different levels of cognitive complexity and types of knowledge. It would also be useful for the department to establish what types of questions were to be asked on the different tests and on the common final examination.

The group might also discuss the teaching and learning events that occur during the last segment of the course, and the assessment of this part of the course. This section presents students with the major topics of evolution and ecology. It requires that students integrate concepts learned in the first two thirds of the semester with these rather difficult concepts. At the same time students are completing assignments and writing important papers and class tests for other courses which distracts them from this section of the biology course. The department might develop learning activities that can be presented during class and laboratories to help students develop a deeper understanding of these important topics. Given that the final examination has been changed in 2005 and again in 2006, the department might consider recoding it to determine if the new levels of questioning are satisfactory. The members of the department also expressed interest in reviewing the types of knowledge and levels of cognitive complexity developed through the work in laboratories. At the close of the 2007 academic year the department is considering these issues and adjusting Biology NYA. It is planning to move on to study the second biology course Biology BLB.

SUPPORTING DOCUMENT A

OBJECTIVES & TOPICS FOR TASK ANALYSIS

BIOLOGY NYA

FALL 2004

OBJECTIVES	TOPICS
1. Distinguish the relationships between the structure and functions at the various levels of organization within living things 2. Understand that organisms belong to different domains and kingdoms, the mechanisms that contribute the diversity of living things, and their life cycles, (includes genetics); 3. Appreciate the mechanisms of evolution contributing to the complexity and diversity of living things; 4. Understand the relationship of the organism to its environment; 5. Explain the transformations of matter and energy that occur in the living world; 6. Utilize appropriate concepts and terminology. 7. Develop general science skills which includes: Following instructions (e.g.: a protocol), Presentation skills (e.g.: tables, graphs, posters, reports), Interpretation (e.g.: data, diagrams, pictures, slides, etc.) Understand models 8. Ecosystems 9. Lab 10. Molecules & their environment	A. Introduction to Biology 1. Science of Biology 2. Levels of Biological Organization 3. Characteristics of Living Things 4. Introduction to the concept of evolution B. Chemical Basis of Life 1. Macromolecules 2. Chemistry of water 3. Aspects of DNA and the Central Dogma C. Introduction to Biological Diversity Includes life cycles and cell cycle D. Cells and Cell Theory 1. Prokaryotic and eukaryotic cells 2. Cell Structure 3. Cell Reproduction (Mitosis & Meiosis) E. Introduction to Genetics 1. Patterns of Inheritance 2. Human Genetics 3. Genetic variation 4. Fruit Fly F. Introduction to Ecology 1. Population Biology 2. Community Interactions 3. Ecosystems G. Evolution 1. Evidence of evolution 2. Mechanisms of Evolution 3. Speciation

CHAPTER 12

MATHEMATICS

CONTENTS

Mathematics, as taught at Cégep, has a unique role. It is not a program itself, nor is it part of the core subjects (English, French, Humanities and Physical Education). Instead, it provides specific courses to several programs. The largest number of courses is taught in the Health and Pure and Applied Science programs and the Commerce option in Social Science. As well, other specialized courses are taught in the three-year career programs.

Calculus 1, the course selected for study by the Math department, is a compulsory course for the Science program and the Commerce option in Social Science. As well, students in the World Studies with Mathematics option in Social Sciences or in the International Baccalaureate program must also take Calculus 1. Additionally, a small number of students, primarily from career programs, complete the course without credit, to satisfy University entrance requirements that are not met by their respective program. Access to the course can be achieved in several ways as outlined in Supporting Document A.

Calculus 1 offered to Science students (201-NYA) is different from the course offered to Social Science students (201-103). 201-NYA emphasizes science applications whereas in 201-103, examples and applications are drawn from economics, business and social science. For both Science and Social Science, this course is the first of three compulsory mathematics courses. Calculus 2 and Linear Algebra must be taken after successful completion of Calculus 1.

A substantial review of the teaching and student assessment was carried out as part of the Science Program Evaluation, presented to the Board of Governors in April 2004. One of the primary recommendations of the report was that "departments should become familiar with and seek the assistance of teachers involved in the PAREA research project team now entering its second year of implementation at the college" (p. 59).

The conclusions for the report on Mathematics can be found in Supporting Document B. In the report, mathematics was described as having made a substantial contribution to the attainment of the stated objectives, and graduates reported being generally satisfied with their Mathematics courses. However, several comments made in this document are pertinent to this project. For example, it was determined that "while many teachers employ rigorous forms of assessment, both formative and summative, assessment is inconsistent from one section of a course to another. In other words, *there is a lack of coherence in assessment of student acquisition (*of knowledge*) between multiple sections of the same course*" (p. 43). Addressing the same topic in a later conclusion, the report states, "Students perceive inequity in subject coverage, assessment and workload. *This matter requires immediate attention*" (p. 43). Also, it was noted in the report that common course outlines are not used between different sections of the same course, and that in the focus groups students felt that the level of difficulty was different between sections of the same course.

Another conclusion was directed specifically towards Calculus 1 (201-NYA). Interviews and focus groups with students suggested that there was an inconsistency in the manner in which the teachers dealt with the highly variable school background knowledge of incoming students.

Finally, with respect to program management, it was stated that, although the Mathematics department discusses its curriculum during meetings, “there is little evidence that the comments and perceptions of students, faculty who sit on the Science program Committee, or the Administration are seriously considered in the revision of course material and assessments” (p. 42).

These findings suggest that the approach taken by this project could prove a useful strategy for the department in terms of addressing the first issues. However, the last comment suggests that effecting the change needed to ameliorate these problems may be a challenge for the PAREA research team.

THE RESEARCH PROCESS

In fall 2004, Mathematics joined the project and selected Calculus 1 as the target course, with the intention of examining both the Science and Commerce versions of the course. Two subject-matter experts (SMEs) or coders were elected by the department and agreed to participate. One was a veteran of the Mathematics department and the second was a relative newcomer. Both coders attended a coding workshop during the semester where they were introduced to the standard taxonomy. As well, the coders were given readings from other researchers who had addressed the issue of taxonomies in mathematically based disciplines.

Four teachers of Calculus 1 Science agreed to participate and signed consent forms. These teachers accounted for seven sections. One other teacher was currently teaching the course as well, but was expected to retire the following semester so did not participate. In the Commerce course, seven teachers, representing five sections, joined the project and signed consent forms, and again, one teacher declined due to imminent retirement. At this point, the process of gathering assessment material from the participating teachers began.

The winter 2005 semester began with the process of defining the topic categories to use in coding. This was a relatively simple task in that all teachers in both versions of the course used the same text, so the topics were numbered according to the textbook chapters. The ministerial objectives were described as being too vague, and the issue of generating a set of objectives for the course was put aside.

The coders began with some practice coding, and indicated that they were comfortable with Bloom's taxonomy, the generic taxonomy presented to all participating departments. However, Bloom's cognitive domain did not always offer to offer terminology that captured the thinking skills required in Calculus 1. For example, it was difficult to distinguish Apply from Analyze in terms of strategies used to solve math problems. As they coded, the coders became more aware of the difference between Apply and Analyze as it applied to Calculus 1 items. They both agreed that the Apply code would be used for straightforward standard questions on a topic, and Analyze would be used if there was a twist or an unusual approach to the question. A decision was made to continue to use Bloom's Taxonomy.

They began by coding a final exam and the first test of the first section to be coded. It was at this point that the coders and the PAREA team became aware of the preponderance of Procedural/Apply items over all other code combinations. This situation had occurred with other disciplines, notably Chemistry and Quantitative Methods, and it was resolved, at the suggestion of coders for those departments, by coding the relative difficulty of the questions. This approach allowed the coders to handle another issue that had arisen during coding - the 'guiding' question. It was felt that two questions could be asking for the same procedure as an answer, but could be asked in a way that might lead the student more easily to the correct answer. This usually meant asking for all the steps explicitly. The coders decided to code each step separately and reduce the level of difficulty. By April, the coders said that they felt they had clarity in their minds as they coded and that disagreements were easily resolved.

Coding was completed at the beginning of the fall 2005 semester, so entry of the codes into Excel worksheets or SPSS and preliminary data analysis began. After an initial examination of the data, the researchers became concerned about the lack of delineation in the data. Although Calculus 1 is a rather uniform course compared to some of the other disciplines the team has worked with, the differences in the types of task required of the student suggested that there should be more variation in the data. For example, for the Calculus 1 Commerce, the cross tabulation between sections and task type (Supporting Document C) shows considerable variation in tasks. However, the cross tabulation of item difficulty shows little variation (Supporting Document C).

This was surprising to the research team, because the analysis of other disciplines showed a clear relationship between type of task and difficulty. For example, items used for assignments and class activities were more often more difficult than quiz or test items. As well, the preponderance of the code ‘Standard’ in the rating of difficulty was problematic.

A meeting with the coders was arranged to discuss this issue. They described their method of handling the codes for item difficulty. Apparently some of the problem lay in the way they resolved coding disagreements. Whenever there was a disagreement, they resolved it by selecting a middle point, so that if one coder coded an item as Easy and another as Standard, the item was coded as Standard.

A potentially larger source of lack of variance occurred due to the handling of topics. The coders had already indicated that certain topics were more difficult than others, but did not use the difficulty scale to reflect this. In other words, typical items for difficult topics would be coded as Standard, even though they may be very difficult compared to a Standard item on an easy topic.

It was suggested that data on the perceived difficulty of the different topics be gathered from those teachers who taught Calculus 1, by means of a questionnaire (Supporting Document D), and that the resulting data would be used to apply weighting to the existing codes.

This task was completed and the data analyzed (see Supporting Document E for details of the weighting scheme). This recoding resulted in a more variable set of difficulty ratings than indicated by the data in Supporting Document C.

Presentation of results occurred on November 29th, 2005 and nine teachers were present along with the research team. All teachers were provided with a named folder containing the results, a printed copy of the definitions of Bloom's taxonomy and the types of knowledge and a copy of the coding dictionary, prepared by the coders (Supporting Document D). Teachers who participated in the study were given their code so they could recognize their own data during the presentation.

The presentation began with an introduction to the project and to the process of coding and how it was sometimes difficult to fit some things into the Bloom's taxonomy categories, but after a while, patterns developed. Conceptual knowledge seemed to always go with understanding and procedural knowledge occurred usually with Apply and Analyze. Specific codes were developed to code Calculus 1 in terms of the format of the task, for examples 'compute' versus 'calculate'. In terms of the entire project, the coder stated that it would be "interesting to know whether the department will be beefing-up or watering down" in their effort to increase coherence.

The second coder presented the data. In general, there was little direct discussion of the data on the part of the Mathematics department. This is demonstrated by the fact that all the data from both courses was reviewed in one meeting. Other departments spent two or three meetings reviewing their data from this project

Presentation of the results provoked little discussion by the Mathematics department. This was surprising in the light of the divergent outcomes in terms of student success and the apparent uniformity of the classes, in terms of tasks, knowledge, cognitive complexity and difficulty.

At the conclusion of the data presentation meeting, the Mathematics department agreed to hold further meetings to discuss the data and its implications for the Calculus 1 course. As a result of these meetings, to which the PAREA team was not invited, the Department requested further data analyses.

ANALYSIS OF ASSESSMENT TASKS

Comparison of type of tasks used in Calculus 1

The charts below show the relative proportion of grade allocated to different tasks throughout the course, by each teacher. They may not add exactly to the true allocation because of rounding and removal of uncodable items, as well as the fact that all courses have been weighted back to 100% to allow comparison between the sections. As well, it should be noted that two sections, M0912S and M092S will appear to be very similar as they represent the data from two slightly different International Baccalaureate courses, both taught by the same teacher.

Although all sections show a final exam, this does not indicate a common final exam, or even an exam given during the formal exam period. Instead, this code indicates some form of test that evaluates material taught throughout the entire course. However, three teachers did use a common final test. The amount allocated varies between sections, and furthermore students are given the option of allowing their final exam to be worth 100% if this results in a higher grade. Very few students are in a position to take advantage of this, so it was not considered during the analysis. As well, it is noticeable that some sections include class activities and/or assignments, whereas some do not include these less demanding, more formative tasks in their courses, although it should be acknowledged that one teacher indicated that these classroom activities were frequently carried out but not assessed.

