UNIVERSITÉ DE SHERBROOKE

Les effets de l'enseignement assisté par la technologie sur les étudiants du Cégep

The Effects of Technology-Assisted Instruction on Cégep Students

par

Helen Stavaris

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a été évalué par un jury composé des personnes suivantes :

Shehrnaz Choksi	Directrice de l'essai
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SUMMARY

The use of technology in instruction has become a ubiquitous feature in education and has attracted considerable research interest in exploring its influence on the learning environment. The purpose of this study was to investigate how variations of technology used in instructional delivery affect Cégep students, particularly those in their first-year of studies at this level of tertiary education. Specifically, the study contrasted the effects of three methods of instruction that rely on technology differently: 1) an entirely electronically-based approach, 2) a method comprising of a fully in-class setting that was accompanied by a course website, and 3) a combination of both online and in-class methodologies. In order to effectively compare the different instructional methods within one semester, the course was organized into three modules. In this way, students not only had the opportunity to gain an appreciation for each didactical method, but also were in a position to compare all three. This study therefore additionally contributes to the body of research by comparing all three modes of technology-assisted instruction on the same students. In this context, factors that influence student performance, attitudes towards learning, as well as preference towards a particular approach in instructional delivery served as pivotal elements for assessing the suitability for students of this age group at this level of higher education. Examining the relationship of the students' learning styles to preferred methods of technology-assisted instruction was also significant to this study.

Based on two sections of the Introduction to Business course taught by the researcher, the sample was comprised of 75 participants (forty students from one section and thirty-five students from the other), whose average age was seventeen. With two sections of students involved, there was a supplementary opportunity to explore a cross-comparison of outcomes between the technology-assisted instructional methods simply by changing the order in which the methods were offered in each of the sections. In effect, by using the two sections of the same course with alternate timing in delivery, the design of the study permitted **two concurrent comparisons: 1) a 'within' comparison** of the three different

methods involving the same students (the primary objective), and **2) a 'between' comparison** for the same content using different methods (a secondary objective).

Given the exploratory purpose of the research study, various instruments were necessary to examine and evaluate the effects of technology-assisted instruction vis-à-vis the designated research questions. The study relied on the results of class tests, the performance from selected learning activities, as well as the responses from various surveys, which included a general profile questionnaire (to gather demographic and behavioural data on the participants), end-of-module questionnaires (to assess and classify attitudes towards each particular method of instruction), and learning style inventories (to associate learning preferences with attitudes towards the instructional methods applied in this study). Researcher observations recorded throughout the duration of the study were also an integral component of the data collection. Cross-referencing of the quantitative and qualitative data generated from these research instruments served the purpose of triangulating the data.

The findings suggested that although aspects of flexibility and convenience in online learning environments were highly favoured amongst the participants, a methodology that combines the virtual learning environment with interactions in the physical classroom, (particularly the hybrid method) was selected as the preferred mode of instruction by 82% of the participants. Face-to-face interaction with the teacher and the immediacy of the instructor's responses were identified by the participants as important aspects of the learning environment. Of the comparisons carried out on student performance in the different learning contexts, test results did not appear to be affected by the removal of face-face interactions with the instructor, while this was not the case with formative assignments, which demonstrated that the conditions of the different learning environments had an influence on the extent of student engagement during learning activities. Finally, a learning style that relies heavily on theories and analysis was identified amongst those students who had preferred the in-class method (the instructional mode that relied on technology the least), while amongst the students who favoured the entirely online method (the instructional mode that relied on technology the most), they were found to have learning preferences that are characterized by hands-on experiences.

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RÉSUMÉ (FRENCH ABSTRACT)

L'utilisation de la technologie dans le domaine de l'enseignement est devenue omniprésente et a suscité un intérêt considérable en recherche en ce qui concerne son influence sur l'environnement d'apprentissage. L'objectif de cette étude consistait à examiner les répercussions des technologies utilisées dans l'enseignement sur les étudiants du Cégep, plus particulièrement sur les étudiants de première année à ce niveau d'enseignement tertiaire. Plus précisément, l'étude comparait les effets de trois méthodes d'enseignement qui utilisent la technologie de différentes façons : 1) une méthode entièrement électronique; 2) une méthode comprenant l'enseignement donné entièrement en classe et un site Web pour le cours; 3) une combinaison des méthodes d'enseignement en classe et en ligne. Afin de comparer efficacement les différentes méthodes d'enseignement au cours d'une session, le cours a été divisé en trois modules. De cette façon, les étudiants avaient non seulement l'occasion de mieux connaître chacune des méthodes didactiques, mais avaient également être en mesure de les comparer. Cette étude vient ainsi contribuer au corpus de recherche, grâce à sa comparaison des trois méthodes d'enseignement assisté par la technologie utilisées chez les mêmes étudiants. Dans ce contexte, les facteurs qui influent sur le rendement des étudiants, leur attitude à l'égard de l'apprentissage ainsi que leur préférence pour une méthode de prestation pédagogique en particulier constituaient les pivots de l'évaluation de la pertinence des méthodes pour les étudiants de ce groupe d'âge à ce niveau d'enseignement supérieur. Une autre partie importante de cette étude était l'examen de la relation entre le style d'apprentissage des étudiants et leur méthode préférée d'enseignement assisté par la technologie.

L'échantillon comptait 75 participants dont la moyenne d'âge était de dix-sept ans, divisés en deux groupes (40 étudiants dans un groupe et 35 dans l'autre) suivant le cours « Introduction to Business » donné par la chercheuse. Cette division des étudiants participants a également permis de réaliser une comparaison des résultats entre les méthodes d'enseignement assisté par la technologie simplement en changeant l'ordre dans lequel les méthodes étaient offertes aux deux groupes. En effet, la conception de l'étude, fondée sur deux groupes d'étudiants suivant le même cours au cours duquel les méthodes étaient utilisées dans un ordre différent, a permis d'effecteur **deux comparaisons concourantes**: 1) une comparaison des trois différentes méthodes « au sein » des mêmes étudiants (objectif principal); 2) une comparaison « entre » les différentes méthodes utilisées pour enseigner du même contenu (objectif secondaire).

Étant donné la nature exploratoire de cette étude, il a fallu recourir à divers instruments pour examiner et évaluer les effets de l'enseignement assisté par la technologie par rapport aux questions de recherche visées. L'étude repose sur les résultats des examens passés en classe, le rendement des étudiants dans le cadre de certaines activités d'apprentissage ainsi que les réponses aux divers sondages, qui comprenaient un questionnaire de profil général (visant à recueillir des données démographiques et des données sur le comportement des participants), des questionnaires menés à la fin des

modules (pour évaluer et classer les attitudes à l'égard de chaque méthode d'enseignement) et des inventaires des styles d'apprentissage (pour associer les préférences d'apprentissage aux attitudes envers les méthodes pédagogiques utilisées dans cette étude). Les observations de la chercheuse, consignées tout au long de l'étude, faisaient également partie intégrante de la collecte de données. La comparaison des données quantitatives et qualitatives obtenues à l'aide de ces instruments de recherche a servi à la triangulation des données.

D'après les résultats, bien que les aspects pratique et flexible des environnements d'apprentissage en ligne étaient grandement privilégiés chez les participants, la méthode combinant l'environnement d'apprentissage virtuel et l'interaction en classe (particulièrement la méthode hybride) a été choisie comme méthode d'enseignement préférée chez 82 % des participants. Les aspects importants de l'environnement d'apprentissage mentionnés par les étudiants étaient l'interaction en personne avec le professeur et la rapidité des réponses fournies par l'enseignant. En ce qui concerne la comparaison du rendement des étudiants dans les différents contextes d'apprentissage, l'absence d'interactions en personne avec l'enseignement ne semblait pas avoir eu d'effet sur les résultats des examens, contrairement aux résultats des évaluations formatives, ce qui démontre que les conditions des différents environnements d'apprentissage avaient une influence sur la mesure dans laquelle les étudiants participaient aux activités d'apprentissage. Enfin, on a noté, chez les étudiants qui avaient préféré la méthode d'enseignement en classe (utilisant le moins la technologie), un style d'apprentissage qui reposait principalement sur les théories et l'analyse, et chez les étudiants qui privilégiaient la méthode d'enseignement entièrement en ligne (utilisant le plus la technologie), un style d'apprentissage se caractérisant par les expériences pratiques.

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Of course, this undertaking would not have been possible without the ongoing support, patience and understanding of my family who have encouraged me through the years. Thank you for <u>everything</u>! I dedicated this to you.

INTRODUCTION (BACKGROUND INFORMATION)

One of the earliest examples of technology facilitating education was when the chalkboard was supplemented (or replaced) with transparencies with the use of the illuminated overhead projector. Instructors were able to display class notes on printed acetates and were able to highlight and mark comments on the slides with erasable marker pens. Eventually, the use of computers became more mainstream, and instructors were able to project course material using presentation software with the aid of a liquid crystal display (LCD) projector, which along with the computer were installed on a rolling cart along that could be transported to different classroom destinations. Gradually, convenience for making use of a computer in class was made possible with permanent installations of suspended projectors that were connected to the computer at the instructor's podium at the front of the classroom.

The most prominent "instructional frontier" (Casey, 2008), however, came from the possibilities created by the connection to Internet with the access to the World Wide Web. The system identified by the acronym 'www', was developed by Tim Berners-Lee at the end of 1990 and sparked a technological revolution that brought forth an information superhighway and the linkage of computers around the world. The web propelled "enormous opportunities... to better meet students' instructional needs" (Casey, 2008) with the aid of the of online course managements systems such as Blackboard and WebCT (that were labelled as the catalysts). With the options of email and other web-based course tools now available, these online platforms became a viable interface for teachers and students to connect outside of the physical location of a four-walled classroom, thus giving rise to opportunities "to facilitate the instructional communication between instructor and student in cyberspace" (Casey, 2008).

Course management systems permitted faculty to provide online information about the course and its requirements, distribute course materials, and provide communication opportunities between the parties from any computer that connected to the Internet

(Biktimirov & Klassen, 2008). In addition to the convenience afforded to both learners and teachers, online learning systems also made important information available about student access, involvement and performance. Course management systems not only enhanced and extended the traditional classroom, but made a notable difference in facilitating the virtual learning environment (Upcraft & Terenzini, 2003).

The absence of physical encounters between instructors and students is not a recent phenomenon, however. The original implementation of 'distance education' spanned three centuries commencing in the 19th century, where instruction, primarily for vocational programs, was managed through postal correspondence (Casey, 2008). Unlike the delay associated with the earlier practices, the sophistication of contemporary technology can provide resources for any combination of asynchronous, synchronous, audio and video communication leading only to a quasi-separation between teacher and student (Liu, Magjuka, Bonk & Lee, 2007).

With the increasing sophistication of technology, which now includes fast and expedient connections and download access from the Internet, course management systems have become an indispensable tool in teaching. Educational institutions around the world have been responding to the demand for flexibility in education with explosive growth of online learning in almost all sectors (Casey, 2008; Moller, Foshay & Huett, 2008(2)). Web-based mode of instruction (whether entirely online or combined with traditional methods) has taken a prominent role in higher education.

CHAPTER ONE

STATEMENT OF THE PROBLEM

In this electronic era, students of the average Cégep age group are becoming increasingly savvy with technology and are rapidly coming to expect electronic methods to be incorporated in instructional delivery. Even though opportunities for online education are proliferating in universities, for most Cégeps, the implementation of virtual learning components has only recently started to gain momentum. With the increasing popularity of web-based instructional methods, a Cégep or a program of study within a Cégep that wishes to stake a claim of competitive advantage must contemplate comprehensive strategies for implementing such methodologies. Whether didactical methods blend traditional classroom approaches with technology or are entirely dependent on electronic means, questions about the suitability for Cégep students, particularly those at the first year level of tertiary education need to be asked, particularly since the typical student entering the Québec Cégep system is a recent graduate from high school that has to this point completed eleven grades of education and whose average age is seventeen.

The purpose of this study was to investigate how variations of technology used in instructional delivery affect Cégep students, particularly those in their first-year of studies at this level of tertiary education. Specifically, the study contrasted the effects of three methods of instruction that rely on technology differently: 1) an entirely electronically-based approach (the online method), 2) a method comprising of a fully in-class setting that was accompanied by a course website (the web-enhanced method), and 3) a blended combination of both online and in-class methodologies (the hybrid method). In order to effectively compare the different instructional methods within one semester, the course was organized into three modules. In this way, students not only had the opportunity to gain an appreciation for each didactical method, but also were in a position to compare all three.

Although there have been many empirical studies that have explored the pedagogical effects between traditional and virtual instructional methods, most of these

studies, however, have involved different students in same or similar courses. This study additionally contributes to the body of research by comparing all three modes of technology-assisted instruction on the same students. In this context, factors that influence student performance, attitudes towards learning, as well as preference towards a particular approach in instructional delivery served as pivotal elements for assessing the suitability for students of this age group at this level of higher education. Examining the relationship of the students' learning styles to preferred methods of technology-assisted instruction was also significant to this study.

CHAPTER TWO

CONCEPTUAL FRAMEWORK

To ascertain a learner-centered environment, this study was embedded in the junction of three significant theoretical frameworks as they apply to both learning and teaching: 1) experiential learning theory, with references to learning styles 2) social constructivist learning theory, and 3) hierarchy of cognitive learning.

1. EXPERIENTIAL LEARNING THEORY AND LEARNING STYLES

Drawing on constructivist principles from the epistemologies of Dewey, Piaget, and Lewin, Kolb (1984) conceptualized a theory pertaining to experiential learning which made reference to six central assumptions: 1) learning is a process, not an outcome; 2) learning derives from experience; 3) learning requires an individual to resolve dialectically opposed demands; 4) learning is holistic and integrative; 5) learning requires interplay between person and environment; and 6) learning results in knowledge creation (Wingfield & Black, 2005).