Figure 12.1

GRADES ALLOCATED TO TYPE OF TASK BY DIFFERENT TEACHERS

CALCULUS 1 - SCIENCE

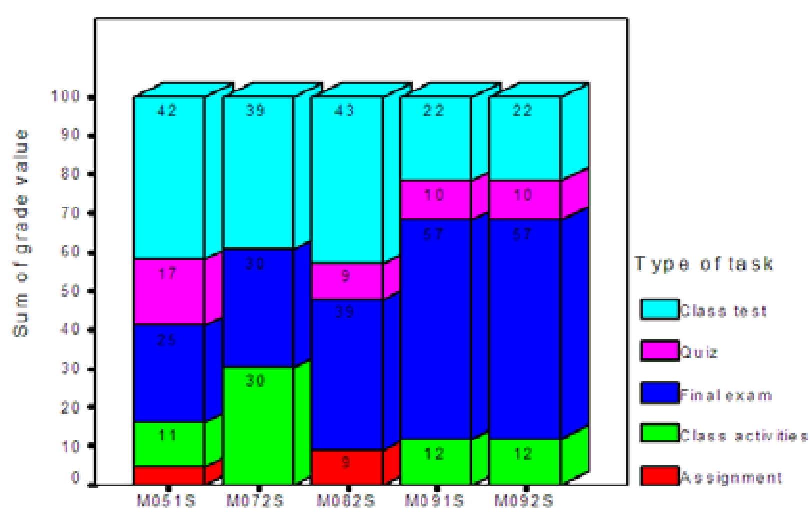
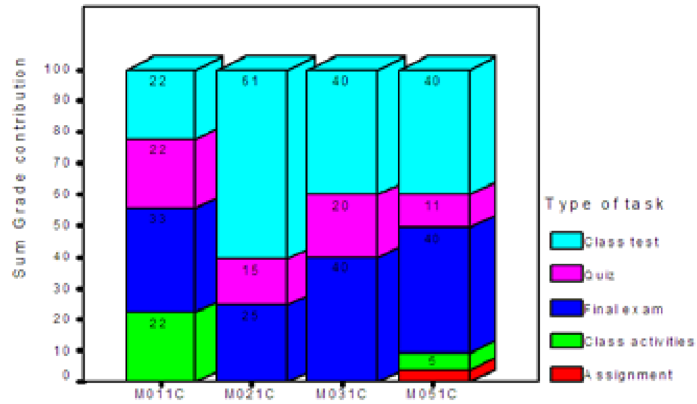


Figure 12.2

GRADES ALLOCATED TO TYPE OF TASK BY DIFFERENT TEACHERS

CALCULUS 1 - COMMERCE



Comparison of format of tasks used in Calculus 1

Again, there is variation between the teachers, but Compute is the most frequently used task in all sections. In Science, there is a large amount of derivation in one section that also has fewer graphing items than others. Also in Science, the range of word problems is less than in Commerce. This is significant as the teachers indicated that students often find word problems more difficult.

Figure 12.3

GRADES ALLOCATED TO FORMAT OF TASK BY DIFFERENT TEACHERS

CALCULUS 1 - SCIENCE

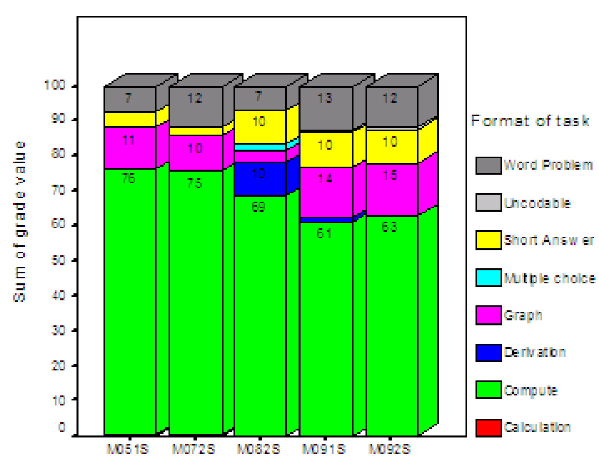
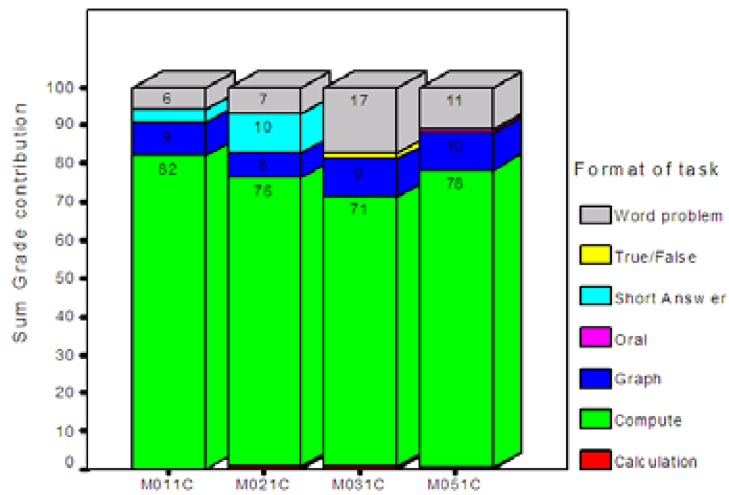


Figure 12.4

GRADES ALLOCATED TO FORMAT OF TASK BY DIFFERENT TEACHERS

CALCULUS 1 - COMMERCE



Comparison of the types of knowledge required by different Calculus 1 teachers

These results demonstrate clearly the lack of delineation in the Calculus 1 data, and lend support to the need for coding item difficulty. There is minimal variation between the sections.

Figure 12.5

GRADES ALLOCATED TO TYPE OF KNOWLEDGE BY DIFFERENT TEACHERS

CALCULUS 1 - SCIENCE

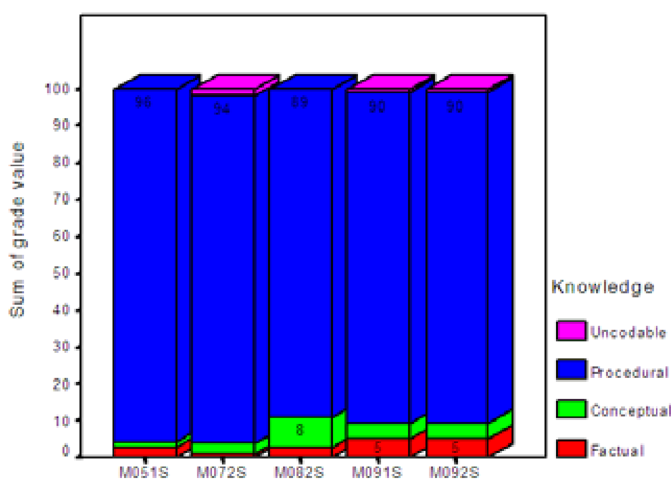
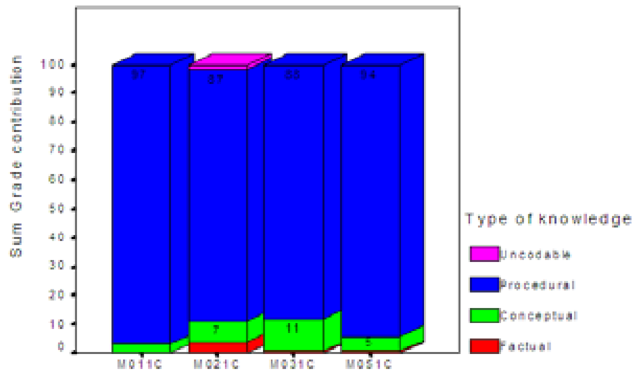


Figure 12.6

GRADES ALLOCATED TO TYPE OF KNOWLEDGE BY DIFFERENT TEACHERS

CALCULUS 1 - COMMERCE



Comparison of cognitive complexity required by different teachers

Once more, as with type of knowledge, the results show little delineation between the sections in terms of cognitive complexity, with application being the primary code.

Understanding seems to be demanded more in Commerce Calculus 1, which is interesting since the coders indicated that understanding seemed to be a more challenging task in Mathematics than application. However, the amounts are small, as are the differences.

Figure 12.7

GRADES ALLOCATED TO COGNITIVE COMPLEXITY BY DIFFERENT TEACHERS

CALCULUS 1 - SCIENCE

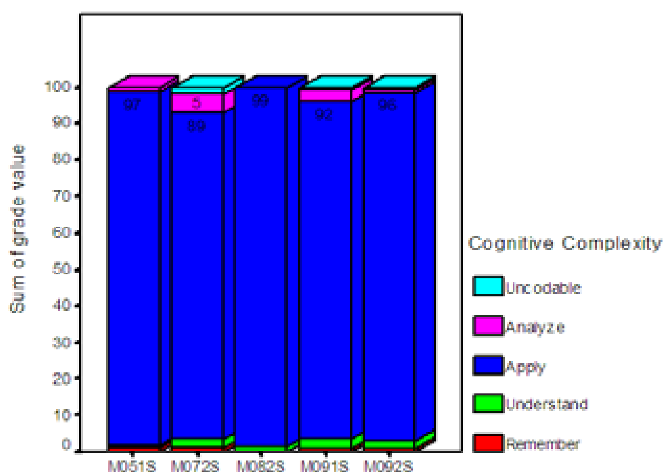
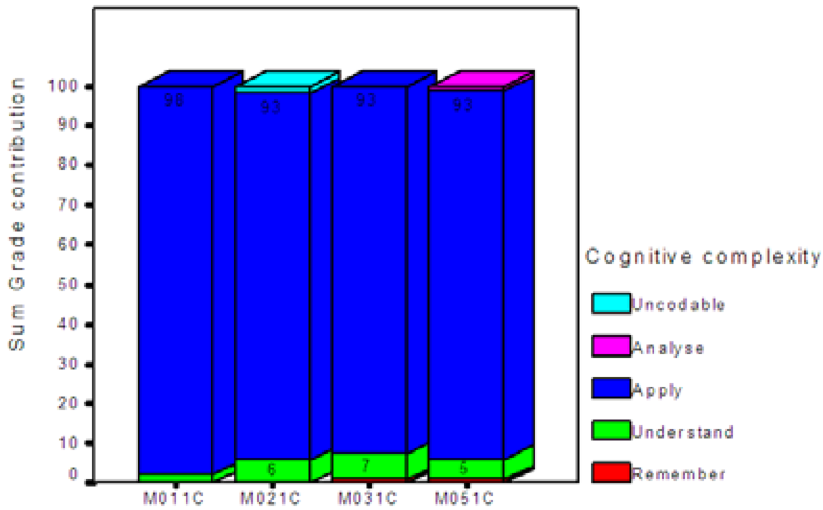


Figure 12.8

GRADES ALLOCATED TO COGNITIVE COMPLEXITY BY DIFFERENT TEACHERS

CALCULUS 1 - COMMERCE



Analysis of difficulty between different teachers

The results show the difficulty ratings after they have been weighted by topic difficulty. There is some differentiation between sections, but it is relatively insignificant. Not surprisingly, the two IB sections are the more difficult sections in science. There is somewhat more variability in the Commerce sections. It is not possible to compare between Science and Commerce because the weightings were applied differently using a different set of topics for the Commerce and Science sections.

Figure 12.9

GRADES ALLOCATED BY DIFFUCULTY BY DIFFERENT TEACHERS

CALCULUS 1 - SCIENCE

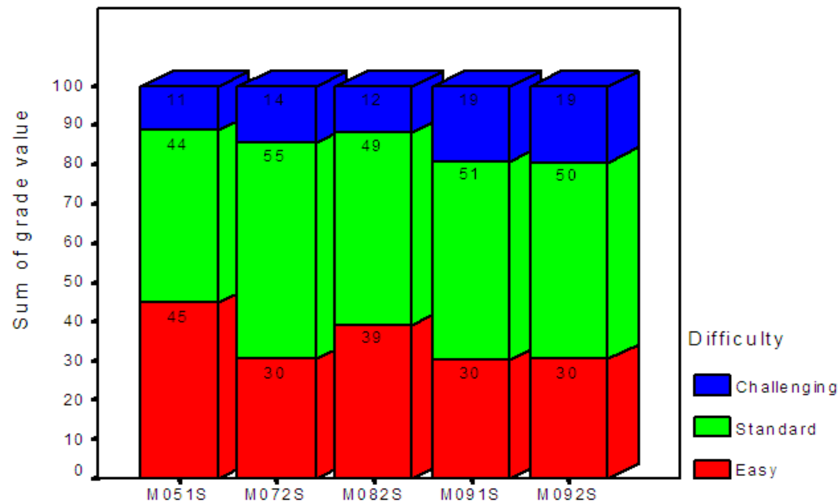
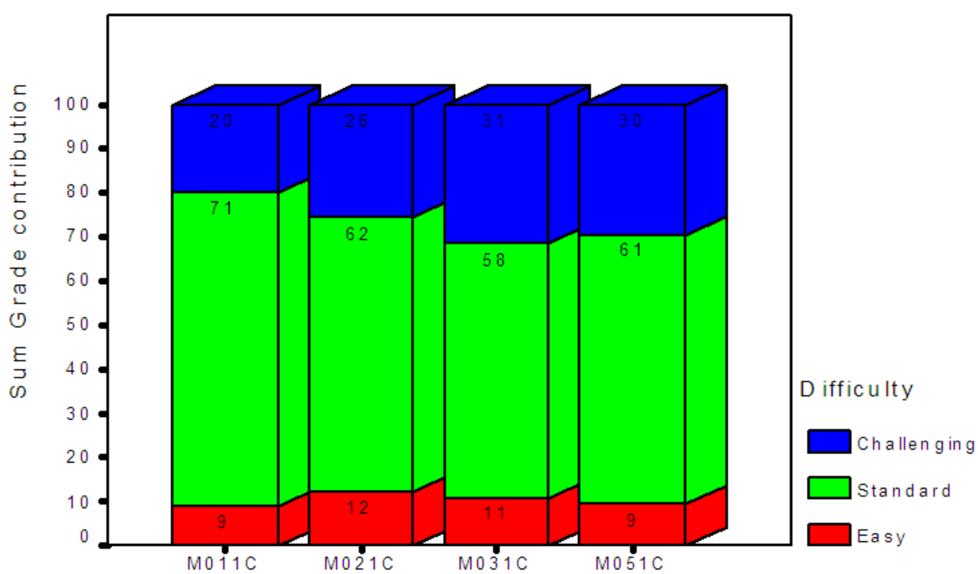


Figure 12.10

GRADES ALLOCATED BY DIFFICULTY BY DIFFERENT TEACHERS

CALCULUS 1 - COMMERCE



Analysis of grades allocated to topics in course work and final exam

The list of topics that were coded in Calculus 1 can be found in Supporting Document D, listed in the questionnaire. Analysis of these topics was done for Calculus 1 Science with respect to the common final that was used by three teachers, and the following data was presented. See Figures 12.11 and 12.12. A similar analysis was presented for commerce, Figures 12.13 and 12.14.