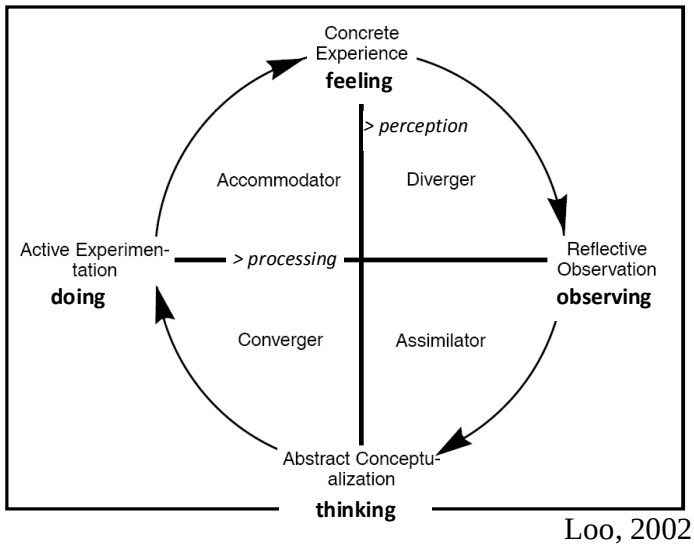
In his experiential learning model, Kolb represented these assumptions to depict the stages of the learning cycle (or to identify the dimensions of the learning process, since not every learner adopts each one (Goorha & Mohan, 2010)). These include -

a) **concrete experience** or ***feeling*** (obtained through examples, readings, observations, etc.),
b) **reflective observation** or ***watching*** (obtained through reflection, questions),
c) **abstract conceptualization** or ***thinking*** (obtained through theories, concepts, analogies),
d) **active experimentation** or ***doing*** (obtained through solving problems, making decisions)

(Loo, (2002), Goorha et al, (2010)). Although an individual may have a predominating preference, an effective learner would be capable of going through all four stages in different learning situations (Kolb, 1984).

To identify learning styles, Kolb (1985) associated these learning stages on two intersecting continuums (see Figure 1). The *perception continuum (vertical),* which is concerned with how an individual prefers to input (think about) information, ranges between **concrete (specific) examples** (feeling) to **abstract (holistic) concepts** (thinking). The *processing continuum (horizontal),* is concerned with how an individual prefers to handle (process) this information, and spans between **active (hands-on) experimentation** (doing) and **reflective (passive) observation** (observing) (Loo, 2002; Little, 2004). Based on an individual's preferred approach along each of the two continuums, the intersection between them in one of the four quadrants would identify the related learning style.

Figure 1 - Kolb's Experiential Learning Cycle



Loo, 2002

The four learning styles that emerge from this model include the following: **Accommodators**, the *hands-on learners,* who are considered the most action-oriented of all learners, favour concrete examples (feeling) and prefer to actively participate in their own learning by exploring directly (doing). **Divergers** prefer to reflect and reason from concrete examples (feeling) and by considering *multiple perspectives* (observing) preferably by working with others. **Assimilators** are *facts-oriented learners* who appreciate structured and organized information obtained from theories, lectures and expert knowledge (thinking) and then contemplate this information logically (observing). **Convergers**, are *pragmatists* who consider the usefulness of conceptual information (thinking) for practical problem-solving (doing) (Loo, 2002; Little, 2004).

Kolb believed that the characteristics associated with each learning style could correspond to the selection of particular careers or professions, and had reported that *accommodators* were most likely to be found in the business disciplines. However, this was not supported by the meta-analytic examination conducted by Loo (2002) who referred to

1,791 cases from eight studies and found a diverse distribution of learning style preferences among the business students in association to the array of business majors and different skills required to be effective in each. The study conducted by Goorha & Mohan (2010), which aimed to gauge the learning preferences of business school students based on their sample of 149 participants, similarly found the learning styles to be varied, although the results supported the expectation that such students are "...likely to have a predilection for converging and assimilative learning". Concluding remarks from such examinations caution that perceptions are affected by the different learning styles of students (Fortune, Shifflett and Sibley (2006)), and that teaching strategies need to be varied in order to fit the different learning needs and types of learners (Loo, 2002; Moller, et al., 2008(2); Goorha et al., 2010).

2. SOCIAL CONSTRUCTIVISM LEARNING THEORY

Premised on the theories of Piaget and Vygotsky, social constructivism anchors on the principles of experiential learning, but highlights the dimension of social interactions in the learning process. While Piaget focused on the advantages of "symmetrical power" derived from peer-to-peer discussions, Vygotsky emphasized the importance of the *zone of proximal development* to enable learners to expand their learning through interactions with someone possessing greater proficiency on the topic (Conrad & Donaldson, 2004). Empirical research in business education has supported both notions of how cooperative experiences both with peers (Hansen, 2006; Wingfield & Black, 2005), as well as "under the close supervision and coaching of an educator" (Hanson & Sinclair, 2008) can result in higher-level thinking and more permanent learning. Research has also emphasized the psychosocial objective in education in addition to the academic and intellectual ones, by encouraging a purposeful, integrated and mutually reinforcing environment and set of experiences (Upcraft & Terenzini, 2003). The rationale for adopting social constructivist teaching methods in business education is also derived from the demands of the workplace. Since teamwork and the ability to work with others is fundamental requirement for success in the field of business, social constructivist models respond well to the development of such skills.

The use of technology in learning has a valuable role to play in providing essential tools with which to accomplish the goals of a social constructivist learning environment. It has been described as "a means to aid in the creation of learner-centered environments in higher education." (Krentler & Willis-Flurry, 2005). With the interactive functionality of Web 2.0 version, technology is now able to do more than just provided a vehicle to hold or deliver information from teacher to students. It creates valuable opportunities not only "to expand cognitive abilities that otherwise would be impractical, or even not possible in a traditional classroom," (Moller et al. 2008(1)), but also to create virtual communities of various combinations between the different participants: teacher with many students, teacher with individual student, between members of a student team, or across individual students [student to student]).

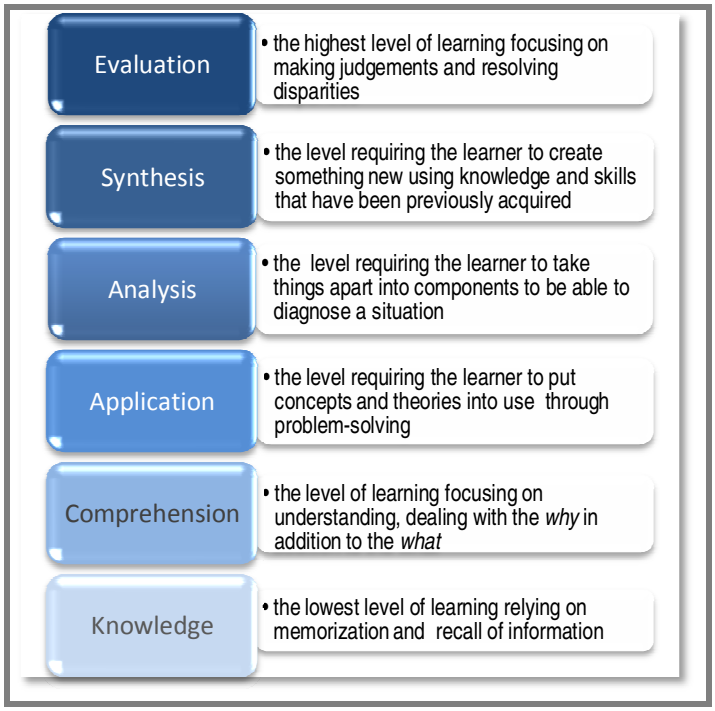
3. HIERARCHY OF LEARNING IN THE COGNITIVE DOMAIN

Effectiveness in a business setting is not only attributed to conceptual knowledge, but also to adeptness in analysis, evaluation and synthesis of information from multiple sources, with the ability to think critically, identify and solve problems, make decisions, as well as implement courses of action (Wingfield & Black, 2005). Business education therefore has the responsibility to offer its students opportunities for the development of pragmatic skills (Hanson & Sinclair, 2008). By incorporating learning activities and experiences in the curriculum that are purposeful and relevant to the learning goals, this helps prepare students to effectively deal with the demands of job requirements by creating meaning to what students need to know and to what they need to be able to do (Wingfield & Black, 2005).

From a cognitive perspective, effectively applying the theories relating to social constructivism and experiential learning rely on involving learners at levels that require higher order of intellectual abilities and skills. Although there have been several typologies formulated to classify the cognitive processes, Bloom's taxonomy (1956) has been widely accepted and used in education and in related research (Halawi, McCarthy, & Pires, 2009). In addition to other taxonomies developed by Bloom pertaining to affective and psychomotor learning, his model relating to the cognitive domain identifies six sequential

levels which also serve as educational objectives in the learning process (see Figure 2). Structured hierarchically, each level represents an increasing degree of difficulty since each stage incorporates the abilities developed in previous levels and requires progressively more intricate abilities to achieve higher levels of thinking. Activities that foster a learner-centered approach go beyond the levels of knowledge and comprehension.

Figure 2 - Bloom's Taxonomy of Learning (Cognitive Domain)



White (2007); Halawi et al. (2009)

CHAPTER THREE

LITERATURE REVIEW

There is a large body of literature regarding the use of technology in instruction. Although many technology-assisted didactical strategies are suitable across disciplines, the review of this literature primarily focused on applications in business education by considering practical insights for organizing and executing online course content while also alerting of the challenges that are inherent in this approach. Based on the empirical studies examined in this review of literature, several were designed as causal-comparative studies examining differences between combinations of traditional, blended and fully-online instructional methodologies. These studies have principally relied on survey research as a methodology to gather data from participants, while content analysis has also been employed for qualitative information in order to complement statistical analyses. With such rapid developments in technology, the research with regards to web-related trends focused primarily on more recent articles so as to make more relevant references to technological innovations. The following important themes emerge from the review of the literature:

1. BENEFITS, CHALLENGES AND CONCERNS OF ONLINE EDUCATION

1.1 Benefits

Online instructional methodology has opened the doors to many benefits for all the parties associated with such courses. Several authors cite *convenience* as the single-most important reason for the soaring preference for these web-based alternatives (Dempsey, Fisher, Wright & Anderton, 2008; Hastings-Taylor, 2007; Hurt, 2008; & Terry, 2007). Results derived from comparative studies using participant groups that involved both faculty and students (Dempsey el al, 2008) and strictly students subjects (Terry, 2007), pointed to convenience as the most attractive reason towards online instruction. For students and teachers alike, flexibility in both scheduling and location are very appealing options whether taking or teaching such courses.

In terms of scheduling flexibility, students are attracted by the opportunities to be able to arrange their academic, work and personal requirements. Particularly in continuing and professional education, online course offerings have become a popular choice since they allow such students to balance course requirements with the demands of work with greater ease. Similarly, the absence of having to commute or relocate in order to participate in a course is a considerable advantage, particularly for students in remote areas, who would otherwise either have to displace their living arrangements or abandon the opportunity to pursue their studies altogether (Hastings-Taylor, 2007; Moller et al, 2008 (2)). Instructors of online courses also are beneficiaries of convenience as afforded by scheduling and location flexibility. In addition, prospects such as creativity, professional development and even better course organization are interesting possibilities associated to web-based teaching (Hastings-Taylor, 2007).

Educational institutions who offer such courses benefit substantially since they not only gain with regards to space requirements, (since online course do not require allocation of already limited classrooms), but also gain from opportunities created by greater accessibility to courses by reaching a larger student population (including those in more remote locations) (Hurt, 2008).

1.2 Challenges and Concerns

Much like in other milieus, in education, flexibility in scheduling demands greater discipline. Online courses are not self-paced, but rather are guided by a timeline involving concrete deadlines. The online forum can be a rigorous one, and hinges on learner autonomy and accountability. Several authors emphasize the need for students to exert a great deal of self-motivation, discipline and time management in order to meet course requirements and achieve learning objectives, much like the campus-equivalents (Hurt, 2008; Hastings-Taylor, 2007; O'Leary & Quinlan, 2007). Moreover, in the absence of classroom explanations and interactions, students are forced to read more and write more. Any student with less than adequate skills in reading, comprehension and writing, as well as in technology, can become overwhelmed, if not defeated by the demands online course methodology (Hurt, 2008).

In investigating the effects of student characteristics on learning as well as the suitability for a web-based environment, a review of the literature reveals the importance of the association to learning styles. Krentler & Willis-Flurry (2005) revealed from their study that the degree to which technology enhances actual student learning is moderated by student characteristics. The results of their findings were supported by an earlier study considered in their research by Greenagel (2002) which identified that a student's learning style influences his or her learning in an electronic learning environment. Fortune, Shifflett and Sibley (2006), whose research also investigated student perceptions of learning between online and on-campus environments, cautioned that perceptions are affected by students' learning styles because of the diversity of student characteristics. Although Kolb's (1985) Learning Styles Inventory (LSI) was been widely used in identifying learning styles, Mentzer, Cryan, & Teclehaimanot (2007) relied on the VARK (Visual, Aural, Read/write, Kinesthetic) diagnostic instrument (Fleming & Bonwell, 2006) in their comparative study between face-to-face and web-based classrooms to determine and relate learning preferences to their student subjects.

Another matter of concern is the online learning environment is how it relies heavily on the honour system (Casey, 2008). Although integrity issues for plagiarizing from the Internet and cheating are critical issues in any educational context, the validity of online assessment particularly invites scepticism since an online environment not only facilitates cheating and plagiarism through web-based access, but also makes it is difficult to determine who is doing the work on the other end (Hurt, 2008).

Although the use of technology offers convenience and flexibility for faculty in terms of scheduling, online methodology is not necessarily an easy alternative to traditional teaching methods. Many authors underline the significant time investment required by the instructor (especially for first-time implementation) to design, maintain and monitor online components of courses (Hurt, 2008; Moller et al 2008(2); Dempsey et al, 2008). In exploring challenges for faculty in electronic environments, Dempsey's study (2008) revealed that online courses can take at least twice the amount of time to manage in contrast to traditional courses. Hurt (2008) also points out that the significant time investment required by the teacher can easily nullify any flexibility benefits provided.

2. STRATEGIES FOR ONLINE EDUCATION

2.1 Didactical Objectives - a Starting Point

Whether the mode of instruction is more traditional or substantially technologically-based, the goal of any didactical strategy in tertiary education should be to provide students with learning opportunities that enable them to develop higher order and self-directed thinking skills (White, 2007). Developing independent learners through critical thinking, problem solving and reflective judgement is the goal of business education since these relate to the competencies sought after by employers so that graduates are able to meet the intricate demands of the business environment (Fortune et al, 2006; Wingfield & Black, 2005).

There have been numerous studies in the realm of educational research that have shown that active and experiential learning results in far greater comprehension and retention of information, higher levels of student motivation and achievement, improved communication skills, as well as stronger interpersonal abilities than through passive learning methods. In their 2005 comparative study investigating the impact on business students' perceptions and outcomes in traditional classroom course designs that included passive and active student involvement, Wingfield & Black's findings from the 111 participating business students surveyed at a major American south-west university revealed that active course designs, specifically the experiential model, resulted in perceptions of more meaningful and relevant learning towards their future jobs ($t(89) = 2.182$, $p < .05$). Although the e-learning environment is not an exact replication of the classroom setting, it can be a close approximation (Smith & Mitry, 2008 referring to findings from Duus & Nielsen (2002)). Accordingly, for online methodology to be considered a viable method of instruction, didactical strategies should include opportunities for active and experiential learner engagement.

2.2 Planning Considerations for Online Instructional Design

Education that is primarily or fully delivered through electronic media requires a shift in thinking from the traditional methods with regards to both approach and tactics of instructional strategies. Markedly different from the classroom setting, didactical components pertaining to content design and delivery, performance expectations, assessment methods, and evaluation techniques must be reconsidered and modified in order to be made suitable for the online environment. In many ways, online education compels a re-examination of the process of learning. In the absence of face-to face contact between the members of the course, the online learning milieu becomes entirely dependent on other forms of web-based dialogue and interactivity. Certain authors regard this virtual setting as a rich learning environment that has the potential to influence student learning and increase achievement (Krentler & Willis-Flury, 2005). Moller et al, (2008(1)) go as far to say that the virtual environment promotes "transformative" cognitive processes of knowledge-building and problem-solving since it compels thinking, creativity, collaboration, and argumentation on the part of the student.

Developing online courses is not simply a matter of converting and offering face-to-face classes online (Hastings-Taylor, 2007). Delivering effective online learning experiences requires a reorientation of didactical strategy using skill and finesse in balancing the dichotomy of technology and pedagogy in the development and delivery of online methodologies (Liu et al., 2007). When technology becomes the vehicle of instruction, the instructor needs to adopt supplementary roles accordingly to be able to manage and facilitate the operational aspects of web-based course components (Hurt, 2008). Essentially, faculty must "retool" to prepare and manage an online course and must also be open and willing to adapt to trends. Technical savvy is a prerequisite not only for course design, but also for circumventing or handling any technical problems as they arise. Although recent innovations in technology have made significant improvements on electronic delivery, online technology is not free of glitches and continues to faces obstacles (Casey, 2008; Hurt, 2008). In exploring the conditions and challenges for implementing online learning in their comparative study, Dempsey et al. (2008) noted that the biggest obstacles for instructors

with web-based instructional delivery was not only the amount of time, but also the unfamiliarity of the technology and the appropriateness of the content for online delivery.

Even though technological innovations have provided an array of instructional choices for the instructor, many authors researching this area of interest emphasize that there should be prudence not to overshadow pedagogical objectives by over-emphasizing use of technology in the curriculum. While Moller et al., 2008(2) suggest that control of the learning must be maintained in a web-based environment, Ducharme-Hansen & Dupin-Bryant (2005) point out that "to create effective online learning, curriculum objectives need to be solid, course activities need to be value laden, and the main focus of the educational experience needs to be the students." Fortune et al. (2006) also highlight that poorly designed high-tech curricula can negatively affect the learning experience, and cautions that student learning in an online setting is influenced not only by the selection of technical tools, but also by their implementation. Similarly, Hurt (2008) argues that both content and rigor of online methodology pivot greatly on the instructor's preparation.

2.3 Key Components of Online Pedagogy

Essentially, the effectiveness (and ultimately the legitimacy) of online education relies on learning opportunities that are derived from four main areas: a) experiential learning, b) sense of community c) communication, and d) feedback. Each of these components is explored in detailed.

2.3.1 Experiential Learning

In an experiential course design, Wingfield & Black (2005) suggest that instructors must ensure that pedagogical opportunities are rooted heavily in both practice and dialogue which focus on providing students with practical knowledge, activities, assignments and experience they can apply in their future, Smith & Mitry (2008) similarly point out that experiential learning can be achieved in a web-based environment through intensive faculty-student interaction based on problem-solving and applications-oriented assignments.

In the landscape of online education, the course website serves more than just as a depository for delivering content information. The various tools available within course management systems provide platforms not only for various types of communication, but also for 'laboratory-type' of experiences that can provide interesting opportunities for expanding cognitive capabilities with active, reflective and higher-order learning by manipulating the learners' internal and external environments (Moller et al., 2008(1)).

Several authors suggest examples that solicit student engagement in order to encourage higher-order levels of thinking: Hastings-Taylor (2007) proposes question prompts to lead to interesting and meaningful online discussions by asking learners to elaborate on topics and consider related issues. Robinson & Hullinger (2008) suggest learning communities to advance mental thinking by promoting discussion and inquiry amongst the participants. The authors also highlight that with the option of asynchronous network communications, students can take more time to think before responding, having the opportunity to think reflectively and critically. Moller et al, 2008(2) also point out that since students have more time not only to formulate responses, but also to make stronger connections, there are increased opportunities for in-depth discussions.

Several authors emphasize how the online learning environment goes beyond the single view of the instructor, and that the learner-to-learner exchanges are just as significant in the learning process as the ones between instructor-to-student (Hastings-Taylor, 2007; Hurt, 2008; Liu et al., 2007; (Moller et al., 2008(1); O'Leary & Quinlan, 2007). For this reason, Fortune et al. (2006) and Moller et al. (2008(2)) recommend appropriate schemes that will incorporate a "network view of learning" suggesting that web-based collaborations must be initiated, encouraged, monitored and guided by the instructor using multiple levels of communication that will permit exchange of views amongst peers in addition to faculty's content knowledge.

2.3.2 Sense of Community

In the absence of physical classroom presence, face-to-face interactions must be replaced with appropriate pseudo-personal opportunities that will make the parties feel

connected to the course, to the instructor, as well as to each other. Hurt (2008) cautions that the convenience and flexibility offered by online course offerings should not be a trade-off for disconnection or seclusion. Several studies have found that a weak sense of social cohesiveness in online courses can create feelings of isolation and stress and can be a detriment to online courses by means of attrition (Hurt, 2008; Liu et al., 2007; Terry, 2007).

Establishing a learning community is a pivotal step in supporting a successful and meaningful virtual learning environment. Rooted in a social constructivist framework, a learning community not only promotes interaction by engaging the parties in a social network (Hanson, 2008) but also encourages higher-order thinking skills through collaborative exchange, as mentioned earlier. Since "the common denominator in successful web-based courses is the people, not the technology" (Ducharme-Hansen and Dupin-Bryant (2005), it is imperative that human interactions in online learning environments must be shaped and nurtured in order to build a sense of affiliation and community (Hastings-Taylor, 2007; Liu et al., 2007).

In a web-based environment, the function of the instructor shifts away from the hierarchical roles of lecturer and context expert, and more to those of facilitator and manager Hurt (2008). Several authors emphasize that although communication between the professor with the students is imperative to facilitate the learning process, peer interaction is equally essential to instil the sense of community amongst classmates, especially since these type of exchanges encourage social reinforcement (Liu et al., 2007; Moller et al., 2008(1); O'Leary & Quinlan, 2007; Smith & Mitry, 2008; Terry, 2007). Peer interaction responds well to both pedagogical and social objectives in an online environment. Not only do sources of interaction and communication between students reduce psychological distance and foster a supportive environment (O'Leary & Quinlan, 2007), but, as mentioned earlier, cooperative structures requiring high levels of interactivity also encourage active and higher-level thinking and learning (Hansen, 2006; Moller et al., 2008(1); O'Leary & Quinlan, 2007).

Using a case study approach, Liu et al., 2007 examined students' perceptions of learning communities in online courses by looking at how a sense of community relates to learner engagement, perceived cognitive learning, and overall satisfaction. Working with a

sample of twenty second-year MBA-program students and twenty-eight faculty members involved in courses across a wide spectrum of business disciplines, the study employed the Strauss and Dorbin's constant comparative method to triangulate the data from different interview transcripts and to identify emerging themes related to online learning communities. Correlation analyses conducted between items asked on the student survey identified close relationships ($r = .61$, $p < .01$) between the sense of learning community and the perceived learning quality and outcomes. The research findings indicated that, in addition to teaching presence (such as facilitation and feedback), equally important aspects that contributed positively to students' learning were teamwork and the sharing of information.

2.3.3 Communication

There are multiple ways of ensuring that communication is maintained and supported in the absence of face-to-face encounters. Successful online learning environments rely heavily on interactions between the members in different contexts (O'Leary & Quinlan, 2007). Liu et al. (2007) suggests that avenues for web-based communication must involve dichotomous opportunities for both task-driven interactions (in order to facilitate the goals of learning), as well as social interactions (in order to foster a sense of camaraderie and community). Although transactional exchanges from instructors to students primarily are aimed to support cognitive learning processes by disseminating and clarifying information and requirements, answering questions, and providing feedback (Casey, 2008 ; O'Leary & Quinlan, 2007), from a constructivist perspective, the online role of the instructor needs to also include a social dimension the promotes a friendly, nurturing, and supportive tone which motivates participation, and offers guidance, reassurance, and encouragement (Liu et al. (2007) referring to Anderson, Rourke, Archer & Garrison, 2001). Dynamic relationships between instructor and students lead not only to higher levels of learning and achievement outcomes, but also to increased satisfaction (O'Leary & Quinlan, 2007).

Liu et al. (2007) emphasize how synchronous and asynchronous communication strategies respond to different objectives in a collaborative learning process as well as to virtual community building. Synchronous communications, such as text-based chat

discussions and video conferencing offer a continuous learning forum that simulates classroom group discussions and fosters a social interaction between the participating members of the class. Asynchronous communications on the other hand, which include any combination of email correspondence, discussion boards, and blogs, etc., encourage "deeper dialogue and continuous discourse without time or geographical limitations" Hurt (2008) also underscores that discussion threads & online assignments offer students opportunities to reflect on the material and to revisit it more than they would in the seated course.

Online forums are also particularly conducive for shy students who would not ordinarily speak out or participate openly in a seated class because they may feel less inhibited on the discussion board (Hurt, 2008). Although telecommunication tools provide several opportunities for computer-mediated communication, the shortcomings of asynchronous methods include variables that cannot be substituted through written messages or transmitted images since behaviours and emotions are difficult to convey online. Non-verbal or social cues (comprising tone of expression, gestures and proximity) are filtered out in electronic transmission, leaving communication to be impersonal and more transactional or task-oriented, in an e-learning environment (Casey, 2008; Liu et al., 2007; O'Leary & Quinlan, 2007).

2.3.4 Feedback

Another essential component to learner success in a web-based environment is instructor feedback. There is an intrinsic need for students to have prompt performance feedback and reassurance from the instructor as an indication of whether they are "on the right track," (Hastings-Taylor, 2007). Compared to the traditional classroom setting which allows for timely instructor response to student questions, the clarification of misinterpretations, or the redirection of any points of incomprehension, students in on online environment are deprived of this instructor immediacy (O'Leary & Quinlan, 2007). Student satisfaction in an online environment depends to a large extent on the timeliness and quality of dialogue provided to them in instructor feedback (Hastings-Taylor, 2007; Liu et al., 2007; Smith & Mitry, 2008). Accordingly, Moller et al (2008(2)) suggest that the

degree and type of interaction, as well as feedback, offered to students should vary depending on the types of learners and their individual learning needs.

With this individual attention offered to students, learning, in essence, becomes customized and this can be considered another benefit or advantage to online learning (Moller et al., 2008(2)). For the instructor, however, who can spend considerable amount of time providing individualized feedback and even repeatedly answering the same question (Hurt, 2008), this becomes a particular concern, especially when course enrolments are large (Smith & Mitry, 2008). With the increased time requirement for contact hours, coupled with the additional time investment for web-based course development and teaching, these become serious shortcomings for the instructor when teaching an online course (Dempsey et al., 2008; Hurt, 2008; Moller et al, 2008(2).

3. COMPARISON OF THE METHODS

There have been several empirical studies to examine the relationship between the use of technology in pedagogy and the influence on the learning environment. Although these explorations have examined diverse variables in an assortment of permutations, the explicit or inherent question underlying such studies is whether student learning is enhanced. Opinions among the academic community differ as to whether the educational use of technology benefits student learning. Perspectives vary according to individual attitudes towards technology. Many traditional educators have serious reservations about online education and express concerns about quality control (Casey, 2008) whereas more technically-progressive instructors, who keenly embrace technology, consider its implementation as an indispensible instructional tool and consider it as "a means to aid the creation of a learner-centered environment in higher education" (Krentler & Willis-Flurry, 2005).

In his comparative study between online, hybrid and campus courses, Terry (2007) presents empirical results derived from a sample total of 830 graduate students enrolled in economics, computer information systems and finance courses using one of the three instructional modes. Among other points of interest, the author investigated grade

distribution, course evaluation and explicit achievement of learning objectives. Using a nonparametric approach for statistical methodology to compare the three instructional modes, the author relied on the Kruskal-Wallis test since a normal distribution was not assumed. Out of the variables tested to measure effectiveness on student performance, the field of study or the students' major was found to have the greatest statistical significance. The research results indicated that the pure form of online instruction to be the least effective of the three modes using direct assessment results with control for student ability, effort and demographic characteristics, while identifying campus and hybrid approaches to be superior to their purely online counterpart based on relative student performance. The author did caution, however, that the empirical results provided evidence to indicate that technology and faculty sophistication is pivotal factors and that the gap between online and campus courses will narrow as these improve over time.

Alternatively, in their study of students enrolled in either online or on-campus sections of a business communications course, Fortune et al. (2006) examined variables pertaining to face-to-face interaction and to perceived learning and reported that "the online mode of instruction was just as effective as the traditional in-class delivery method with respect to skill development."

Some authors on online education emphasize that the effectiveness of web-based courses is greatly tempered by key factors in the virtual learning environment. The main ones that have been noted in the review of the literature include 1) the level of interactivity between teacher and student (such as communication) (O'Leary & Quinlan, 2007; Krentler & Willis-Flurry, 2005; Terry, 2007), 2) the degree of preparedness to use online tools (for both students and teachers) (Dempsey, 2008), and 3) the sense of community (which includes social presence and opportunity for collaboration) (Liu et al., 2007; Terry, 2007). Another point impeding in the success of online instruction is the suitability of the type of course offered (Hurt, 2008).

Although several studies have relied on *student outcomes* to compare the effectiveness of online pedagogy to that of traditional methods, there is a debate in educational literature regarding "the extent to which test performance is an accurate measure

of student learning" (Krentler & Willis-Flurry, 2005). Certain authors have overtly raised various points of contention about the use of grades alone to arrive at conclusions regarding the pedagogical effectiveness of instructional methods. Robinson and Hullinger (2008) quoted Bucy (2003) to emphasize the point that comparative research on pedagogical methods should determine whether the students are learning what is intended of them to learn, not whether they are learning the same as traditional methods. Moller et al. (2008(2)) even go as far as to question the validity of the comparison between traditional and online pedagogical methods altogether since virtual education is faced with different didactical issues surrounding course content design and delivery, performance expectations as well as types of assignments, assessments and evaluation techniques (to name but a few). In their review of research studies conducted in analyzing class size and achievement in higher education, Toth and Montagna (2002) stated that the use of "...oversimplified methods of assessing achievement may lead to invalid inferences" since student achievement cannot simply be based on the class grade alone.