For the most part, the relative emphasis of topics in the exams matches that of the course work. It was also pointed out by members of the department that there could be a discrepancy in some of the topics taught late in the term, since there might not have been time to complete formal assessment on those topics, although students would have been exposed to typical questions that could be asked on those topics.

Figure 12.11

GRADES ALLOCATED TO TOPICS IN *COURSE WORK*

CALCULUS 1 - SCIENCE

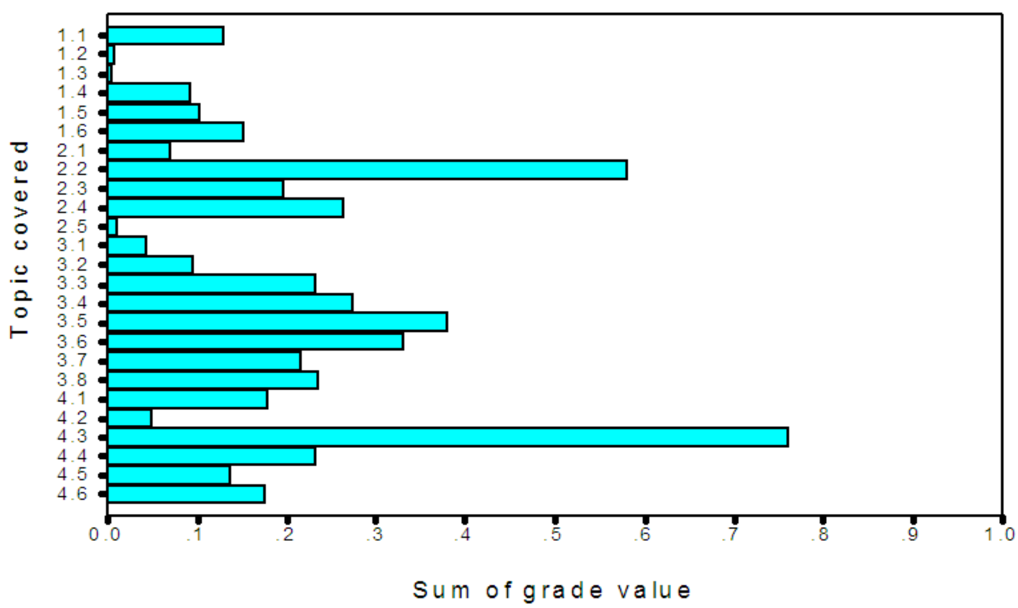


Figure 12.12

GRADES ALLOCATED TO TOPICS IN *COMMON FINAL*

CALCULUS 1 - SCIENCE

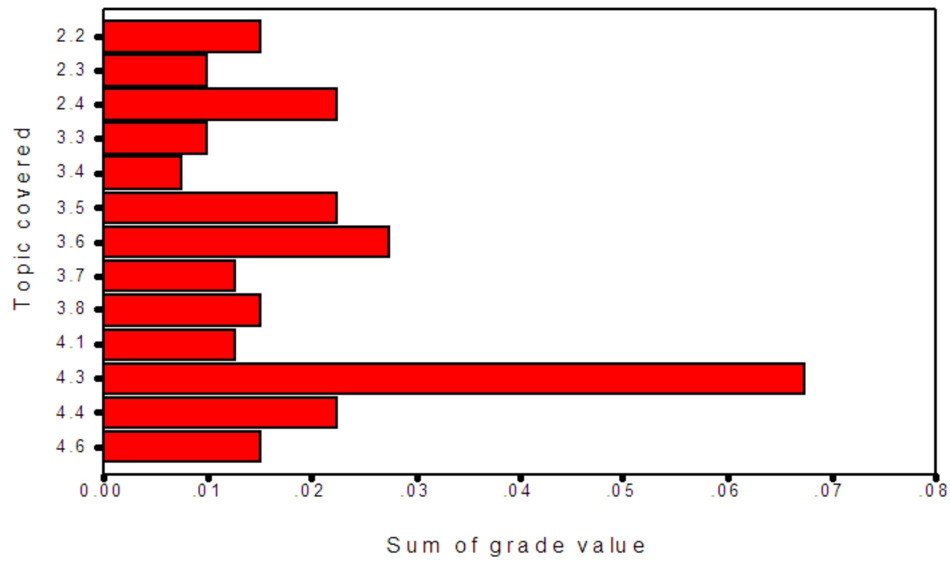


Figure 12.13

GRADES ALLOCATED TO TOPICS IN *COURSE WORK*

CALCULUS 1 - COMMERCE

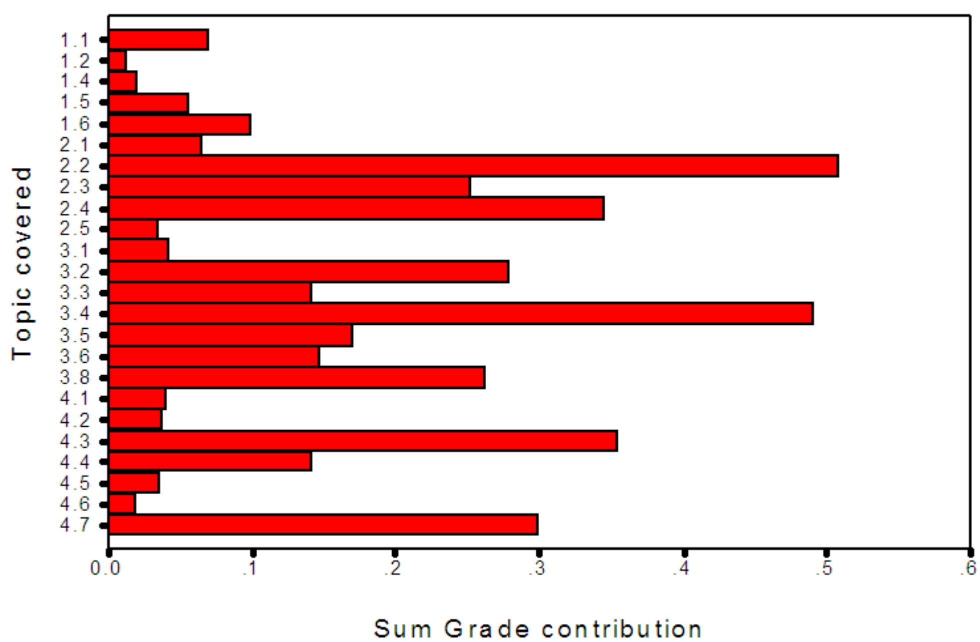
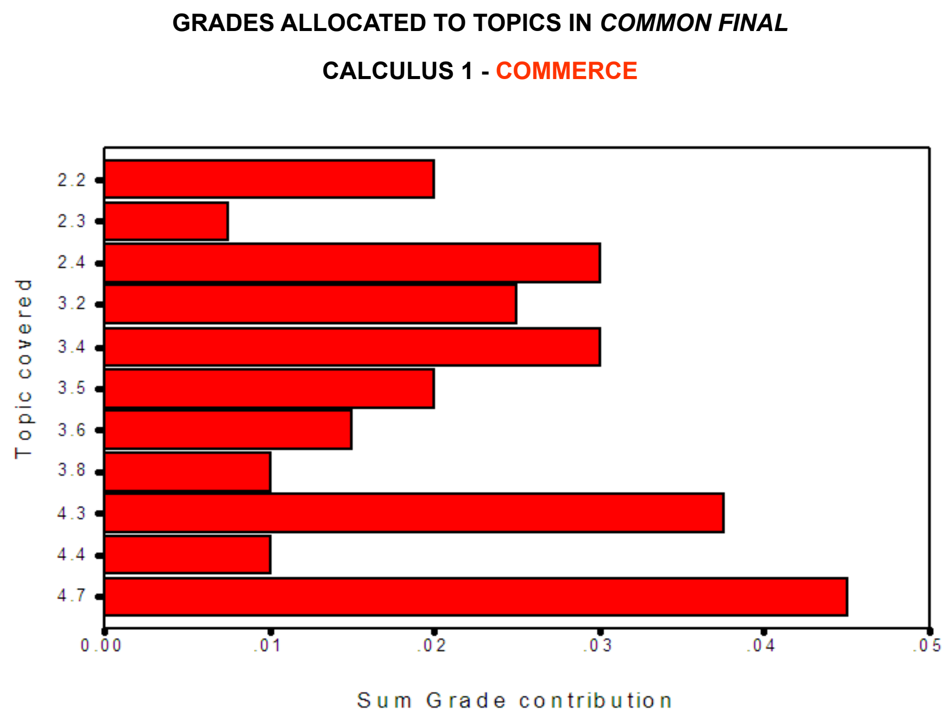


Figure 12.14



Student results

In the following charts, each teacher's group of students has been placed in their individual classes. The incoming strength of the IB sections (M091S, M092S and M011C) is apparent. As well, the Commerce students have somewhat lower high school achievement compared to Science students. Very few Science students have a high school average of less than 70%, which is to be expected given college entrance requirements.

The box plots for the Calculus 1 grades show all grades greater than or equal to 30%, with outliers removed for clarity. The Science graphs, even without the IB sections (M091S and M092S), show a wide range of median values, going from the 60% to the 80%. In some Science sections, all students pass the course. In the Commerce sections, a large proportion of students do not pass the course.