Several research studies investigating or comparing instructional methods have gone beyond student outcomes as the only measure of learning achievement. Terry (2007) considered a "production view" of student learning in his study by relying on several variables such as native ability, effort, mode of instruction and a vector of demographic information. Richardson and Newby (2006) investigated the cognitive engagement of their student subjects with their online courses by taking into account their individual learning strategies and motivations. Similarly, Robinson and Hullinger (2008) relied on student engagement in their own study to evaluate the quality of the online learning experience. Basing their construct and analysis on the *National Survey of Student Engagement (NSSE),* their study focused on frequency distributions to identify relevant engagement factors based on four benchmarks - level of academic challenge, student-faculty interaction, active and collaborative learning and enriching educational experience. Scores were converted to a 10-point numeric scale to arrive at an overall engagement score which was used to make distinctions between sub-groups as identified by grade achievement in the course, study major and demographics (gender and age).

4. SUMMARY

Advancements in technology have opened the doors to a multitude of opportunities in instructional design which are spearheading a transformation in the learning environment. Online learning is taking a prominent role in tertiary education and needs to be approached proactively and strategically so as to harness the benefits it has to offer, and also manage the challenges that accompany it. Although benefits of flexibility and convenience to all participants are interesting and enticing, the commitment required in terms of time and self-discipline for this approach are equally significant and must be embraced knowingly and willingly.

A didactical environment that is fully, or primarily web-based requires a multifaceted appreciation of how learning takes place. In the absence of face-to-face interaction, e-learning needs to be anchored in a social constructivist framework that relies heavily on experiential learning, a sense of community, as well as on open channels of communication and feedback.

Consideration for active experiences on a web-based platform requires a systematic effort of careful planning and design of pedagogical tasks and activities where learners have opportunities not only to ask questions, but also to exchange views amongst peers. Interactions between participants, both orchestrated and informal, foster a sense of community and belonging and are a crucial component for successful online environments. The role of the instructor in an electronic setting goes beyond that of provider of knowledge. Coordinating and facilitating exchanges between class members, as well as providing prompt feedback and ongoing support, are essential responsibilities of the instructor in upholding a dynamic and stimulating virtual learning environment which encourages students to take accountability of the learning process.

5. RESEARCH QUESTIONS

In the context of the review of the literature as well as the theoretical frameworks, this exploratory study investigated the effects of technology-assisted instruction on first-year

Cégep students using the following research questions to guide the collection, analysis and interpretation of data:

RQ1: What elements of technology-assisted instruction enhance student attitudes towards learning?

Elements of technology-assisted instruction served as the *explanatory variables* while student attitudes were the *response variables*.

RQ2: How is student performance affected in the absence of face-to-face interaction with the instructor?

While face-to-face interaction with the instructor is a factor in technology-assisted instruction and was therefore a component of the *explanatory variables*, student performance was the *response variable*.

RQ3: What learning styles can be associated with student preferences amongst the different instructional modes relying on technology?

For this research question, learning style was considered an individual characteristic of the student and therefore served as the *explanatory variable*, while student preference towards a particular mode of instruction relying on technology was the *response variable*.

Considering the purpose of the research study, participants' comfort with the online environment, their ages, as well as the language they studied in high school were viewed as possible *intervening variables* in relation to the research questions and therefore were taken into consideration accordingly.

CHAPTER FOUR

METHODOLOGY

1. RESEARCH DESIGN

The design of the research study was purposely arranged with the objective of optimizing opportunities for multiple comparisons between three instructional methods relying on different degrees of technology. In order to effectively contrast the different modes of instruction within one semester, the course was divided into three modules, one for each of the designated modes used in the study: hybrid, web-enhanced, and online. In this way, students not only had the opportunity to gain an appreciation for each approach, but also were in a position to compare all three. Since three modules are typical in Cégep courses that do not involve a cumulative final examination at the end of the semester, there was no burden placed on the students an account of the research study. The time interval for each module consisted of five weeks (four weeks of instruction and one week designated for the test and the review of this). Since the same Internet-based course management system was used throughout the semester for all modules, an important difference between them was essentially the degree of reliance on technology.

A four-week period was considered a feasible time period for students to appreciate and contrast the different modes of instruction. Each module culminated with a class test, and since a different method was applied to each module, the respective average score received on the test was considered to represent the effects of the degree of technology related to the instructional method. The survey instrument administered at the same time with each class test served to collect data that timely examined student attitudes towards each instructional approach applying different degrees of technology.

For the purposes of attaining a sample size suitable for statistical analysis, students from two sections (groups) of the same course were involved (specifically the Introduction to Business course) taught by the same instructor (the researcher) during the same semester.

By including two sections of the same course under the same conditions, and simply changing the order in which the instructional delivery was offered in each of the sections, a supplementary opportunity was also made possible to explore a cross-comparison of outcomes between the methods. In effect, by using the two sections of the same course with alternate timing in delivery, the design of the study permitted **two concurrent comparisons: 1) a 'within' comparison** of the three different methods involving the same students, and **2) a 'between' comparison** for the same content using different methods. Table 1 summarizes the configuration of the research methodology used in this study.

Table 1 - Research Design of the Three Instructional Methods between the Two Sections

	Module 1	**Module 2**	**Module 3**	*data*	
Group 1	**HYBRID** Mode of instruction (alternating between in-class & online [CMS])	**ONLINE** Mode of instruction (conducted entirely online via the CMS[1])	**WEB-ENHANCED** Mode of instruction (conducted entirely in class & accompanied by the CMS[1])	***primary objective WITHIN COMPARISON*** ⟷	***Same students*** ***Three different instruction methods***
Group 2	**HYBRID** Mode of instruction (alternating between in-class & online [CMS])	**WEB-ENHANCED** Mode of instruction (conducted entirely in class & accompanied by the CMS[1])	**ONLINE** Mode of instruction (conducted entirely online via the CMS[1])	***primary objective WITHIN COMPARISON*** ⟷	
data	***End of module 1*** ***TEST 1*** *+ questionnaire*	***End of module 2*** ***TEST 2*** *+ questionnaire*	***End of module 3*** ***TEST 3*** *+ questionnaire*	*Comparison of the two "withins"*	
	data	***secondary objective BETWEEN COMPARISON*** ↕	***secondary objective BETWEEN COMPARISON*** ↕	*Comparison of the two "betweens"*	
	Same content ***Same instruction method*** ***Different students***	***Same content*** ***Different instruction method*** ***Different students***	***Same content*** ***Different instruction method*** ***Different students***		

[1] CMS Course management system (i.e. the course website).

NOTE: While the course website on Moodle was instrumental throughout the semester, the degree of reliance on it varied depending on the mode of instruction applied during each module.

2. CONCEPTS AND CONSTRUCTS

2.1 Distinguishing Between the Different Modes of Instruction

Since didactical approaches involving technology can be conducted in a variety of ways, the explanations of how the virtual components were executed in each of the different modules are pivotal to the understanding the context of the learning environments compared in this study. ***Mode (or method) of instruction*** refers to any one of the three instructional approaches applied in this study (web-enhanced, online, and hybrid) differentiated by the extent to which each of them relies on technology in order to achieve learning outcomes.

The ***web-enhanced method*** is the one that resembles most to the traditional setting since it requires students to meet face-to-face with the instructor in the classroom for all scheduled classes. Technology is said to "enhance" the conventional approach since students also have access to components of the course over the Internet by way of a course management system (CMS) such as WebCT, Blackboard, or Moodle (the latter was used in this study). Although web-based information provided may vary depending on the instructor and the course requirements, this method is distinguished from the others in that instruction is delivered entirely in the classroom setting, and for this reason, it was also dubbed as the "in-class" approach for the purposes of this study.

At the opposite end of the spectrum, the ***online (or virtual) method*** makes content delivery and communication between the instructor and the students entirely dependent on technology through the use of the course website and possibly with other electronic platforms and devices. In a *synchronous (real-time)* approach, opportunities are arranged for communication between parties that are managed through instant electronic messaging or simultaneous audio-video exchanges. Alternatively, an *asynchronous* manner enables students to choose, within the prescribed deadlines, when to access information and submit requirements that have been made available on the course website. Although there are pedagogical benefits to each of these approaches, in this study, due to various reasons, a **structured and directed asynchronous model** (using only the features and tools provided

within the Moodle course management framework) was considered the most suitable manner for implementing the virtual components.

The ***hybrid (or blended) method*** combines both the online and classroom teaching formats in a selected combination. Whereas a classroom hybrid is mostly offered in class, with some lessons carried out through web-based meetings and activities, the online hybrid is conducted primarily online with only occasional class meetings. For the purposes of this study, the hybrid mode consisted of **alternating between in-class and online "classes"**. The scheduling was intentionally arranged so that the contact hours would not be the same day in order to prevent either a favourable or unfavourable attitude due primarily to reasons of scheduling. This method was purposely applied to both sections during first module since, by maintaining face-to-face contact once during the week, it not only facilitated the learning curve of accessing and working with the course website, it also eased all students' initiation to the virtual learning environment.

2.2 Designing Comparable Online and In-Class Learning Environments

To enable opportunities for cross-comparison, during the second and third modules each group followed a different mode of instruction which involved either the online and web-enhanced (in-class) approaches. Although the course material covered was the same, one of the most challenging aspects created by the research design was composing lessons and learning activities that would be suitable for and comparable between both the online and in-class settings. While the course website consistently made available notes and explanations of the material throughout the semester, to ensure that the same level of rigour was applied to all the instructional methods, **the didactical strategy focused on learning activities that encouraged a climate for exchange and engagement with the objective of achieving higher order learning outcomes**. During the respective modules, while the learning activity would actively involve students of the web-enhanced (in class) section with their team members in the instructor's presence, the same learning activity had to be appropriately formulated for the virtual milieu that offered a similar level of challenge and opportunities for discussion with others. Grades assigned to all of the learning activities of the semester were weighted in a pooled "participation" component valued at 25% of the

overall grade for the course. This ensured that all learning activities were taken seriously and that absences were discouraged from the class sessions.

2.3 Other Key Aspects in the Research Design

For the purposes of making comparisons in the study viable, a deliberate effort was made to maintain consistency between as many variables as possible between the two sections associated to the research study. This exploratory research used two sections of the same course of introductory business (same content) that was taught by the same instructor (the researcher) during the same semester using the same assessments to evaluate student learning, and overall applying the same three instructional methods. In addition to the same learning activities being assigned (which were appropriately configured to the suitability of each learning environment), the three end-of module class tests in the different instructional methods followed the same format, with the same amount of questions which consisted of an equivalent degree of difficulty. **The consistencies in the research design served to strengthen the validity of the data collected.**

There have been suggestions in the literature that not all courses in tertiary education are suitable for the virtual learning environment (Hurt, 2008). The Introduction to Business was considered most appropriate for these research purposes since every topic covered was not only at an introductory and macro level, but was also independent of one another (which implies that dependency on previous material covered was not required to succeed in later chapters). This not only minimized the possibility of the technology-infused didactical approach impeding the students' learning of the material or their chances of succeeding in the course, but for research purposes, also assured that the content within each module was at an equivalent level. As such, **the selection of this course collectively satisfied ethical, pedagogical as well as research objectives.**

Another factor relevant to the implementation of the study relates to **instructor's preparedness** to manage didactical methods in the virtual environment. In addition to being an been avid user of technology in instruction for several years, as a precursor to the research study, the instructor-researcher taught the same course the semester prior to the

study using a combination of technology-infused methods to ensure her capability of managing online pedagogy was refined.

3. SAMPLING (PARTICIPANTS)

As the purpose of the study was to compare the effects of technology used in instructional methods, it was important that the two sections of students involved in the study were drawn from the same population. At the Cégep level, students pursuing business studies comprise those registered for the Commerce profile in the Social Science Program. With multiple sections of this course offered every semester, the researcher had applied, and was subsequently assigned, to teach two sections of the Introduction to Business course designated for Commerce students during the fall 2009 semester. The final actual sample size of 75 participants comprised forty students from one section and thirty-five students from the other. In research-related terms, this is considered a purposive/convenience sample.

3.1 Ethical Considerations

3.1.1 Method of Recruiting Participants

As was mentioned earlier, considerable deliberation was given to the selection of the particular business course used in the study to minimize any risk arising from the implementation of the research study. Rigorous measures were similarly taken to ensure that students registered in any of the two sections designated for the research study were fully informed of the details and the related procedures so as to assist them in making an **informed decision** regarding their participation in the study.

During the first class of the semester, explanations (that were distributed in writing *[see Appendix A]* and also presented by PowerPoint) were made to describe the following: the nature and purpose of the study, the extent of the involvement required by willing participants, the methods of assuring participant privacy and confidentiality, and the options of not participating in the study. Although it was necessary to provide all this information

during the first session, so that any student who wished to switch sections during the course change period was able to do so, students were only requested to submit the consent form by the fourth class of the semester. This gave students the opportunity not only to gain some familiarity with the approach of the course, but also to ask more in-depth questions about the study. With all these mechanisms in place, there was reasonable assurance that any consent granted to participate in the study was one that was appropriately and sufficiently informed.

3.1.2 Methods of Precluding Bias during the Semester

Since the researcher was also the instructor of the course, it was necessary to take precautionary steps to assure the students that the possibility of bias arising from their decision of whether or not to participate in the study was prevented. The simplest and most assuring measure of precluding the possibility of bias during the semester was for the researcher/instructor to pledge that **any data collected for the purposes of the research study would only be looked at or processed after the final grades of the course were submitted**.

Procedures relating to the submission of the consent form *(see Appendix A)* were carefully executed to ensure that researcher/instructor was unable to identify who was or was not participating in the study. Along with the information sheets describing necessary information about the study, all students received the consent form accompanied with an envelope and were encouraged to submit the form in the sealed envelope regardless of their decision (or alternatively their parent's decision, in the case of minors). All sealed envelopes containing the consent forms (signed or unsigned) were safeguarded by a third party in the College until after the end of the semester.

Given the matrix design of the study, the responses from the survey instruments needed to be matched by participant between the modules as well as to the corresponding test results of each module and therefore anonymity was not possible with the survey instruments. The closest approximation to anonymity that could be attained under these circumstances was to work with student identification numbers. As such, data solicited by means of survey instruments revealed only student identification numbers so as prevent

instant recognition during the collection of these during the semester, and therefore preclude the possibility of bias during the semester. The survey instruments collected were placed into large envelopes and only sorted and analyzed after the final grades of the course had been submitted.

Further to the information and assurances provided above, it was brought to students' attention, that they also had the following options: 1) Option to switch to another section of the same course (offered at the beginning only) *(no to the course)* 2) Option to remain in the course without participating in the study *(no to the study)* 3) Option to withdraw from the study without prejudice at any point during the semester *(no to the study, at any point during the semester)*.

Finally, considering the aim and nature of this research, there was **no deception** (whether deliberate or inadvertent) for the purposes of collecting data for this study. In effect, participation in the research study could be considered beneficial to students since it afforded them a unique advantage. In account of the research design, by experiencing and appraising three instructional methods involving varying degrees of technology within one course, this granted students the benefit of recognizing which mode of instruction is compatible with their individual learning style, therefore equipping them with the knowledge of which to follow in their future studies, or equally important, which to avoid.

The preceding information was included in the proposal to the Human Research Ethics Committee (HREC) of Dawson College, the institution in which the research was conducted. The consent form, along with the accompanying cover letter/information sheets describing the research procedures and the extent of involvement required by the participants *(see Appendix A)*, was included in the formal application, along with copies of the research instruments. The final approval to carry out the study was granted by the College's HREC on August 3rd, 2009.

4. DATA COLLECTION, RESEARCH INSTRUMENTS AND PROCEDURES

Given the exploratory purpose of the research study, various instruments were necessary to examine and evaluate the effects of technology-assisted instruction vis-à-vis the designated research questions. To collect pertinent data that would substantiate the findings, the study relied on the results of **class tests**, the performance from **selected learning activities,** as well as the responses from various **surveys**. The surveys included a **general profile questionnaire** *(see Appendix B)* which gathered demographic and behavioural data on the participants, **end-of-module questionnaires** *(see Appendices C, D, and E)* which assessed and classified attitudes towards each particular method of instruction, and **learning style inventories** *(see Appendices F and G)* which associated learning preferences with attitudes towards the instructional methods applied in this study. Researcher observations (that were recorded throughout the duration of the study) were also an integral component of the data collection. Cross-referencing of the quantitative and qualitative data generated from these research instruments served the purpose of triangulating the data.

4.1 Class Tests

For the purposes of a quantitative comparison, the test score generated by each of the three class tests served as a measure of student performance relating to the degree of technology applied in each of the different instructional methods. As described earlier, to ensure that assessment results between modules can be compared, the three class tests were weighted equally (25% each), and also formulated with the same format comprised of the same number of questions that required only objective responses. Given the introductory and independent topics of the course, these consistencies in the course content made it practicable to compose tests with an equivalent degree of difficulty.

In order to remove the influence of the assessment setting in the comparison of the didactical approach using varying degrees of technology, **all tests were administered in the classroom** regardless of the method of instruction. The results of these end-of-module class tests assisted in answering in part the second research question which asks whether the absence of face-to-face interaction with the instructor affects student performance.

From the review of the literature, several research studies that have similarly investigated the effects of online and classroom pedagogy have used test scores, or overall course outcomes, to evaluate the effectiveness of the instructional methods (Biktimirov & Klassen, 2008; Krentler & Willis-Flurry (2005), Mentzer et al., 2007; O'Leary & Quinlan, 2007; Wingfield & Black, 2005), There is, however, some debate in the literature about the use of test results as a measure of student performance. Such arguments can be moderated to some extent when strategies of instruction (and similarly those of assessment) encourage higher levels of learning.

4.2 Selected Learning Activities

For the purposes of providing a more comprehensive view of student performance, a supplementary approach involving formative assignments was incorporated in the study so as to further probe the influence of the different environments on the learning process. Since the design of the study was arranged in different modes during the second and third modules between the two class sections (in-class versus online), two assignments, one in each module, were conducted. For the first learning activity, attributes of student responses were compared between those having taken place on an online discussion forum versus those an in-class exchange. The second assignment was more intricate and therefore considered how students approached the requirements in the different settings and also how they performed in each of them. These qualitative and quantitative contrasts appended another dimension in the findings towards the second research question.

4.2.1 Assignment 1

The first assignment, conducted during the second module, pertained to the chapter on business ethics. The requirements were to watch an eleven-minute video describing an ethical dilemma of a particular corporation and to provide comments on the issues presented by applying specific terminology related to this chapter. For the section that was working in an online environment during this module, the video clip was made available via hyperlink on the course website. Using the platform of a discussion forum, within each team, students were required to post two comments for the purposes of this assignment, one to present their

views and another to respond to other comments made by one or several other teammates. Since the online format was asynchronous throughout the course, and in order to allow sufficient time for response comments to be posted, students were given several days to complete the requirements of this assignment.

The same learning activity was conducted in class for the other section which was made conducive for the physical classroom. For these students, the video-clip was shown at the beginning of the class time and then they were provided with thirty minutes to write down their individual comments on a prescribed sheet of paper. Subsequently, students were given the remainder of the class time (30 minutes) to exchange ideas between their respective team members and were asked to record the key elements of the collective discussion on a separate designated sheet of paper. Both the individual and team comments were used in this analysis of the data.

4.2.2 Assignment 2

The second assignment examining the effects of the comparative learning environments on student performance was conducted in the third module during which time the two sections of students had switched between online and classroom methods. This assignment related to the chapter on management and presented students with an introductory level case summary describing the situation of a small company. Referred to as a "SWOT" analysis (an acronym for the type of components to be explored), the objective is to identify the company's strengths and weaknesses, as well as to consider possible opportunities and any imminent threats to this entity. To assist with the fulfillment of the assignment's requirements, (as well as to correspond to the different styles of learners) detailed explanations were made available to students both by written as well as by audio-visual descriptions (via video clip) of these procedures. Unlike the first assignment, for which the web-enhanced module made use of the technology (video clip) only during class time, both resources were made equally available to both sections on the respective course websites for the second assignment.

Since this was their first attempt at a management analysis, students were given adequate time to complete the assignment, one week for students in the online environment, and two classes (the equivalent of one week) for those in the classroom venue (who had comparable access to the case and the explanations on the course website). Although all students were asked to initiate the analysis independently, both sections were given the option of completing the assignment either individually or with their respective team members. While the section attending classes unanimously selected to work on the assignment in groups, only a few students in the virtual setting preferred to collaborate with others on the online forum made available for this assignment.

4.3 Surveys

4.3.1 The General Profile Questionnaire

Factors that have been explored in education literature and found to be moderating variables of student performance include individual differences pertaining to demographic and behavioural characteristics (Krentler & Willis-Flurry, 2005; Richardson & Newby, 2006; Terry, 2007). With the objective of examining whether such variables have an effect on student learning in relation to instructional methods using technology, data collected from this survey served to contextualize the analysis pertaining to the second research question. Administered at the onset of the semester, the general profile questionnaire *(see Appendix B)* asked participants questions related to three categories: 1) comfort with technology (which solicited information regarding access and the extent of use of technology), 2) skills, habits and attitudes towards school (which asked them to identify how they feel about such aspects as teamwork, deadlines, attendance, etc.), and 3) general demographics (which in addition to such variables as age, gender, language, also asked participants to classify the number of hours per week dedicated to work and extracurricular activities). Although not all variables were taken into consideration in the data analysis, the questions for this questionnaire were either extracted or adapted from *The National Survey of Student Engagement (NSSE)* which is touted in the literature as a practical instrument that measures the dimension of student engagement in academic pursuits (Robinson & Hullinger, 2008, also referring to Kuh, 2003). While the NSSE has been primarily used in relation to

on-campus instructional methods, the principles are equally applicable to those that are assisted by technology.

4.3.2 The End-of-Module Questionnaires

These questionnaires were developed on the basis of the review of literature (Biktimirov & Klassen, 2008; Dempsey et al., 2008; Fortune et al., 2006; Krentler & Willis-Flurry, 2005; Liu et al., 2007; O'Leary & Quinlan, 2007**;** Robinson & Hullinger, 2008; Smith & Mitry, 2008; Terry, 2007) as well as from the researcher's experience with technology-assisted instruction. Each of the three end-of-module questionnaires *(see Appendices C, D, and E)* was a brief survey that was administered at the same time as the test for the respective module. The objective of these questionnaires was to determine what factors were affecting participants' attitudes towards the mode of instruction experienced during each module. Students were also asked to specify their individual preference for an instructional method using technology if they were to retake the course. An optional open-ended question at the end of each survey was included for the purposes of collecting qualitative data which served to validate the responses acquired from checklists and Likert-type scales. Additional qualitative input was obtained from participants using a blog forum that was made available only during the online module in order to capture sentiments (satisfaction or frustration) towards the purely virtual approach in a timely manner.

The three end-of-module questionnaires repeated the same questions but with reference to the particular instructional method applied in the module. Data collected from these surveys contributed to responding to the first research question concerned about which elements of technology-assisted/-based instruction enhance student attitudes towards learning.

4.3.3 The Learning Styles Questionnaires

Learning styles have been identified in education literature as an important variable in understanding student attitudes towards learning and their learning environments (Goorha et al, 2010; Hurt, 2008; Loo, 2002; Mentzer et al., 2007). Closely related to cognitive styles,

learning preferences are related to a learner's personality, temperament, motivations, which reflect a fairly consistent way in which he or she responds to or interacts with stimuli in the learning context (Loo, 2002). Although there are several frameworks that have been developed to identify learning style preferences, the criteria for selection were based on practicable tools that are commonly used in empirical research. Since different instructional methods were used this study, two diagnostic assessments were deemed necessary to ensure that different perspectives of learning were appropriately considered in the study: Kolb's Learning Style Inventory *(see Appendix F)* and the VARK Questionnaire by Fleming and Bonwell *(see Appendix G)*. The assessment of learning styles was relevant in answering the third research question, which is concerned with associating learning style preferences with a preferred method of instruction relying on technology.

Given that there were several requirements placed on the participants for the purposes of the study during the earlier part of the semester (consent form, general profile questionnaire, etc.), it was decided by the researcher/instructor to administer these questionnaires in the later part of the term, particularly during the respective web-enhanced (in-class) modules of each section so that any clarifications can be provided in person. Explanations of learning styles were suitably incorporated in the course content since learning styles are also referred to when profiling the aptitude of business leaders and entrepreneurs.

4.3.3.1 Kolb's Learning Style Inventory

Embedded in the experiential learning theory which is relevant to this study, Kolb's Learning Styles Inventory (LSI) (originally developed by David Kolb in 1985 and last updated to version 3.1 in 2005 by David and Alice Kolb) is a self-reporting questionnaire that has been widely accepted as a standardized instrument and its validity has been supported for assessing an individual's learning style. Using an adaptation of the LSI *(see Appendix F)*, the questions depict various learning situations and require the respondents to assign a numerical weight that corresponds to their preferred approach towards the described situation. Possible responses represent one of Kolb's four stages of learning. Values assigned to the responses are then grouped and subsequently calculated to determine a position along

each of the vertical (perception) and horizontal (processing) continuums. The intersecting point on a quadrant represents the respondent's learning style.

4.3.3.2 The VARK Questionnaire

The VARK questionnaire (originally developed by Fleming in 1987, and last updated by Flemming and Bonwell in 2006 to Version 7) uses a different perspective of assessing how individuals gather and use information by relating preferences only to perceptual approaches*:* visual (V), aural (A), read/write (R), and kinesthetic (K). For each situation described in the list of questions, participants can select none, one, several, or all of the four responses provided, which correspond to any of the four preferences. The distribution of the summarized number of responses amongst the four categories represents the degree of inclination towards any of the approaches. According to the profile generated by the questionnaire, an individual can have several preferred modes of learning. The questionnaire used for this study was a variation oriented for younger people in which the original questions have been rephrased by the authors to describe activities and behaviours more fitting for students of this age group *(see Appendix G)*. Although the statistical validity of the results generated by the VARK questionnaire has not been determined conclusive, the questionnaire is highly popular in educational research.

4.4 Validity of Self-Reporting Instruments

Arguments can be raised regarding the validity and overall credibility of research data collected with the use of self-reporting instruments. Limitations arise when the participants may be inclined to respond with socially acceptable answers, or to agree with statements, or even to provide inaccurate answers when there is reluctance to reply truthfully (Gay, Mills, Airasian, 2009). Research shows, however, that "respondents generally tend to answer accurately when questions are about their past behaviour, with the exception of items that explore sensitive areas, or put them in an awkward, potentially embarrassing position" (http://nsse.iub.edu/html/vsa.cfm). Considering the objectives of the study, the issue of honesty can be reasonably remedied since few (if any) questions asked on the survey instruments could be perceived as sensitive by the participants. Although anonymous

responses can help to overcome any hesitations (Gay et al., 2009), this option was not feasible since the study required responses on the surveys to be matched not only between modules, but also to test results.

5. DATA ANALYSIS

To address the stated research questions, mixed methods, combining both qualitative and quantitative approaches, were used to analyze the data related to this cross-sectional, causal-comparative study.

5.1 Quantitative

Quantitative analyses were primarily performed using the Statistical Package for the Social Sciences student version 15.0 (SPSS Inc., 2007) *(see Appendix H)*. Spreadsheet software using Microsoft Excel (2007) was also used to tabulate learning styles preferences more expediently, and also to graphically represent the data more aesthetically.

At the descriptive level, tabulations of data, represented by numerical summaries and graphical charts, provided insight regarding the distribution and frequencies of occurrences, while measures of central tendency and variability compared the different perspectives based on the matrix-like structure of the research design. Correlation procedures and tests at other levels of statistical analyses, which included chi-square, paired and independent sample *t*-tests were performed, for which statistical significance was established at an alpha level of .05, the acceptable standard of probability for research in the education domain.

5.2 Qualitative

Qualitative analyses were included for the purposes of triangulating the data. Although few similar studies in the review of the literature included such a perspective, due to the smaller sample involved in this study, it was considered necessary to complement statistical analyses with a qualitative dimension. Valuable perspective was gained from

participants' contributions collected from the optional open-ended question placed at the end of each of the end-of-module surveys, as well as from the blog forums made available on the course website during the online module. Content analysis procedures were applied for the coding and organizing the themes that emerged from the comments made. Additionally, records kept by the researcher of in-class observations and email correspondence with student participants also provided beneficial insight to the data and were incorporated in the explanation of the results wherever appropriate.

CHAPTER FIVE

PRESENTATION AND INTERPRETATION OF THE RESULTS

1. CHARACTERISTICS OF THE SAMPLE

The purposive/convenience sample was comprised of students from the two sections of the same course taught by the researcher. Of the 80 collective possible subjects, consent for participation in the study was received from 76 students (a 95% response rate). All but one participant completed the course as well as the research study requirements rendering the final actual sample size to 75 students (forty from one section and thirty-five from the other).