Figure 12.15

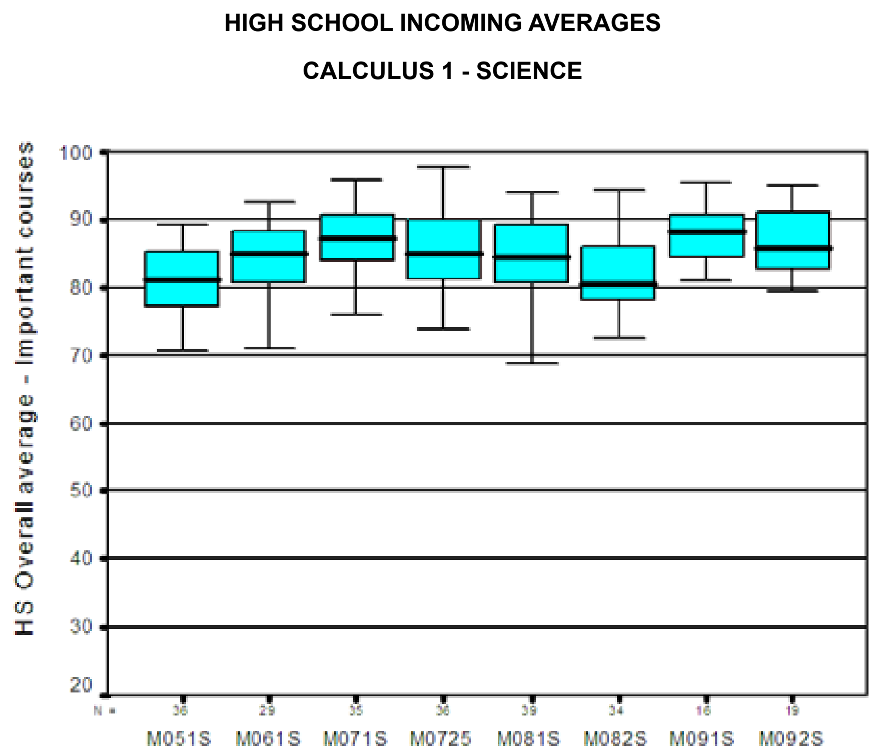


Figure 12.16

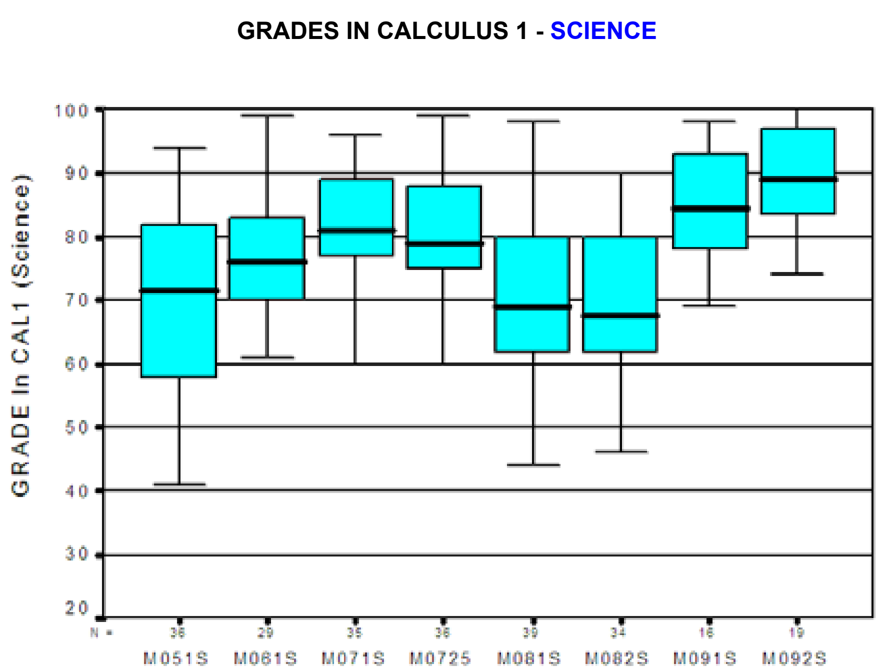


Figure 12.17

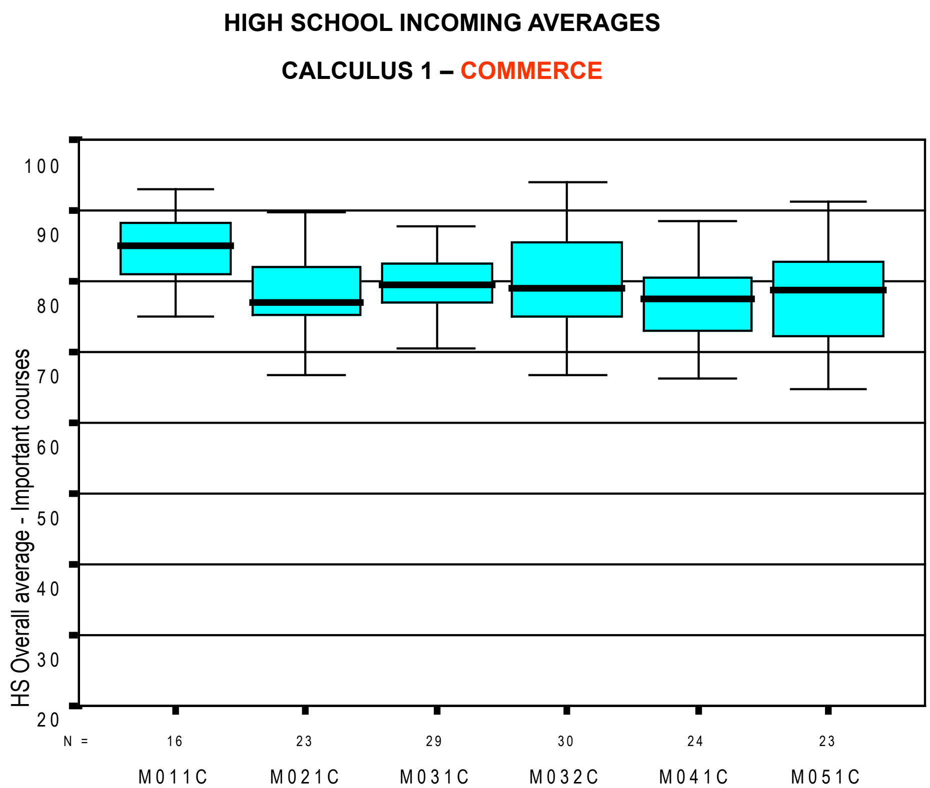
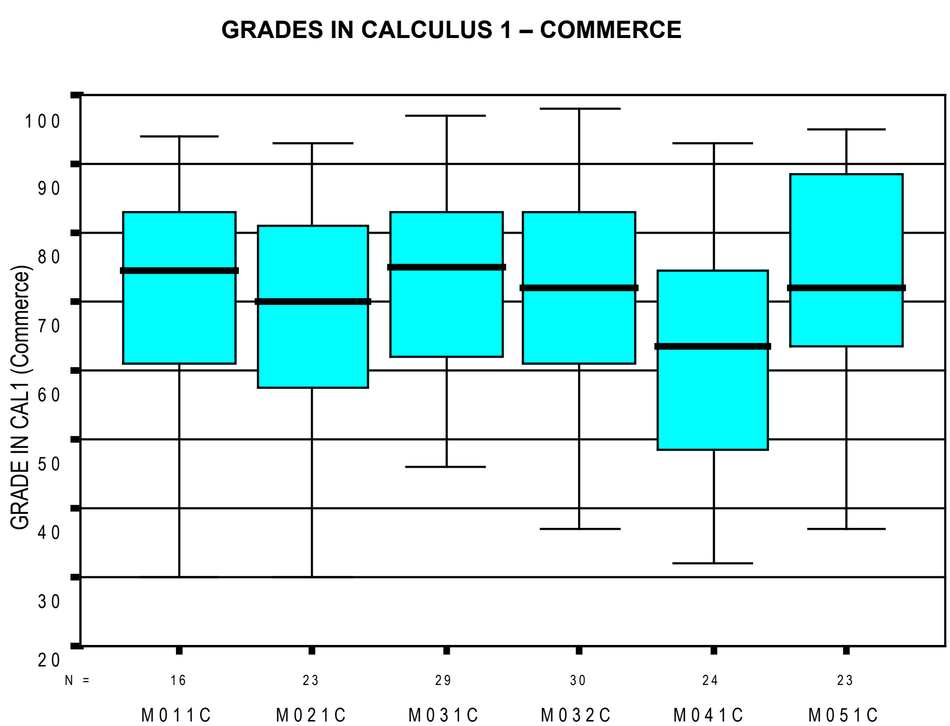


Figure 12.18



Further analysis requested by the Mathematics Department

The Math department wondered whether Mathematics 536 was a better predictor of success in Calculus 1 than the overall average of the Ministerial courses. The following graphs, comparing the means of Overall High School Average, Math 536 and grade in Calculus 1 were produced.

Both the graphs and the associated correlations show that Math 536 is a slightly better predictor of performance in Calculus 1. However, there are some sections which do not seem to follow the trend.

A second request was for the data from fall 2001, 2002 & 2003 to be analyzed in terms of box plots and means and standard deviations. The results can be found in Supporting Document F.

The coders also carried out an item by item analysis of performance on the recent common final. Although the PAREA team not did participate in this analysis, the coders reported that it was useful in terms of gaining an understanding of student success and difficulty with the final exam.

Figure 12.19

MEAN HIGH SCHOOL AVERAGE, MATH 536 GRADE AND CALCULUS GRADE BY SECTION

CALCULUS 1 - SCIENCE

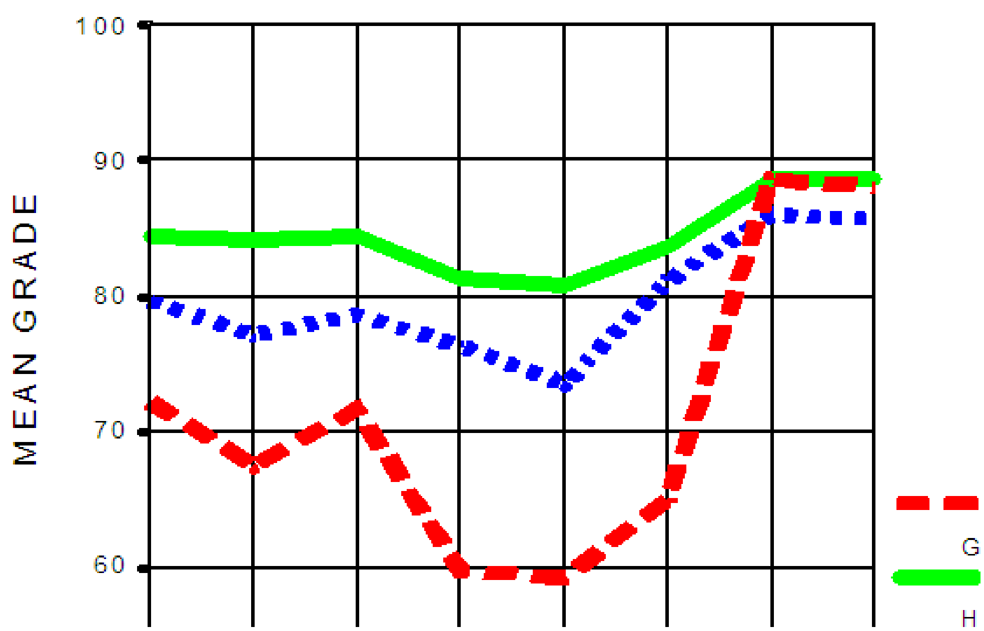
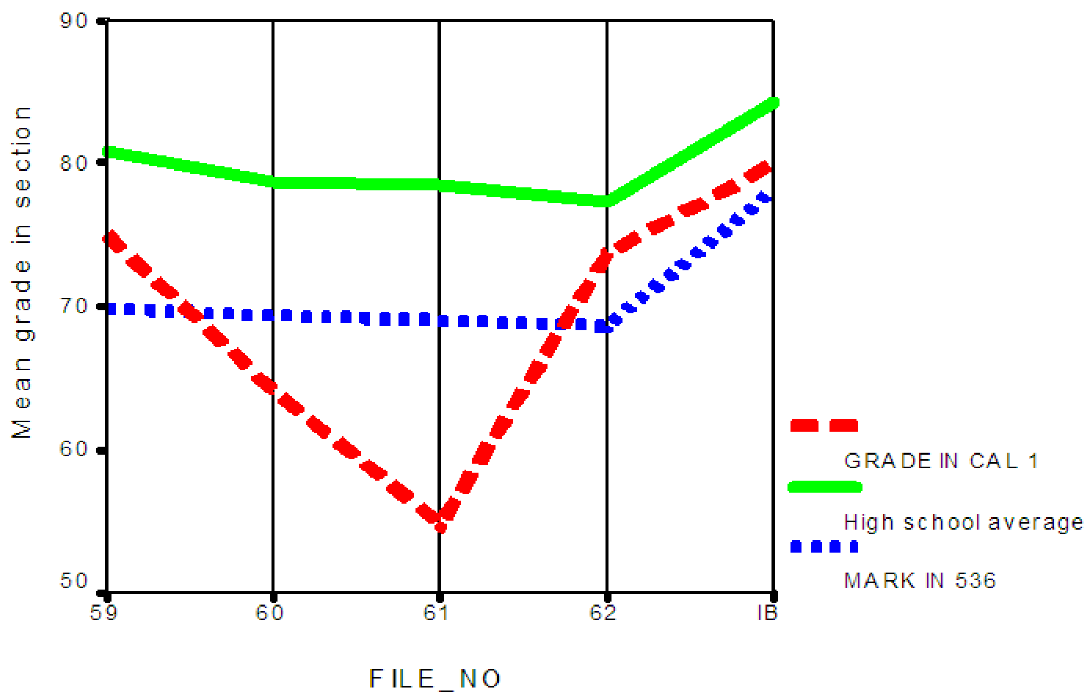


Figure 12.20

MEAN HIGH SCHOOL AVERAGE, MATH 536 GRADES AND CALCULUS GRADES BY SECTION

CALCULUS 1 – COMMERCE



REFLECTION

At the first presentation of the data to the PAREA research team and members of the Mathematics department, the overall impression was the remarkable lack of delineation in the data. Because so few of the available codes were used, there was little to differentiate one section from another, particularly in terms of Type of Knowledge and Cognitive Complexity. The team felt it was necessary to try to understand this outcome in terms of the coding task and the Mathematics Department's approach to it.

One explanation could be that the taxonomy was, in fact, not appropriate for the task. This observation was made by the coders several times throughout the coding process. Each time they were invited to adjust the taxonomy or to create a new one that used terminology more suitable to the thinking processes required by math. One of the coders, during the data presentation recalled how difficult it had been to fit the items into the taxonomy and the other coder reflected on his feelings that Conceptual Knowledge seemed more challenging in Calculus 1 than Procedural knowledge.

Another explanation could be that the Mathematics Department felt under pressure to demonstrate their coherence and this somehow influenced the coding process. There is some support for this position given by the fact that the PAREA research team was excluded from any of the follow-up meetings. This situation only occurred in Mathematics, and suggests that perhaps the research team failed to convey the nature of the research and generate the degree of trust required for an open communication.

Regardless of whether one or both of the above factors were in play in this situation, the outcome of the project did not appear to impact on the Calculus curriculum or on departmental policies and procedures. Consequently, a *Table of Issues and Resolutions* was not constructed. It did however, highlight for the PAREA team, factors that are required in order to achieve a coherent curriculum: a discipline-specific taxonomy for coding assessment items, departmental commitment and leadership, and a willingness to work in partnership to continually negotiate the fit between external demands and the department's own goals and strategies.

SUPPORTING DOCUMENT A

SUPPORTING DOCUMENT A

Flowcharts Showing Access To Calculus 1

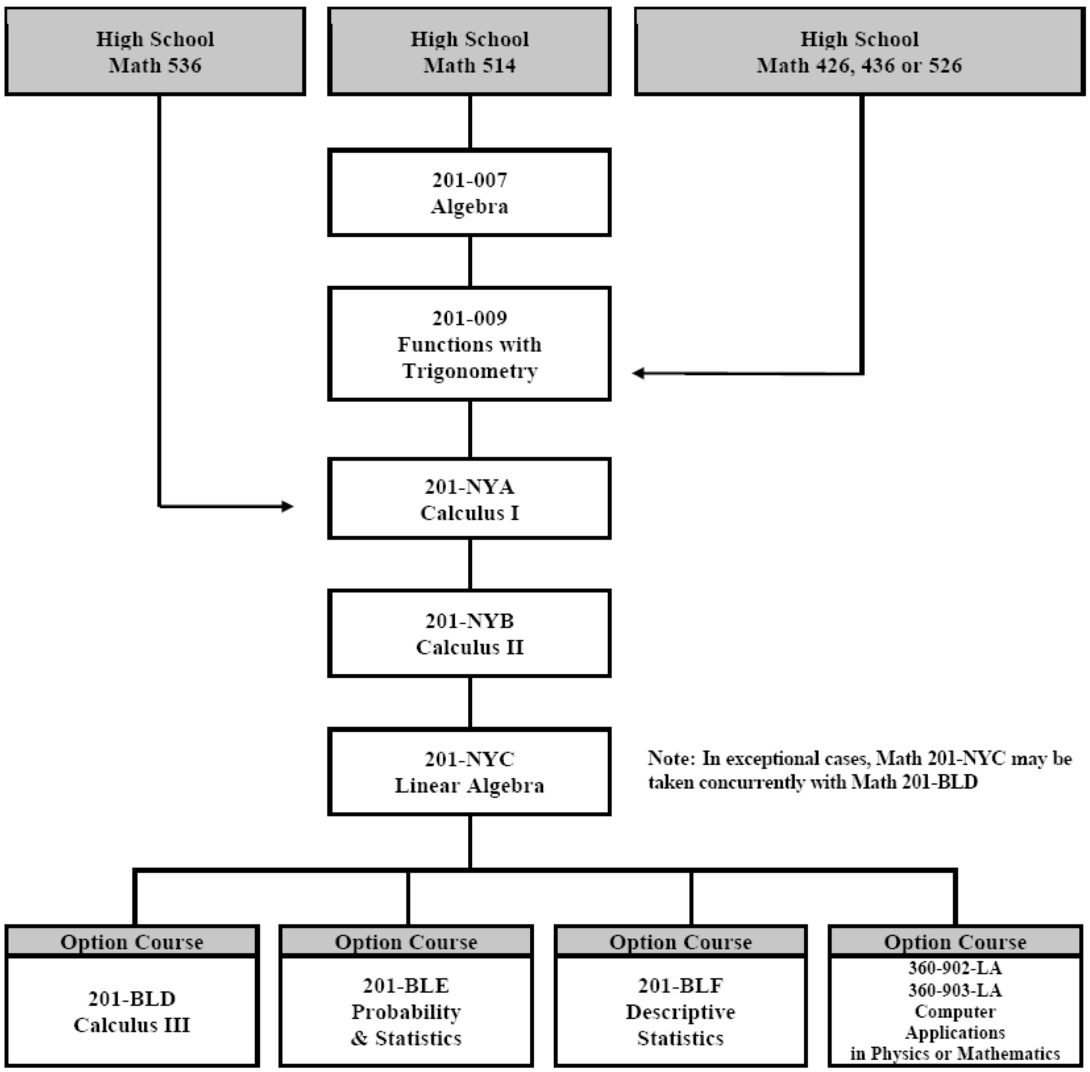
Math Chart for Explorations, Science and IB Science

Math Entrance Requirement for Explorations: Math 514 with a minimum grade of 75%, Math 426, Math 436 or Math 526

Math Entrance Requirement for Sciences: Math 536

Math Entrance Requirement for IB Sciences: Math 536 with a minimum grade of 80%

Students who are lacking Math 436 or Math 536 can register for the equivalent courses - Algebra 201-007 and Functions with Trigonometry 201-009. These courses cannot count toward any diploma requirement. They are considered as extra courses outside the program.



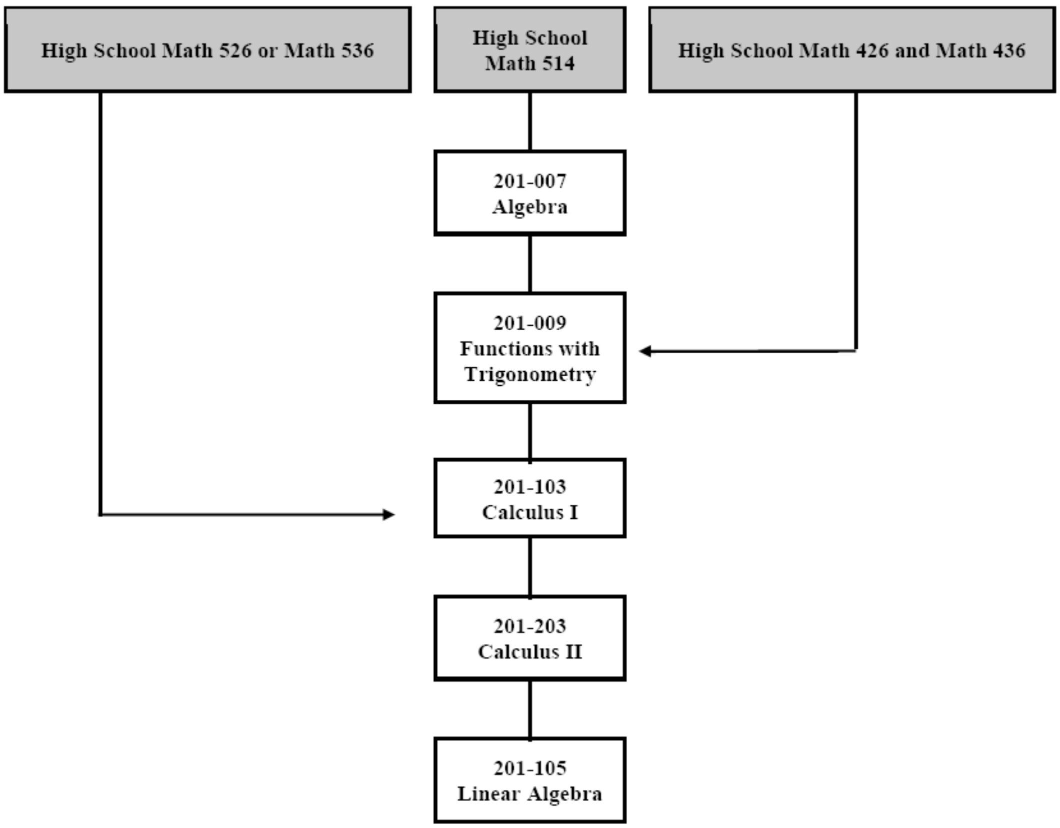
NOTE: **The optional courses may not be offered every semester. Please consult the sessional timetable for more information.**

Math Chart for Social Science and IB Commerce & Management

Math Entrance Requirement for Social Science (Commerce and World Studies with Math): Math 526 or Math 536.

Math Entrance Requirement for IB Commerce: Math 526 or Math 536 with a minimum grade of 80%

Students who are lacking Math 436 or Math 536, and who wish to continue their Math studies, may register for the equivalent courses - Algebra 201-007 and Functions with Trigonometry 201-009. These courses cannot count toward any diploma requirement. They are considered as extra courses outside the program.



SUPPORTING DOCUMENT B

Science Program Evaluation

Submitted to the Board of Governors - April 2004

Conclusions on Mathematics Page 43

Conclusions

43. Graduates are generally satisfied with Mathematics courses, although they do express dissatisfaction with specific components of their "Mathematics experience", notably with inequities in teaching and assessment.

44. Mathematics makes a substantial contribution to the attainment of the stated objectives and the aims of the Science program.

45. Students perceive that there is inconsistency in the way teachers of the NYA course (Calculus I) handle the often highly variable high school background of incoming students. Although some of these variations may be due to inherent student ability, much of it may be due to differences in the High School preparation they received.

46. While faculty may be enthusiastic about the subject area, their teaching methods don't always translate to enthusiasm in the classroom. Teaching methods need to be varied and updated.

47. While many teachers employ rigorous forms of assessment, both formative and summative, assessment is inconsistent from one section of a course to another. In other words, there is a lack of coherence in assessment of student acquisition between multiple sections of the same course.

48. The small number of students who benefit from a faculty member as a mentor or who partake in activities such as math conferences or math contests feel that there is high added-value to their education.

49. The College can clearly provide IT for classroom use. However, technology and other innovations in the teaching will only succeed if welcomed by the faculty.

50. The quality of education in mathematics could be improved by addressing the following issues:
    - Coherency in the curriculum including common outlines, common assessment schemes and common exams. Coherence in program delivery is a crucial issue. Students perceive inequity in subject coverage, assessment, and workload. This matter requires immediate attention.
    - Widening the now limited range of external inputs, and their informality, which is a constraint on the maintenance of curriculum currency, curriculum delivery and staff development.

51. Although not discussed elsewhere in this chapter, the Integrative Activity and Comprehensive Assessment are clearly not working in Mathematics. However, Mathematics is collecting examples of previous IA's which may be used by department members to develop new interdisciplinary activities. As one of the crucial disciplines of the Science Program, Mathematics acknowledges that it must be more actively involved with these Ministry required areas of the curriculum.

SUPPORTING DOCUMENT C

CROSS TABULATIONS OF TASK TYPE AND DIFFICULTY

CROSS TABULATION OF TASK TYPE BY SECTION (COMMERCE)

Teacher's code * Type of task Crosstabulation

Teacher's code	M011C	Count	0	64	26	17	12	119
		% within Teacher's code	.0%	53.8%	21.8%	14.3%	10.1%	100.0%
	M021C	Count	0	0	26	19	38	83
		% within Teacher's code	.0%	.0%	31.3%	22.9%	45.8%	100.0%
	M031C	Count	0	0	26	54	28	108
		% within Teacher's code	.0%	.0%	24.1%	50.0%	25.9%	100.0%
	M051C	Count	19	58	26	13	35	151
		% within Teacher's code	12.6%	38.4%	17.2%	8.6%	23.2%	100.0%
Total		Count	19	122	104	103	113	461
		% within Teacher's code	4.1%	26.5%	22.6%	22.3%	24.5%	100.0%

CROSS TABULATION OF DIFFICULTY BY SECTION (COMMERCE)

Teacher's code * Difficulty Crosstabulation

Teacher's code	M011C	Count	4	114	1	119
		% within Teacher's code	3.4%	95.8%	.8%	100.0%
	M021C	Count	0	83	0	83
		% within Teacher's code	.0%	100.0%	.0%	100.0%
	M031C	Count	18	90	0	108
		% within Teacher's code	16.7%	83.3%	.0%	100.0%
	M051C	Count	4	147	0	151
		% within Teacher's code	2.6%	97.4%	.0%	100.0%
Total		Count	26	434	1	461
		% within Teacher's code	5.6%	94.1%	.2%	100.0%

CROSS TABULATION OF NEW DIFFICULTY RATING BY SECTION (COMMERCE)

Teacher's code * Difficulty Crosstabulation

Teacher's code	M011C	Count	8	90	21	119
		% within Teacher's code	6.7%	75.6%	17.6%	100.0%
	M021C	Count	10	52	21	83
		% within Teacher's code	12.0%	62.7%	25.3%	100.0%
	M031C	Count	21	53	34	108
		% within Teacher's code	19.4%	49.1%	31.5%	100.0%
	M051C	Count	10	66	75	151
		% within Teacher's code	6.6%	43.7%	49.7%	100.0%
Total		Count	49	261	151	461
		% within Teacher's code	10.6%	56.6%	32.8%	100.0%

Supporting Document D

QUESTIONNAIRE - TOPIC DIFFICULTY RATING

To: Math Department Members

From: Malcolm Harper

Regarding: PAREA Project Update

I mentioned at the last department meeting that we have finished coding the evaluation instruments used in the Calculus I classes during the Fall session 2004. We are currently analyzing the data created by the coding. As part of this analysis we need to decide the relative difficulty levels of the various topics that we teach in Cal I. I have attached a form that shows the topic categorization we used when we coded the grading instruments. I am asking you to assign a level of difficulty to each topic category:

1 – easy/accessible – the majority of the class can master this topic with standard effort.

2 – medium/standard – about half the class can master the topic with standard effort.

3 – difficult/inaccessible – few of the class can master the topic with standard effort.

If we wanted more specific guidelines, we could define "the majority" to be greater than or equal to two-thirds while "few" could be less than or equal to one-third. "About half" then would be between one-third and two-thirds.

Some notes:

- Please consider the science and the commerce students separately. I have attached a separate form for each.
- Base the difficulty levels primarily on your experience teaching commerce and science students here at Champlain.
- If you are unable or unwilling to assign difficulty levels for any reason please let me know so that I won't be waiting on your response.
- Assign the difficulty levels according to the topic groupings attached since these are the groupings we used while coding. If you have questions, concerns, or suggestions regarding how the topics were grouped let me know so that we can take your comments into account in the future.

CALCULUS I SCIENCE

We are interested in your experience teaching these topics to science students. Please give each topic group a difficulty code:
1 – Easy, 2 – Standard, 3 - Challenging

Number	*Topic*	Location in Stewart	Difficulty Code
1	**Review of Functions**		
1.1	Definition, notation, domain, and range of functions and graphs	1.1, 1.3	
1.2	Polynomial functions	1.2, B, C	
1.3	Trigonometric functions and their inverses	D	
1.4	Exponential and logarithmic functions	1.5, 1.6	
1.5	Inequalities, absolute value	A	
1.6	Other (vertical asymptotes for example)		
2	**Limits**		
2.1	Finding limits intuitively including infinite limits	2.2	
2.2	Finding limits using the limit laws	2.3	
2.3	Continuity of a function	2.5	
2.4	Limits at infinity	2.6	
2.5	Some special limits for example $\sin(x)/x$ as $x \to 0$	3.4	
3	**The derivative of a function**		
3.1	Tangents, velocities and rates of change	2.1, 2.7	
3.2	Derivatives, the derivative of a function and the formal definition of the derivative	2.8, 2.9	
3.3	Derivatives of polynomial and exponential functions	3.1	
3.4	The product, quotient and chain rules for derivatives	3.3, 3.5	
3.5	Derivatives of trigonometric functions	3.4	
3.6	Implicit differentiation	3.6	
3.7	Higher order derivatives and acceleration	3.7	

3.8	Derivatives of logarithmic functions and logarithmic differentiation	3.8	
4	**Applications of differentiation**		
4.1	Related rates	3.10	
4.2	Linear Approximation & Differentiation	3.11	
4.3	Relation of derivative to shape of graph including maximum and minimum values and mean value theorem	4.1, 4.2 4.3	
4.4	L'Hopital's rule	4.4	
4.5	Graphing of functions	4.5	
4.6	Optimization	4.7	
4.7	Marginal analysis and optimization in business, elasticity of demand	4.8	
4.8	Newton's Method	4.9	

CALCULUS I COMMERCE

We are interested in your experience teaching these topics to commerce students. Please give each topic group a difficulty code:
1 – Easy, 2 – Standard, 3 - Challenging