1.1 General Demographics

The sample from both sections comprised of 39 females and 36 males. All were freshman students experiencing their first semester at Cégep with ages ranging between 16 and 18 years, with the majority (91%) being 17 years old at the onset of the semester. Thirty-five per cent of the students self-reported their high school average to be in the 70s, while the high school average of the remaining 65% was in the 80's. No one reported below or above this range. While it is typical that students in a Commerce profile aspire to pursue their studies at the university level, 91% (68 students) expressed this intention upon graduation from Cégep, while 8% (6 students) were uncertain of their future goals and one student was interested in starting and operating a business.

1.2 Language

Since a virtual learning environment places high demands on students to have a high comprehension and ability in the language of study (in this case English), the recent rise of applicants from French high schools to English Cégeps necessitated the examination of the relationship of language of study in high school to test performance in the course

involved in the research study. Out of the pool of participants in both sections, 36% (27 students) reported to have followed their high school studies strictly in French, while the remaining studied either primarily in English or a combination of both (and a few even in three languages that additionally includes their mother tongue). Chi-square tests showed no statistical significant relationship between test performance on any of the three instructional modes and the language of study in high school.

1.3 Hours Spent per Week on Work or Extracurricular Activities

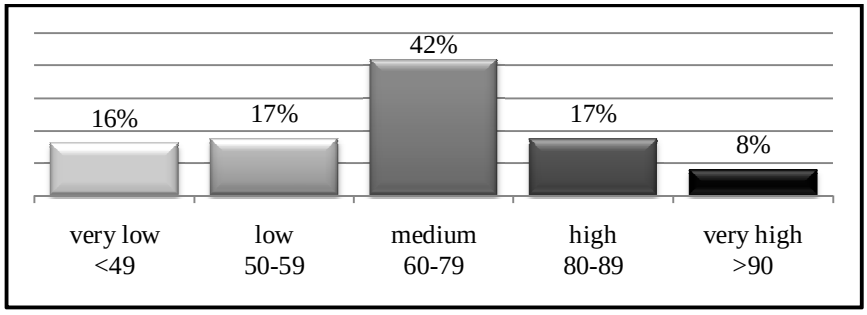
At the Cégep level, it is generally considered that a student's employment schedule in excess of 15 hours per week is likely to impede on his/her academic performance. To determine whether such a factor would act as a confounding variable in the analysis of the test outcomes, participants were asked to report the number of weekly hours spent on at employment, as well as on time dedicated on sports-related activities. While 42% and 31% did not dedicate any time to a job or to sports respectively, only 12% (9 students) reported to work more than 15 hours at their employment per week and similarly only 5% (4 students) on sports activities. Chi-square tests revealed no statistically significant association between these activities with the test results from any of the three modes of instruction.

1.4 Comfort with the Online Environment

Another relevant factor in the consideration of student performance in this study was participants' individual predisposition with the online environment upon entry to the course. On a general profile survey conducted at the onset of the semester, students were prompted to indicate, using a five-point Likert-type scale (ranging from never, rarely, sometimes, often to very often), the degree to which they use online applications and tools such as emailing, social networking (Facebook, Twitter), online chatting, blogging, and downloading. By assigning different weights to the answers on the Likert-type scale on the basis of frequency, the responses were tabulated and calculated for each participant rendering each individual a degree of interaction (or comfort) with the online environment on a scale of 0 to 100. Although the median for the entire sample was 71, the range of level of behaviours was quite wide for the sample (see Figure 3). Despite the variation of online

behaviours amongst the participants outside of the classroom, the Pearson correlation procedure found no statistical significance in the relationship between the degree of comfort with the online environment and test performance on any of the modules.

Figure 3 - Students' Degree of Comfort with the Online Environment



2. ANALYSIS OF DATA VIS-À-VIS THE RESEARCH QUESTIONS

The analyses of the data have been organized according to the three research questions specified for this study.

2.1 Research Question 1

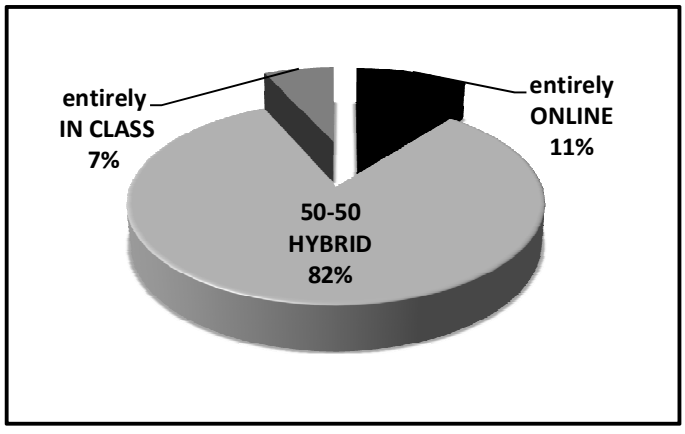
2.1.1 Participants' Preferred Method of Instruction

To contextualize the data pertaining to the first research question, which aims to identify **what elements of technology-assisted instruction enhance student attitudes towards learning**, students were asked to indicate at the end of each of the three modules which method of instructional delivery they would prefer to follow if they had to take the course again: alternating in-class and online "classes", purely online, or purely in-class (accompanied with the course website). Although the third survey captures the best snapshot of the participants' preferred methodology, since all three variations of technology-infused approaches had been experienced by that time, the intermediate responses provided from earlier modules offered insight as to how students felt about the varying degrees of technology used in instructional delivery.

While virtual classes were unfamiliar to the students at the onset of the semester, after they had all experienced the hybrid method during the first module, participants were enthralled at the opportunity of being able to carry out learning activities outside of the physical classroom. Using content analysis procedures to categorize the remarks voluntarily contributed in the open-ended question of the end-of-module survey, two-thirds of these comments were found to make references to a high level of enthusiasm for online classes. The selection for the preferred methodology at the end of this first module was 84% in favour of the hybrid method that combines both virtual and classroom instruction.

When the component of face-to-face interaction was entirely removed from the pedagogy during the online module (which occurred at different times during the semester for each section), scepticism about "virtual classes" emerged in the qualitative comments on the survey collected from this module. The majority of comments received (32 out of the 42) either underlined their difficulties in managing this approach or explicitly opposed the removal of classroom instruction entirely. Many also offered suggestions about how the alternating hybrid approach was most suitable for their learning, which kept receiving the strongest majority of the votes as the preferred method.

Figure 4 - Students' Preferred Method of Instruction (surveyed at the end of the semester)



At the end of the semester, after participants had experienced all three methods of technology-infused instructional delivery, the answers collected from the questionnaires administered at the conclusion of the final module indicated that 82% of the participants chose the hybrid mode, (one which combines both physical and virtual learning environments equally) as their preferred method of instruction (see Figure 4). Although most participants were steadfast towards their preference for the hybrid

approach on all three questionnaires, there were a few that varied their responses depending on the method experienced during the module. Notably, the instructional delivery that requires students to attend two classes per week in a physical classroom was consistently the least preferred method on any of the three end-of-module surveys.

2.1.2 Aspects Creating Favourable or Unfavourable Attitudes

In addition to selecting their preferred method of instructional delivery, students were also asked on each of the end-of-module questionnaires to identify aspects that created a favourable or unfavourable attitude towards the particular methodology. Both qualitative and quantitative approaches were used in order to compare the consistency of the replies. To ensure that qualitative feedback was collected during the absence of face-to-face interaction with the instructor, and also to capture the most timely reactions from the students when using technology for the purpose of learning, students were encouraged to express their views about the virtual methodology using a blog forum that was made available on the course website during the online module of the course. Students were simply asked to report what they thought were the "pros and cons" of the instructional method conducted entirely online, without any further prompting. The data collected from the blog were analyzed using content analysis procedures, and the coding was made in accordance to the themes that emerged from the comments provided.

Out of the ninety-six (96) unfavourable comments or "cons" mentioned about the online learning environment, the majority focused on concerns and trepidations about such didactical-related issues as 1) not having face-to-face interaction with the teacher (22%), 2) not having the promptness of responses from the instructor when questions arise when covering the material (21%), 3) feeling of having to learn on one's own or even that learning was compromised (16%) and 4) not benefiting from the questions asked by others and not having the opportunity to interact with others in the class (14%). While there was also mention that the purely virtual method requires more discipline on students' part (7%), some expressed that having to check the course website regularly for assignments was cumbersome (10%), and some even found online learning to be complicated to follow (4%).

More than half of the favourable remarks mentioned on the blog (38 out of 73, or 52%) were dedicated to non-pedagogical related elements which included such benefits as *a better schedule* (since either morning, lunch-time or afternoon classes were replaced with web-based components) and opportunities relating to *convenience* (with specific references to "more personal time"). The elements of technology-based instruction that students expressed to enhance their attitudes towards learning (with the objective of specifically answering the first research question), were primarily underlining the opportunities availed from the *flexibility of the learning environment*. The most cited reasons favouring the virtual methodology (32%) were *the ability to work at one's own pace*, and *having "freedom" of choice or "independence" as to when to learn* (as opposed to a fixed classroom schedule). While some participants' comments (7%) explicitly stated that they felt they *worked and learned better in this type of environment*, other remarks (7%) underlined an appreciation for *feeling less social pressure from collaborative situations with other students* that are more pronounced in face-to-face situations. Even though the favourable comments regarding the online methodology per se ranged from "liked it" to "really loved it", (also included were expressions such as "refreshing", "a great idea", even "awesome" [keeping in mind that the average is seventeen years of age]), there was a notable recurrence of comments that explicitly indicated preference for the hybrid method, which was succinctly denoted by one participant as "the best of both worlds".

The *course website* was another important element of technology-assisted instruction that students mentioned that enhance their attitudes towards learning. Comments made on the blog as well as on the open-ended question found on the end-of-module surveys referred to how the information and instructions provided were "clear", "very organized", and "helpful". In the other modules where the pedagogy was less dependent on the technology, students' comments pointed out to the benefits of the accompanying course website's unlimited availability, which they felt supported the learning obtained from classroom.

Despite the repeated requirements during the semester to use avenues such as discussion forms, blogs and wikis to enable communication and assist the collaboration between the students in the virtual environment, there was no mention whatsoever in favour

of such technological elements in the voluntary feedback. There was however, mention of the *benefits of group work* from the questionnaires collected in relation to the web-enhanced (in-class) methodology. Even though several participants (67%) had indicated on the general profile survey their degree of comfort with the online social networking was medium to high (refer back to Figure 3), virtual exchanges for pedagogical reasons were not embraced so enthusiastically. This was particularly noted when a few online assignments were offered with the option of discussing with others in the group on blogs or wikis, and only a small number of students chose to participate in these online exchanges.

In addition to the qualitative perspectives collected, on each of the end-of-module questionnaires students were asked to choose as many applicable reasons (from the checklist provided) for "liking" or 'disliking" the pedagogical approach experienced during the module. The tally for each of the items on the checklist is represented in percentages relative to the total amount of participants involved in the study from both sections and are summarized and compared below.

Table 2 - Reasons for Liking/Disliking an Instructional Method (both sections combined).

	HYBRID Method	**ONLINE Method**	**IN-CLASS Method (web-enhanced)**
	I dislike not having ►	**I dislike not having ►**	**I like having ►**
1. ► live interaction with the teacher	32.0%	72.0%	80.0%
2. ► questions answered immediately by the teacher	56.0%	61.3%	72.0%
3. ► live interaction with other students	14.7%	37.3%	49.3%
	I like being able —	**I like being able —**	**I dislike not being able —**
4. — to work at my own pace	74.7%	81.3%	37.3%
5. — to have a more flexible schedule	82.7%	97.0%	89.3%
6. — to learn without being in class	66.7%	58.7%	n/a
7. I feel more ►insecure/secure◄ about my learning.	n/a	► insecure 42.7%	► secure 53.3%

In the comparison of the results found on Table 2, the percentages between the hybrid and online methods indicate that both the benefits and drawbacks of virtual classes

resonated with more participants during the online module phase (with the exception of item number 6, which relates to learning without being in class). Also notable was the significant difference between the hybrid mode and the other two methods for the aspect of "live interaction", in particular with the teacher. Interestingly, the absence of face-to-face exchanges with the instructor (and to a lesser degree with other students in the class) was not perceived by many as pivotal component to the learning environment during the hybrid method, yet it was valued by more participants during the other methods. Considering that hybrid was this first module and particularly that the physical and virtual environments were equally combined in the hybrid mode, it is understandable how the items took more significance in the remaining modules. A further look at the comparison of all items listed between the online and in-class modes of instruction indicates that components of the learning environment were appreciated by more students during the modules in which they were either entirely absent (online) or fully available (in-class). The results of these quantitative data correspond to several of the qualitative comments described earlier.

Based on a collective view of the various results for this research question, even though convenience and flexibility have been identified as the key elements of technology-assisted instruction that enhance student attitudes towards learning, there are also more significant findings that can be drawn. By indication of both the selection shown towards the preferred instructional methodology, as well as the supporting comments and percentage of selections marked on the checklist of reasons, it is apparent that at this age and at this entry level in their tertiary education, the physical environment provides opportunities and familiarity that students are not necessarily willing to forgo entirely from their learning setting. Only a few students were willing to manage the demands and discipline required to succeed in a entirely online environment, while a significant majority of the participants (89%) selected an instructional method that maintains either partially (82% for hybrid) or fully (7% for in-class) maintains face-to-face interaction, an evidently valued component of the learning environment for students of this age group.

2.2 Research Question 2

The second research question, concerned with **how student performance is affected in the absence of face-to-face interaction with the instructor**, was explored from different perspectives in order to ensure that "student performance" is appropriately represented in this analysis. In addition to the test results from each of the three methods of instructional delivery that employed varying degrees of technology, performance on selected learning activities was also considered in order to compare the effects on students in the different learning environments.