Number	*Topic*	Location in Stewart	Difficulty Code
1	**Review of Functions**		
1.1	Definition, notation, domain, and range of functions and graphs	1.1, 1.3	
1.2	Polynomial functions	1.2, B, C	
1.3	Trigonometric functions and their inverses	D	
1.4	Exponential and logarithmic functions	1.5, 1.6	
1.5	Inequalities, absolute value	A	
1.6	Other (vertical asymptotes for example)		
2	**Limits**		
2.1	Finding limits intuitively including infinite limits	2.2	
2.2	Finding limits using the limit laws	2.3	
2.3	Continuity of a function	2.5	
2.4	Limits at infinity	2.6	
2.5	Some special limits for example $\sin(x)/x$ as $x \to 0$	3.4	
3	**The derivative of a function**		
3.1	Tangents, velocities and rates of change	2.1, 2.7	
3.2	Derivatives, the derivative of a function and the formal definition of the derivative	2.8, 2.9	
3.3	Derivatives of polynomial and exponential functions	3.1	
3.4	The product, quotient and chain rules for derivatives	3.3, 3.5	
3.5	Derivatives of trigonometric functions	3.4	
3.6	Implicit differentiation	3.6	
3.7	Higher order derivatives and acceleration	3.7	

3.8	Derivatives of logarithmic functions and logarithmic differentiation	3.8	
4	**Applications of differentiation**		
4.1	Related rates	3.10	
4.2	Linear Approximation & Differentiation	3.11	
4.3	Relation of derivative to shape of graph including maximum and minimum values and mean value theorem	4.1, 4.2 4.3	
4.4	L'Hopital's rule	4.4	
4.5	Graphing of functions	4.5	
4.6	Optimization	4.7	
4.7	Marginal analysis and optimization in business, elasticity of demand	4.8	
4.8	Newton's Method	4.9	

SUPPORTING DOCUMENT E

CODING DICTIONARY AND

WEIGHTING SCHEME USED TO DEVELOP NEW DIFFICULTY SCALE

FORMAT OF TASK

Calculation
A task that requires only routine arithmetical and/or algebraic calculation such as could be done on a calculator.
Compute
Regular calculus computations.
Derivation
Prove or derive formula.
Graph
Sketching a graph or answering questions on the basis of information in a graph.
Oral
Any oral presentation of work.
Short answer
A written answer that is just 1 or 2 sentences long. The student must answer in his or her own words.
True/False
The student must determine whether a statement is true or false.
Multiple Choice
The correct answer is selected from a choice of several alternatives.
Word Problem
A problem that describes a situation in words. The words have to be transferred into symbolic mathematical language before a solution can be derived.
Uncodable
It was not possible to assign the item to any of the available categories.

FIRST LEVEL OF DIFFICULTY SCALE

This coding is done when a coding team becomes aware that items, particularly in the *Analyze* and *Apply* categories of cognitive complexity, need further refinement in terms of the difficulty of the task required. The first scale used by the coders ranked on a scale of 1 to 5 with 1 denoting “easy” and 5 denoting “hard.”

SECOND LEVEL OF DIFFICULTY SCALE

The second difficulty scale was derived as follows:

- Math teachers rated topic difficulty separately for Commerce and Science.
- Ratings were summarised using the mode. Where there were two modes, the more extreme mode was taken. Where the two modes were at each extreme, the median was taken.
- The resulting rating for each topic was applied to the original rating using multiplication. For examples, an item originally coded 3 (Standard) for a difficult topic (coded 3) would generate a value of 9. Since the original codes were 1,3,& 5 and the topic codes were 1,2,3, the resulting values ranged from 1 (an easy question on an easy topic) to 15 (a difficult question on a difficult topic).
- Using frequency counts of the values, a three point scale was set up to allow a reasonable proportion of values to fall within each range. The range was 1- 5 = **easy** 6-8 = **standard** and above 9 was **challenging**. This range was used for both Commerce and Science. Have attached the tables –six was chosen as the middle because it was an item that was coded standard originally, and coded standard as a topic (3 * 2).

Difficulty * NEWDIFF Crosstabulation - SCIENCE
Count

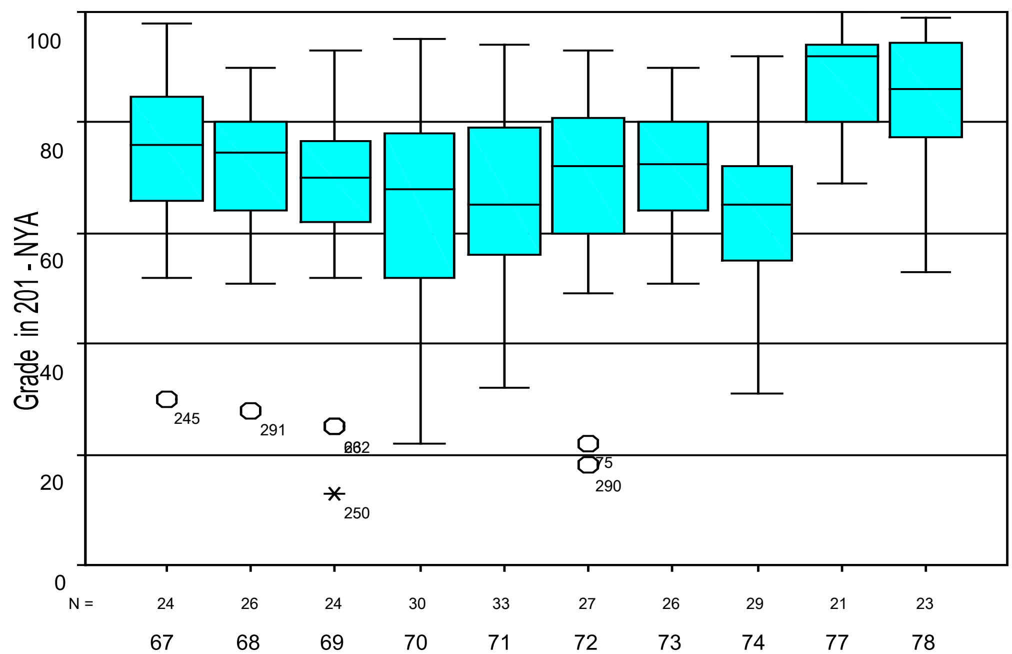
		Multiple								Total
		1.00	2.00	3.00	5.00	6.00	9.00	10.00	15.00	
Difficulty	Easy	4	6	216	3					229
	Standard					290				290
	Challenging						44	7	5	56
Total		4	6	216	3	290	44	7	5	575

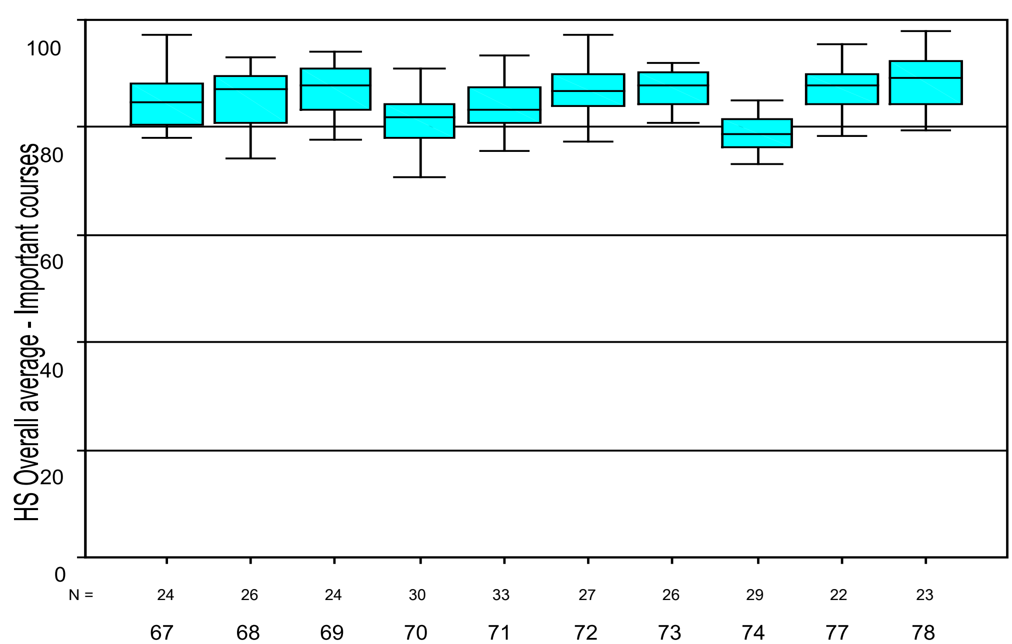
Difficulty * NEWDIFF Crosstabulation - COMMERCE
Count

		Multiple					Total
		2.00	3.00	6.00	9.00	10.00	
Difficulty	Easy	20	29				49
	Standard			261			261
	Challenging				150	1	151
Total		20	29	261	150	1	461

SUPPORTING DOCUMENT F

201-NYA Fall 2001 (Science)





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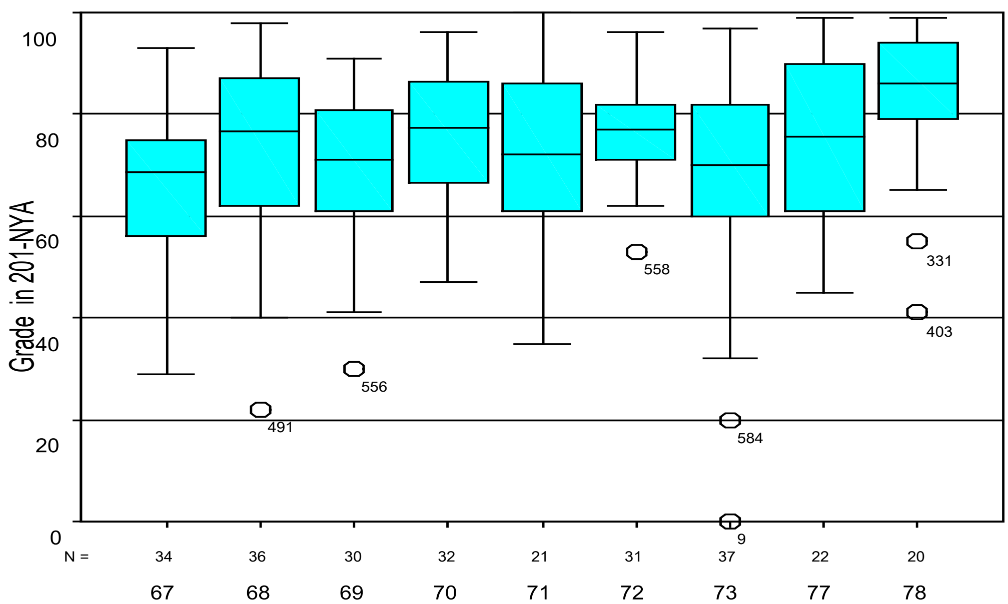
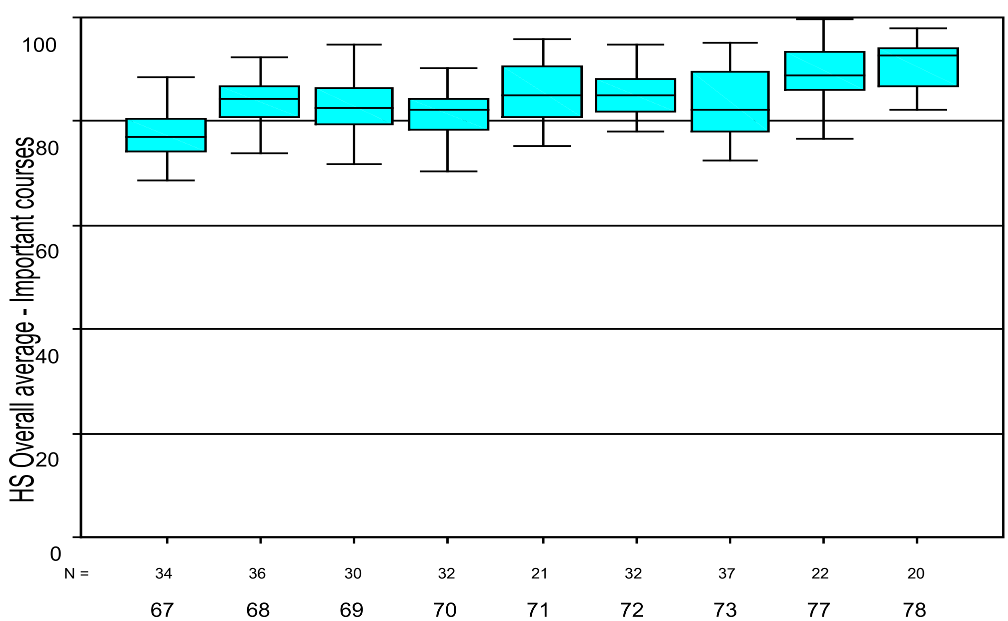
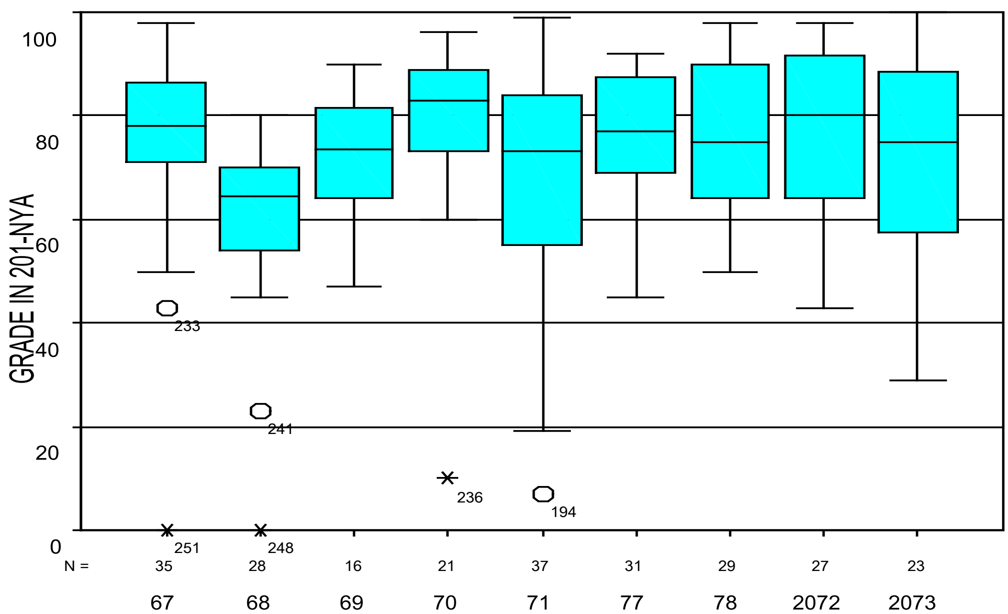
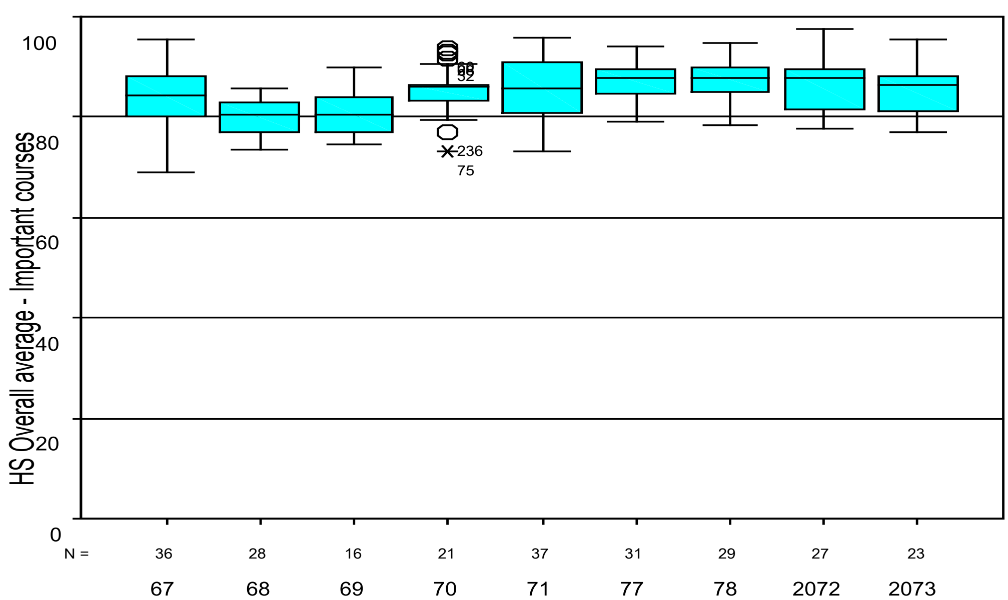




201-NYA Fall 2003 (Science)





MEANS AND STANDARD DEVIATIONS

201-NYA Fall 2001 (Science)

Report

			HS Overall average -
67	Mean	74.58	84.8980
	N	24	24
	Std. Deviation	15.053	4.73746
68	Mean	71.85	85.6420
	N	26	26
	Std. Deviation	13.534	5.01018
69	Mean	65.33	87.0435
	N	24	24
	Std. Deviation	19.792	4.82193
70	Mean	66.00	81.9314
	N	30	30
	Std. Deviation	15.998	4.78153
71	Mean	65.88	83.5698
	N	33	33
	Std. Deviation	15.827	4.81531
72	Mean	68.52	86.9498
	N	27	27
	Std. Deviation	17.932	4.51661
73	Mean	72.81	87.1755
	N	26	26
	Std. Deviation	10.080	3.53636
74	Mean	64.86	78.8154
	N	29	29
	Std. Deviation	15.080	3.29982
77	Mean	86.86	87.4134
	N	21	22
	Std. Deviation	10.091	3.96010
78	Mean	84.13	89.0214
	N	23	23
	Std. Deviation	11.799	5.29981
Total	Mean	71.34	84.9980
	N	263	264
	Std. Deviation	16.331	5.33121

MEANS AND STANDARD DEVIATIONS

201-NYA Fall 2002 (Science)

Report

			HS Overall average -
67	Mean	66.18	77.8024
	N	34	34
	Std. Deviation	14.807	4.09987
68	Mean	73.94	83.7018
	N	36	36
	Std. Deviation	17.004	4.68661
69	Mean	69.40	83.2325
	N	30	30
	Std. Deviation	14.219	5.92618
70	Mean	75.16	81.5079
	N	32	32
	Std. Deviation	12.475	4.88531
71	Mean	73.24	85.2302
	N	21	21
	Std. Deviation	16.318	5.67188
72	Mean	77.65	85.3189
	N	31	32
	Std. Deviation	9.552	4.20373
73	Mean	66.22	83.8291
	N	37	37
	Std. Deviation	20.659	6.59652
77	Mean	74.32	89.2316
	N	22	22
	Std. Deviation	16.441	5.17478
78	Mean	82.60	90.5092
	N	20	20
	Std. Deviation	14.748	4.84131
Total	Mean	72.55	83.9347
	N	263	264
	Std. Deviation	16.067	6.13835

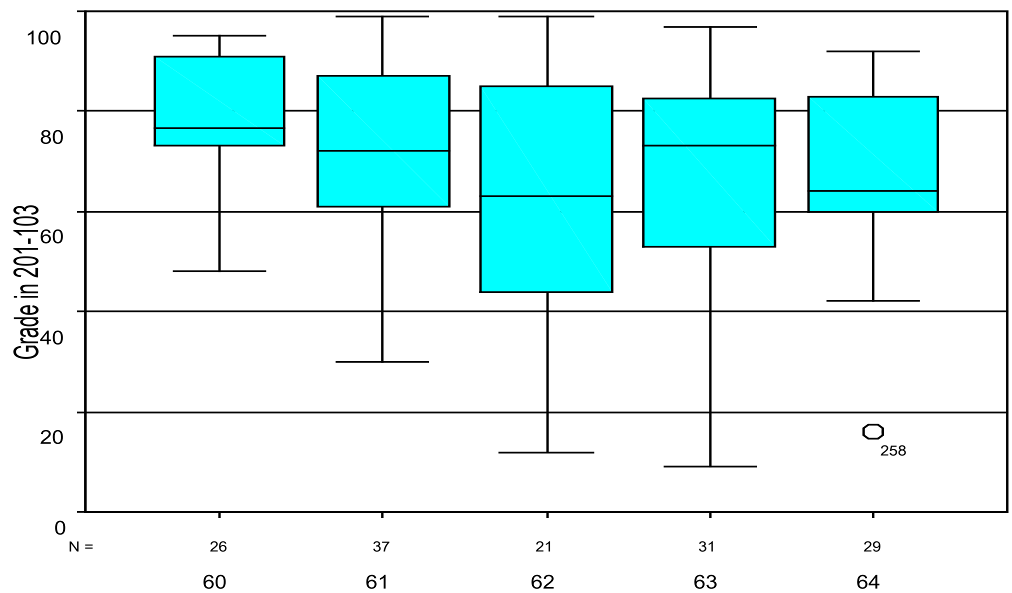
MEANS AND STANDARD DEVIATIONS

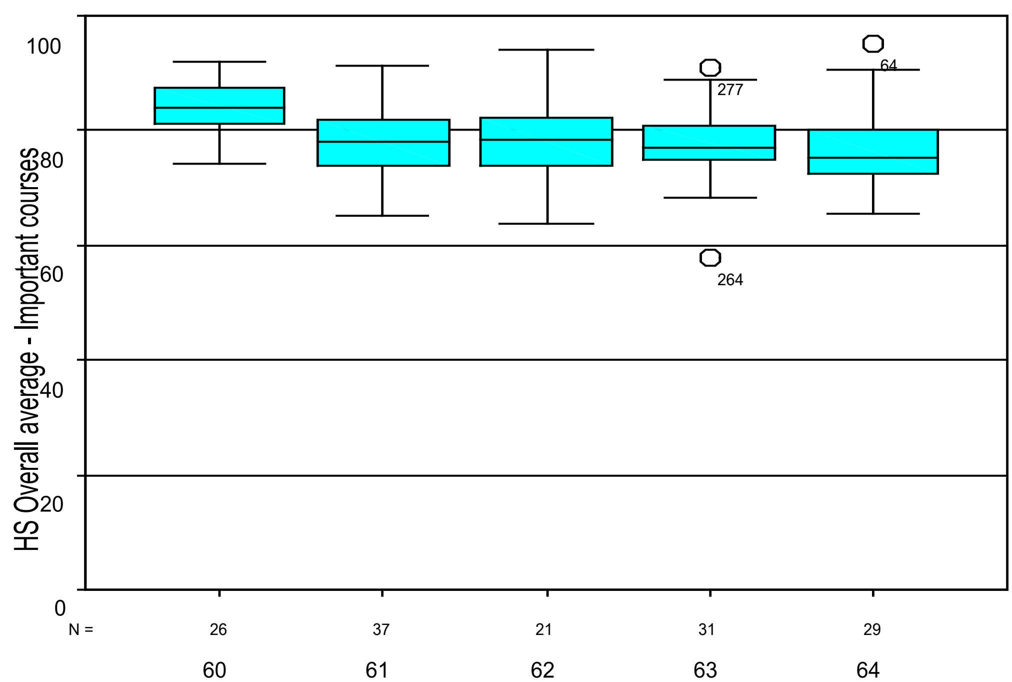
201-NYA Fall 2003 (Science)

Report

			HS Overall average -
67	Mean	74.66	84.3003
	N	35	36
	Std. Deviation	17.984	5.69001
68	Mean	60.14	79.9943
	N	28	28
	Std. Deviation	16.359	3.64850
69	Mean	72.00	80.5963
	N	16	16
	Std. Deviation	12.749	4.44537
70	Mean	78.52	85.5462
	N	21	21
	Std. Deviation	18.010	5.27561
71	Mean	70.11	85.2384
	N	37	37
	Std. Deviation	21.891	6.31739
77	Mean	77.00	87.1852
	N	31	31
	Std. Deviation	11.112	3.44496
78	Mean	75.66	87.2772
	N	29	29
	Std. Deviation	14.524	4.33615
2072	Mean	76.67	86.0621
	N	27	27
	Std. Deviation	17.047	5.18352
2073	Mean	71.00	85.3522
	N	23	23
	Std. Deviation	21.996	5.40936
Total	Mean	72.78	84.8187
	N	247	248
	Std. Deviation	17.925	5.46193