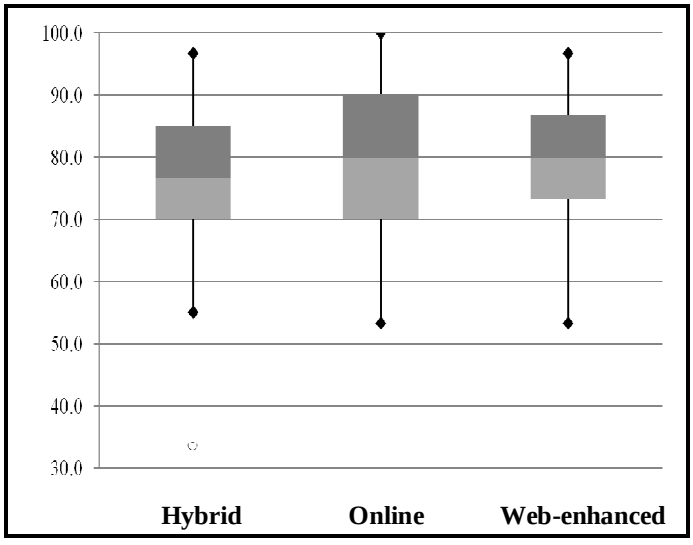
2.2.1 Test Results

An overview of the tests results for both sections combined shows minor differences, particularly between the means of the online and web-enhanced (in-class) methods (see Table 3). The hybrid mode produced a slightly lower average, but because this methodology was administered first to both sections, this disparity can be attributed to transitional adjustments taking place in the first part of the semester during which time freshman students familiarize themselves with the demands of tertiary education as well as with the instructor's didactical and assessment style. Box plots for each of the three didactical modes (see Figure 5) illustrate the comparable spread of the data, and also reveal an outlier for the hybrid mode (which can further explain the lower mean score

Table 3 - Overview of Test Results by Mode of Instruction (both sections combined)

	Hybrid	Online	Web-enhanced
Mean	**76.3%**	**79.8%**	**79.3%**
SD	10.7	11.1	9.6
n	*75*	*75*	*75*

Figure 5 - Box Plots of Test Results by Mode of Instruction (both sections combined)

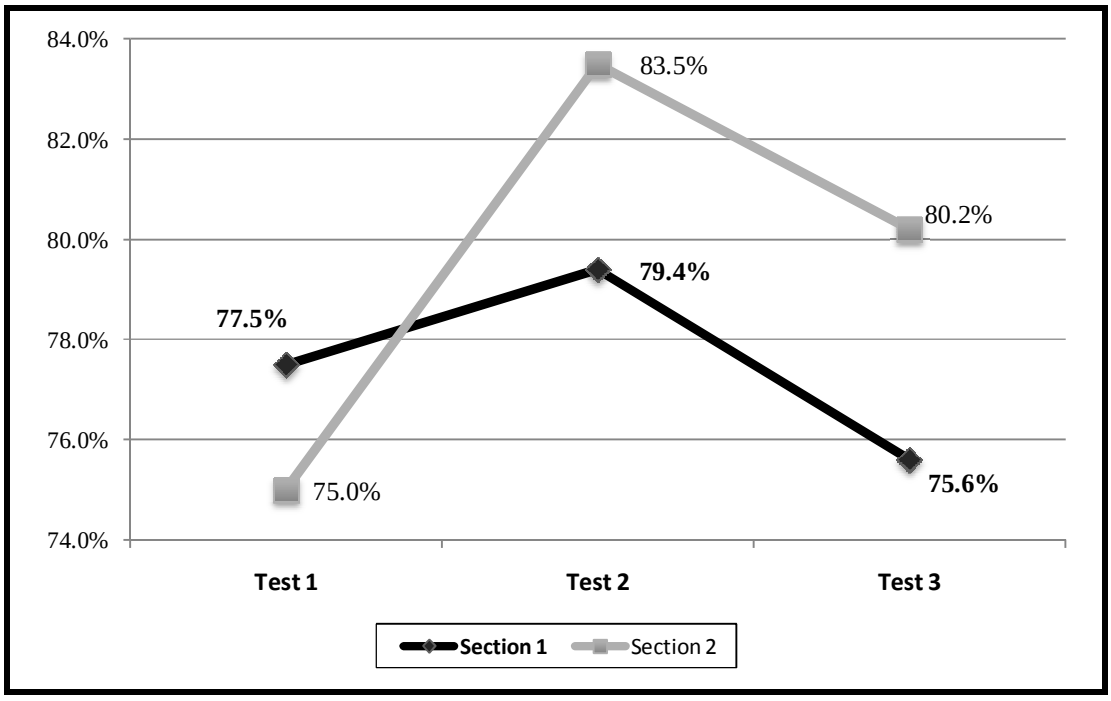


which arose for this method). A more in-depth analysis of the test scores explored the test results of the two sections separately by using two perspectives: 1) an analysis within each section and 2) an analysis between both sections.

2.2.1.1 Comparison within Each Section

The first examination of the breakdown of the test scores takes into account the order in which the three tests were taken. A graphical representation of the means of the test results for each section (see Figure 6), highlights two similarities in the comparative results. Notwithstanding the amount of technology infused in the delivery in relation to each test, the strongest relative performance *within* each section occurred for the second test. Additionally, the scores of the third test, for both sections, showed a decline from the previous results. While it is common that the results of a first test bear the effects of transitional factors, as described earlier, it is also not unusual that the performance of the last test is impacted by the escalated demands placed on student during the last portion of the semester from their various courses. The relative results from both sections represent a typical situation in the performance of Cégep students during the semester.

Figure 6 - Test Results (Means) by Test Number (separate sections)



When taking into consideration the mode of instruction related to each test score (see Table 4), this reveals that the degree of technology infused in the didactical method was not the factor that influenced test performance. While section one had achieved the highest mean test score after having followed an online instructional methodology, section two's peak performance was derived from a web-enhanced approach. Likewise, when both sections' tests scores dropped for Test 3, again the instructional methods were different. Although there is the possibility that scores achieved on class tests may not be the most appropriate measure to gauge the effectiveness of a didactical method, from this evaluation it appears that the timing in which the tests was a more significant factor on test performance than the amount of technology incorporated in instruction.

Table 4 - Cross Tabulation of Mean Tests Grades by Mode of Instruction

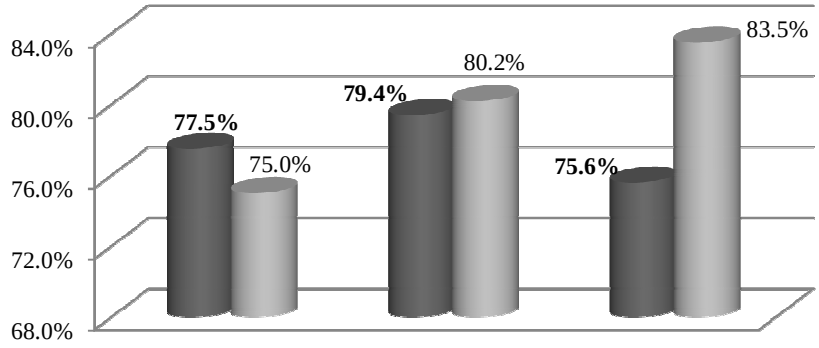
	TEST 1	TEST 2	TEST 3
SECTION 1 **Instr. Method**	**Hybrid**	**Online**	**Web-Enhanced**
Mean	**77.5%**	**79.4%**	**75.6%**
SD	*12.0*	*11.4*	*10.0*
n	*40*	*40*	*40*
SECTION 2 **Instr. Method**	**Hybrid**	**Web-Enhanced**	**Online**
Mean	**75.0%**	**83.5%**	**80.2%**
SD	*9.1*	*7.3*	*10.8*
n	*35*	*35*	*35*

Statistical analysis was also used to compare test scores *within* each section. By conducting *t*-tests on the paired combinations of the test scores (i.e. Test 1 & 2, Test 1 & 3, and Test 2 & 3), statistical significance was found in the difference of means both between Tests 1 & 2 (-8.57, $p < .01$) as well as between Tests 1 & 3 (-5.23, $p < .05$) for section two, whereas the only statistically significant difference found for section one was in the comparison between Test 2 & 3 (3.83, $p < .05$). These findings shed a different light on the two sections involved in the study. For section two, since both statistically significant differences were found in relation to Test 1, these can be linked to the transitional factors arising during the first part of the semester as explained earlier. For section one, however, the statistical difference between Tests 2 (online) and Test 3 (web-enhanced) underscores that the tests results were affected by some other aspect in the learning environment, which is further investigated in the subsequent analysis.

2.2.1.2 Comparison between Sections

The second examination of the breakdown of the test scores compares the results achieved *between* the two sections. Using Independent *t*-test procedures, two perspectives were considered. The first comparison of the means of grades in the three class tests *by test number between sections* did not show any significant difference (see Figure 6). However, the second comparison organized *by mode of instruction between sections* (see Figure 7) indicated a significant difference in the average test grades between the outcomes of the web-enhanced approach (mean difference of -7.93, $p < .001$). This was the second significant difference highlighted in statistical analysis that related to the test results from the blended method. By contemplating the circumstances surrounding the web-enhanced learning environment, two possible causes may explain the incongruity arising between the related test results: 1) the content of the material tested, and 2) the order in which the modules took place.

Figure 7 - Test Results (Means) by Mode of Instruction (separate sections)



	Hybrid	Online	Web-enhanced
Section 1	**77.5%**	**79.4%**	**75.6%*** **
Section 2	75.0%	80.2%	83.5%***

*** Statistically significant mean difference between sections at $p < .001$.

Since the research design alternated the order in which the online and web-enhanced modules were offered to each of the two sections, the end-of-module tests assessed different material. However, considering that not only the format of the tests were diligently kept as comparable as possible, but principally because such an inconsistency would have also been apparent in the test results related to the online method, this first possibility is minimized. It is therefore more likely that the disparity of test scores are due

to the timing in which this module was delivered to section one more so than from the difference in the material covered.

On account of the research design, section one had returned to follow classes in an entirely face-to-face setting during the third and final component of the course after having experienced two previous modules that had required partial or no attendance in the physical classroom. There is a strong possibility that the requirement for ongoing attendance during the in-class (web-enhanced) module was not perceived so favourably by the students after having followed instructional methods that in comparison did not heavily emphasize class participation. There are two sets of different data that point to this interpretation. Firstly, based on the researcher's observations during class time, there was increased restlessness noted in the third module compared to the first (which had required class attendance only once a week). Secondly, based on participants' selection of a preferred instructional method collected from the last survey, not one student from section one had opted for the entirely in-class (web-enhanced) method as the preferred choice of instructional delivery compared to other section which followed the modules in the reverse order (see Table 5). It appears that the experience in the virtual setting from earlier modules may have altered students' attitude towards a learning environment that is conducted strictly in the classroom.*

Table 5 - Frequencies of Preference for Instructional Delivery Based on Final Survey

	Section 01	**Section 02**	**TOTAL**	***Percentage***
Hybrid	37	25	**62**	***82%***
Online	3	5	**8**	***11%***
In-class (W/E)	0	5	**5**	***7%***
TOTAL	40	35	**75**	***100%***

In interpreting all the data collectively in reference to the second research question, there is no evidence based on any of the analyses of the tests results conducted to indicate that test performance was affected by the absence of face-to-face interaction with the instructor.

* It should be noted that the last class for section one was conducted online due to immobilizing injuries suffered by the researcher/instructor from an accident just prior to the end of the semester. Even though the test for the last module was invigilated by a replacement teacher for both sections, the test, along with the accompanying end-of-module questionnaire, had been prepared by the researcher/instructor. Although it would be difficult to determine to what extent this event affected the research study, it is likely to have been minimal since the researcher maintained strict control to ensure the continuance of the study at the same standards set in the earlier modules.

2.2.2 Specific Learning Activities

Another perspective of student performance in the comparison of the different learning environments explored how the learning process was affected using formative assessments. Two specific learning activities (one in each of the second and third modules) were used for the purposes of these analyses both requiring cognitive skills at the application and even analysis levels in accordance to Bloom's taxonomy.

2.2.2.1 Assignment 1 - The Discussion of an Ethical Dilemma

In the assignment which presented an eleven-minute video of an ethical dilemma of a company and asked students in either learning environment to discuss the issues presented by applying specific terminology related to this chapter, the following elements were kept equivalent in both settings: 1) the watching of the video, 2) the individual consideration of the issues with use of the terminology, and 3) the reflection of other team members' perspectives. Despite the parallel requirements, however, the attributes of the responses were reflective of the environment in which they were provided. In the physical environment, students delineated the issues incorporating the appropriate terminology suggested in their individual submissions, whereas in the virtual platform, only the students who were first to post to the discussion forum followed this format. The remaining students of the team did not repeat the answers of the first post, but instead selected one issue and offered a more in-depth perspective. As more personal views were provided on the forum, less consideration was given to the requirement of using the necessary terminology. The online setting not only allowed students unlimited access to the video, (several students admitted to watching the video more than once), but also more time to contemplate and record their responses, which were consequently more in-depth and multi-faceted. Conversely in the classroom environment, although the students dutifully applied the terminology to the situations presented in their individual responses, the confines of the class time, however, limited the extent to which they reflected upon the issues, both individually as well as collectively with their group members. Due to the dissimilarity of responses, evaluation was conducted differently between sections, and therefore the respective grades could not be considered in this analysis.

2.2.2.2 Assignment 2 - The Management (SWOT) Analysis

The assignment conducted in the third module dealt with a basic management (SWOT) analysis for the purposes of identifying the company's strengths and weaknesses, as well as possible opportunities and threats posed to the enterprise. A notable difference between the two sections in the different learning environments was the number of questions asked to the instructor. While the students in class did not hesitate to ask questions either for further explanation of the requirements or for affirmation of their work, the students in the online setting emailed only a few queries with regards to the assignment, despite the open invitation made by the instructor on the course website, particularly in relation to this assignment. Even though in both environments, the students were given the options to collaborate with others and were encouraged to ask the instructor questions, it appears that the practicality of the physical environment facilitated greater opportunities for interactions both between team members and with the instructor which consequently led to higher scores on this assignment. Despite the fact that students in the virtual milieu were accustomed with the tools to communicate online both with the instructor and with others in their team from previous assignments, most opted not to make use of these resources.

Table 6 - Cross Tabulation of Grades on the SWOT Assignment by Mode of Instruction

grade ranges >	**60-69**	**70-79**	**80-89**	**90-99**	*TOTAL*
IN-CLASS (w/e) section 1	**0**	**4**	**9**	**27**	*40*
ONLINE section 2	**3**	**9**	**13**	**10**	*35*
TOTAL	*3*	*13*	*22*	*37*	*75*

To ensure the equivalence in the grading, the assignment was evaluated following an answer key that allotted a specified amount of marks for the answers expected. While the mean of the results for the section working online was 82.74% on this assignment (SD=8.85), the section in the web-enhanced (in-class) format had a mean of 91.45% (SD=7.54). A closer look at the distribution of the grades for this particular assignment highlights the superior performance in the in-class (web-enhanced) environment with 36 out of the 40 students (90%) achieving scores beyond 80 per cent, compared to the 23 out of the 35 students (approximately 66% of the class) in the online setting (see Table 6). A chi square test was conducted to see whether the observed association, in the above

table, between the type of learning environment and the grades was statistically significant. The chi square statistic (13.186) with 3 degrees of freedom, is significant ($p < .01$), indicating that there is strong evidence of a relationship between the type of learning environment used to complete the assignment and the range of score achieved.