201-103 (Commerce) Fall 2001



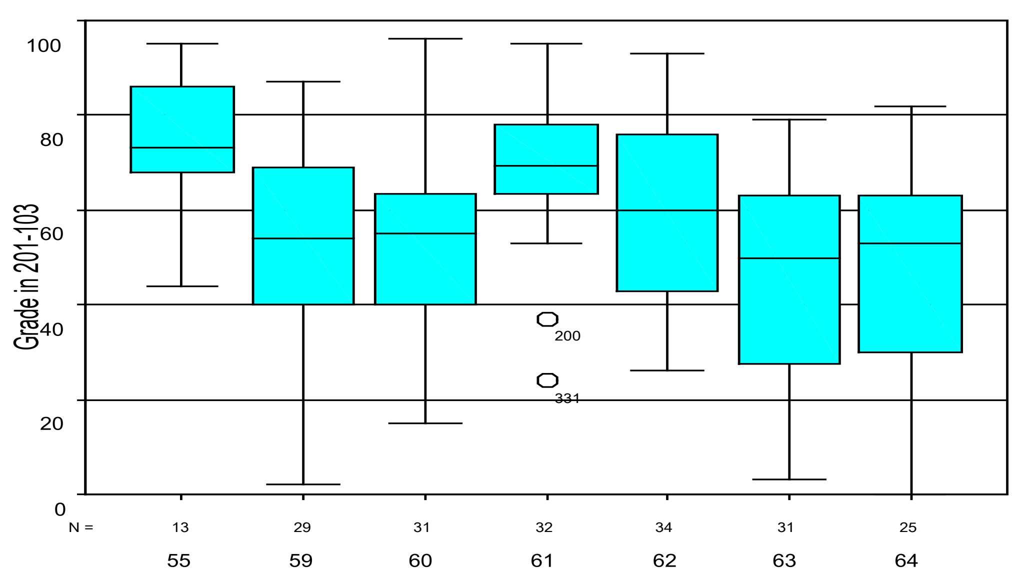


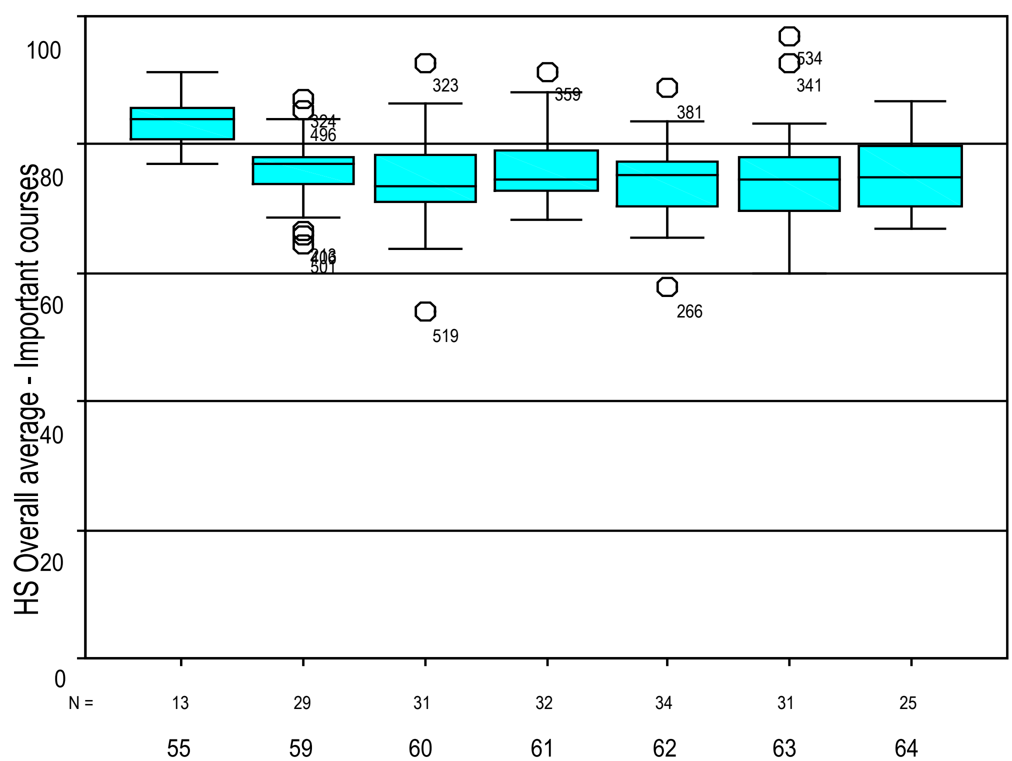
MEANS AND STANDARD DEVIATIONS

201-103 (Commerce) Fall 2001

File number of the group		Grade Numeric	HS Overall average - Important courses
60	Mean	80.04	84.2936
	N	26	26
	Std. Deviation	11.640	4.45232
61	Mean	71.97	77.8419
	N	37	37
	Std. Deviation	17.931	6.58748
62	Mean	63.67	78.6139
	N	21	21
	Std. Deviation	25.488	7.49783
63	Mean	66.03	77.6842
	N	31	31
	Std. Deviation	21.706	6.45011
64	Mean	66.69	76.3391
	N	29	29
	Std. Deviation	17.335	6.52627
Total	Mean	69.87	78.7828
	N	144	144
	Std. Deviation	19.596	6.82263

201-103 (Commerce) Fall 2002





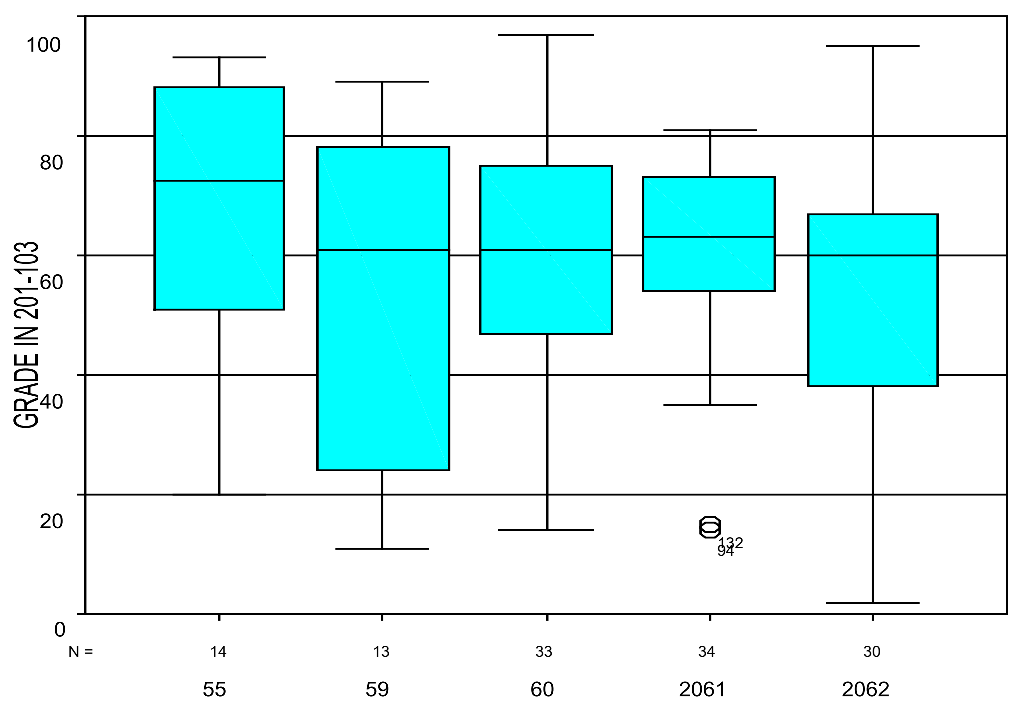
MEANS AND STANDARD DEVIATIONS

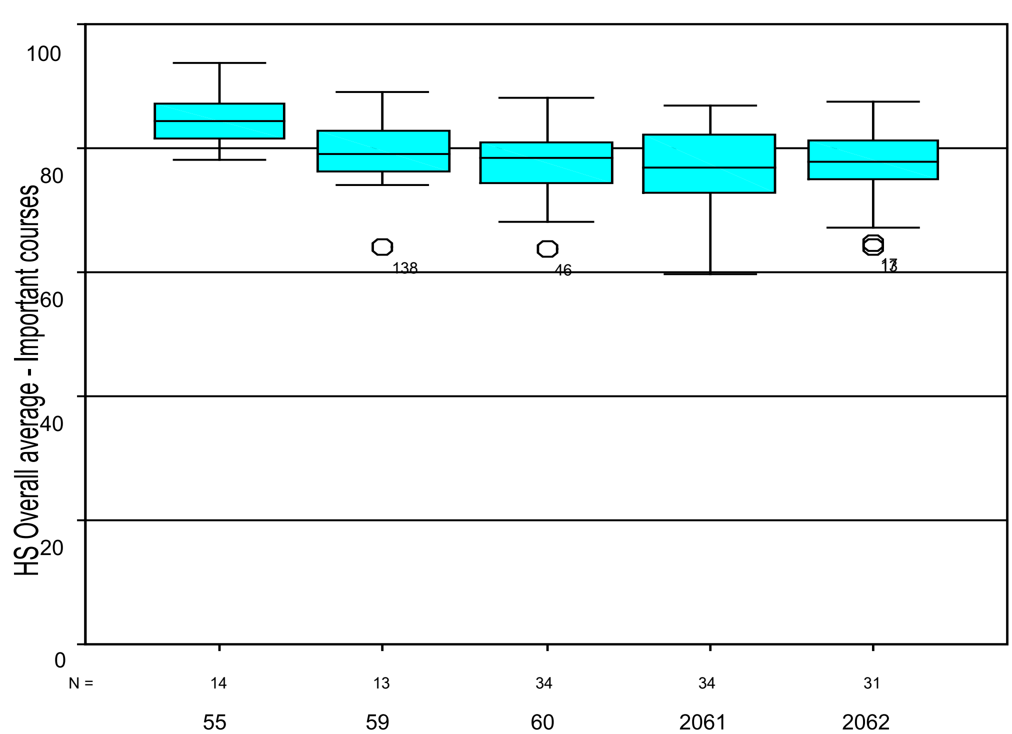
201-103 (Commerce) Fall 2002

Report

			HS Overall average -
55	Mean	75.38	83.7610
	N	13	13
	Std. Deviation	14.402	3.87863
59	Mean	52.24	76.1106
	N	29	29
	Std. Deviation	21.982	5.68448
60	Mean	54.03	74.1382
	N	31	31
	Std. Deviation	20.716	7.19230
61	Mean	69.09	76.5085
	N	32	32
	Std. Deviation	14.163	5.88618
62	Mean	58.76	74.3705
	N	34	34
	Std. Deviation	17.865	5.88262
63	Mean	45.94	74.9342
	N	31	31
	Std. Deviation	21.994	7.72050
64	Mean	47.92	75.5110
	N	25	25
	Std. Deviation	21.566	5.73391
Total	Mean	56.42	75.8051
	N	195	195
	Std. Deviation	21.203	6.60117

201-103 (Commerce) Fall 2003





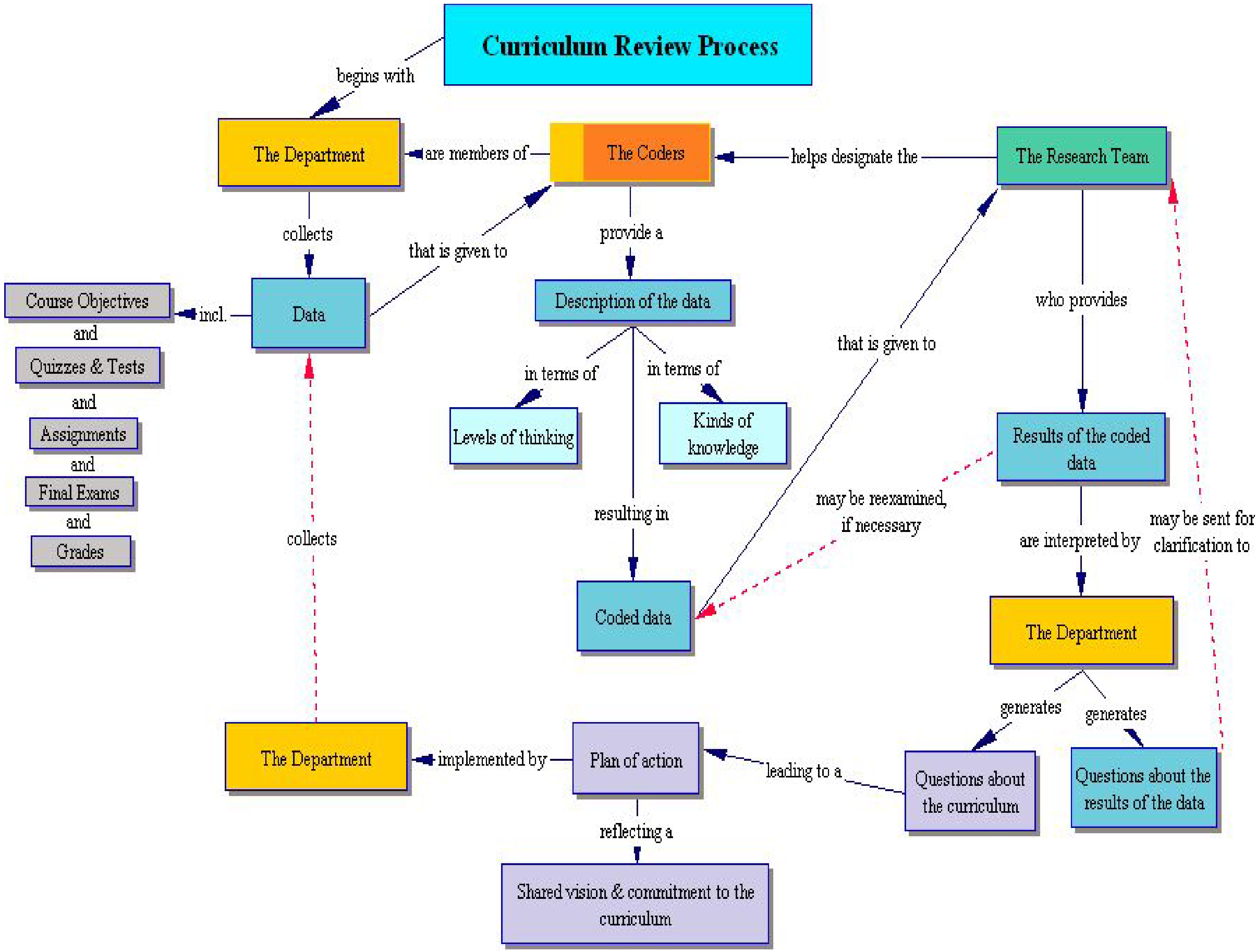
MEANS AND STANDARD DEVIATIONS

201-103(Commerce) Fall 2003

Report

			HS Overall average -
55	Mean	68.93	84.9893
	N	14	14
	Std. Deviation	23.003	4.76710
59	Mean	52.46	78.5585
	N	13	13
	Std. Deviation	28.527	6.08680
60	Mean	59.76	77.7537
	N	33	34
	Std. Deviation	20.635	5.52870
2061	Mean	61.62	77.2358
	N	34	34
	Std. Deviation	16.081	6.05516
2062	Mean	52.23	77.3564
	N	30	31
	Std. Deviation	22.494	6.14308
Total	Mean	58.72	78.4032
	N	124	126
	Std. Deviation	21.533	6.19226

Curriculum Review Process


Curriculum Review Process
begins with
The Department
are members of
The Coders
helps designate the
The Research Team
collects
that is given to
provide a
Data
incl.
Course Objectives
and
Quizzes & Tests
and
Assignments
and
Final Exams
and
Grades
Description of the data
in terms of
Levels of thinking
in terms of
Kinds of knowledge
that is given to
who provides
Results of the coded data
may be reexamined, if necessary
resulting in
Coded data
are interpreted by
may be sent for clarification to
collects
The Department
generates
generates
Questions about the curriculum
Questions about the results of the data
leading to a
The Department
implemented by
Plan of action
reflecting a
Shared vision & commitment to the curriculum

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