In interpreting these results in relation to the second research question, concerned with how student performance is affected in the absence of face-to-face interaction, the analyses from both these learning activities serve to accentuate how the conditions of the learning environment affect how, and to what extent, the steps in the learning process are carried out. For the first assignment, which dealt with the subject of business ethics, the physical setting provided structure to facilitate the application of the terminology in the context of the scenario provided, but constrained the extent of the analysis due to the limitations imposed by class time. In contrast, the virtual environment provided ample opportunity for review and reflection (which included other viewpoints more comprehensively) but enabled students to disconnect from the more fundamental objectives of the assignment.

The second learning activity involving the basic management analysis also highlighted a distinction in student performance between the two learning environments. Although the online offered more flexibility to work on the assignment, it also required students to take more responsibility in making use of the resources available to them in order to duly complete the assignment's requirements (as an additional point of interest, the results for those students who had collaborated online with other members of their team and asked questions to the instructor, achieved scores for this assignment in the 90-99 range). Alternatively, the web-enhanced setting, which weaved the advantages of both the physical and virtual settings, not only offered availability of the resources on the web, it also enabled a highly dynamic interactions with the instructor as well as with other students to take place with ease in the classroom.

2.3 Research Question 3

The third research question, which aims **to associate learning style characteristics of students with individual preferences towards the different instructional modes using technology,** relied on the frameworks of the VARK Questionnaire (Fleming and Bonwell), and Kolb's Learning Style Inventory (LSI).

2.3.1 Learning Preferences according to the VARK Questionnaire

All but two of the participants were found to have a *multimodal* approach for learning (i.e. a profile that combines of all four modes [visual, aural, reading/writing and kinesthetic] as the preferred way of gathering and using information). Not one participant had a profile that involved only one or a combination of two modes, but the participants found to be trimodal, each had a different mix and both had selected the hybrid method as their preferred method of instruction (see Table 7).

Table 7 - Distribution of Learning Preferences (VARK Profiles) amongst Participants

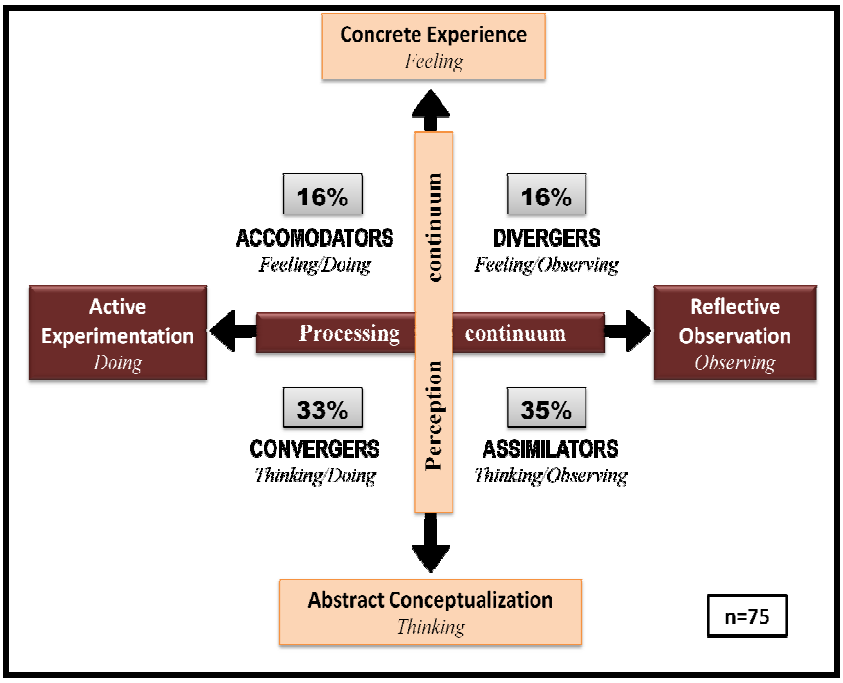
Profile	unimodal				bimodal						trimodal				multimodal	
Mode	V	A	R	K	VA	VR	VK	AR	AK	RK	VAR	VAK	VRK	ARK	VARK	*Total*
Count	-	-	-	-	-	-	-	-	-	-	**1**	-	-	**1**	**73**	*75*

Unfortunately, the varied distribution of preferences amongst those categorized in the multimodal profile rendered it difficult to make a rational association with the participants' selection for any of the three instructional methods applied in this study. However, some students, particularly amongst those who had taken this diagnostic assessment after having returned to the classroom for the third module, were able to easily identify why a purely online methodology was not compatible with their individual learning style. These students admitted to the researcher that they like to learn by *listening* to the instructor's explanations and the class discussions (i.e. aural mode). Despite attempts made to simulate the aural aspect of instruction in the virtual environment by means of providing resources such as audio-video clips on the course website, the entirely online approach generally tends to comprise less of the aural aspect compared to the other methods of instruction which include a degree of face-to-face interaction with the instructor.

2.3.2 Learning Style Preferences according to Kolb's LSI Framework

The assessment from Kolb's Learning Style Inventory (LSI) revealed that the learning styles of the participants comprised mostly of assimilators (26 students or 35% of the sample) and convergers (25 students or 33%), and by a smaller, but equal amount, of accomodators and divergers (12 students or 16% each) (see Figure 8).

Figure 8 - Distribution of Learning Styles amongst the Participants (Kolb)



The diversity of results from Kolb's learning styles inventory also raised challenges in isolating characteristics within the large cluster of participants who had selected the hybrid mode as their preferred method of instruction (62 students); however, amongst those students who chose the purely online approach (8 students) as well as those who selected the web-enhanced (in-class) method (5 students), a distinct learning orientation was recognized for each of these two groups (see Table 8).

Table 8 - Cross Tabulation of Learning Styles (Kolb) with Preferred Mode of Instruction

	PREFERRED MODE OF INSTRUCTION				
LEARNING STYLE	**web-enhanced**	**online**	**hybrid**	*TOTAL*	*Percentage of Participants n=75*
diverger	**-**	**-**	**12**	*12*	*16%*
assimilator	**5**	**-**	**21**	*26*	*35%*
converger	**-**	**5**	**20**	*25*	*33%*
accomodator	**-**	**3**	**9**	*12*	*16%*
TOTAL >	*5*	*8*	*62*	***75***	***100%***

Of the students who selected the web-enhanced (in-class) method, all of them associated to an *assimilating* learning style (the one which relies heavily on theories, concepts, and analysis). Although there were other assimilator-type students amongst the participants, based on researcher observations throughout the semester, those whose preferred instructional methodology was that of entirely in-class lessons, all were active contributors in class discussions as well as in team assignments conducted in class. They also made frequent use of the availability of the instructor's office hours to verify their knowledge or ask more probing questions about the course material.

Conversely, amongst those students who selected the purely online mode as their preferred method of instruction, they all had a higher tendency towards *active experimentation* (doing) on the processing dimension. Whether these students had a *converging* (doing and thinking) or an *accommodating* (doing and feeling) learning style, the aspect common for all those participants who selected virtual pedagogy was their inclination for "doing" which involves more hands-on pursuits. Related researcher observations identified these students as more reserved in their in-class contributions as well as in their collaborations with team members, and any contact with the teacher (albeit minimal) related strictly to administrative issues (computer access, absences, grades).

In interpreting the data, since not assimilators had selected the in-class approach, or similarly, not all learning preferences involving "doing" had chosen the online mode, it is difficult to draw a definite conclusion in associating learning styles with preferred methods of instruction. However, it is understandable how the appeal of the different environments coincided with the different approaches to learning. It appears that the need for information sourced by different perspectives is a greater priority for those selecting the in-class method compared to those who chose the purely online approach, who prefer to learn through trial and direct experience. It should also be pointed out that the test outcomes of either of these groups of students were too diverse to identify a pattern amongst them, and the highest mark amongst the test results was not necessarily representative of the preferred methodology selected.

CHAPTER SIX

DISCUSSION AND CONCLUSION

1. SUMMARY OF FINDINGS IN RELATION TO PREVIOUS STUDIES

The present study explored the effects of technology-assisted instruction on first-year Cégep students from various perspectives so as to provide an encompassing snapshot of various factors in the different learning environments involving technology. The combination of quantitative and qualitative dimensions in the analyses of the data served to compensate for the small sample of 75 Commerce students involved in the study who had entered Cégep directly from high school and whose average age was that of seventeen years. The matrix design of the study optimized the opportunities for comparison between the two sections of participants who had all experienced, in an alternate order, three different technology-infused instructional methods by the end of the course.

Elements that were found in this study to enhance student attitudes towards learning in virtual environments included primarily those of flexibility and convenience and were similarly repeatedly mentioned in the literature (Liu, 2007; Terry, 2007, Dempsey, 2008). Aspects of self-paced learning were found to be the most appealing pedagogically-related features of the online environment; however, in spite of the these strongly favoured advantages, after having experienced all three variations, the preferred mode of instruction for a significant majority of the student participants was the one which combines both the classroom and virtual learning environments, specifically, that of the hybrid method.

Since only a small percentage of the participants had selected the fully online approach as method of choice, it can be hypothesized that for students of this age group, the physical environment provides opportunities and familiarity that students are not necessarily willing to relinquish from their learning setting. These findings are consistent with a recent study from Beqiri and Chase (2009) which demonstrated that familiarities in the learning setting play a significant role in a student's satisfaction of the course, and that entirely online

courses are better appreciated by students at the graduate level (adult learners) than those in undergraduate studies. Based on the findings of their own study, the authors also recommended that instructional strategies should lean towards blended modes of delivery.

Interaction with the instructor, and the benefit of the immediacy of responses arising from this, were also recognized by the participants of this study as essential factors of the learning environment. These findings support those of an earlier study from Richardson and Swan (2003) that examined the significance of social presence in online courses and indicated that teacher immediacy and communication with other students as pivotal aspects in online education. Additionally, findings from the study comparing online to traditional methods of learning conducted by Fortune et al, (2006) found the difference in the value placed on face-to-face interaction was based on the degree of student independence. The course website, which contained various course materials and was also the means of interfacing during the virtual applications for the course, was also itemized as a valuable component for learning. Other studies that similarly investigated the implementation of technology in instructional delivery, also found that Internet-based tools, specifically those enabling access to lecture notes, assignments and email (which were found to be heavily used), as well as discussion boards (which were found to be used to a lesser extent), were perceived as "productivity enhancers" (Zhao, Alexander, Perrault, Waldman and Truell, 2009). Findings of an earlier study by Krentler and Willis-Flurry (2005), which had made use of discussion boards for virtual participation, had also suggested that the student learning experience was enhanced by use of technology.

To appropriately represent the examination of the effects of technology-assisted instruction on *student performance*, two perspectives were considered in this study: performance on tests (summative assessments) and performance on learning activities (formative assignments). Firstly, based on the various analyses of the test outcomes from the different modules representing the different applications of technology in instruction, there is no evidence to indicate that test performance was affected by the absence of face-to-face interaction with the instructor. The findings of this study coincide with to those of another study which had found the best predictor of achievement in undergraduate online courses to be that of academic aptitude (Bell, 2007).

The second approach evaluating student performance through learning activities highlighted notable differences between the online and the web-enhanced (in-class) learning environments. The analysis of the assignment which involved discussions within student groups indicated qualitative differences in both the breadth and depth of student responses between the different settings, while the evaluation of another, more intricate assignment, quantitatively emphasized that the physical environment (which facilitated face-to-face interactions with the instructor as well as with others in the class) resulted in superior student performance. The differences revealed in the second assignment between the learning environments were consistent with results of a study that similarly compared the three technology-infused methods and had found that significantly lower grades were earned by coursework completed in the online format than in the alternative two settings (Terry, 2007). The analyses from both learning activities serve to accentuate how the conditions of the learning environment affect how, and to what extent, the steps in the learning process are carried out. It appears that although students can adapt to the different learning environments to prepare for tests, the immediacy of the physical environment is of great assistance to the learning process.

Lastly, the present study also investigated learning styles to determine whether particular learning preferences can be associated to a favoured method of technology-infused instruction. Corresponding to findings of studies that similarly explored learning styles preferences of business students (Goorha et al, 2010; Loo,2002), the two diagnostic assessments used in the study student participants of this study found participants to be multimodal (in that they rely on several modes to perceive and process information) and that a majority preferred *assimilating* and *converging* approaches to learning (in accordance to Kolb's framework). Specifically in relation to instructional method of choice, those who had selected the web-enhanced (in-class) approach were associated to a learning style of an *assimilator* (a style characterized by the need for detailed explanations and theories), while amongst the students who selected the purely online method, they were found to have learning preferences for *active experimentation* (which include approaches that involve hands-on learning). In general however, the results highlight how no one didactical approach is suitable to respond to all the various styles and needs of the learners.

2. LIMITATIONS AND STRENGTHS OF THE STUDY

It may be assumed that the current study was limited in a way by not having incorporated and examined the effects of synchronous or real-time exchanges in the online environment. Although this exclusion likely restricted students' perceptions about the extent of the online approach (which in turn may have influenced the results of the study), it would have otherwise been detrimental to this particular research if any of the participants were unable to contribute to synchronous discussions for reasons that would include not having access to a computer during a scheduled online meeting.

Limitations of this study are primarily due to the characteristics of the sample. Even though the convenience sample satisfied research objectives, by statistical standards, it was small in size and lacked randomization since participants were limited to one program of study that was also only executed in one Cégep (albeit a large institution that is represented by a multicultural student population). However, it can be argued that by having used the same students to contrast the different instructional methods (which unlike other studies that included in their sample different students from various courses or programs of study), this consistency made the comparisons more viable, and therefore, this can be considered as a major strength of this study. Additionally, since the sections of the course used in the study were not promoted during registration as technology-driven, the convenience sample appropriately represented students with various comforts levels with technology, and not only by tech-savvy students, who are frequently attracted to such genre of courses.

3. FUTURE RECOMMENDATIONS

Considerations for future research should apply the same methodology on a sample involving second year Cégep students to examine the effects on those who are not newly initiated to tertiary education. Alternatively, a longitudinal study that examines how students adapt and evolve with technology-assisted instruction from their first year up until graduation from Cégep would also be interesting, although more challenging to execute

Since the hybrid method was so popular amongst the student of this study, there are also several options to empirically examine different types of blended approaches (an online hybrid versus a classroom hybrid) so as to investigate to what extent the component of face-to-face interaction in the classroom is missed by students of this age group. Also, as technology-assisted instruction becomes further integrated amongst Cégep courses, future studies should be directed at comparing synchronous and asynchronous learning environments.

4. CONCLUDING REMARKS

A learning environment is a complex structure of multiple variables, and for this reason, technology should not be applied haphazardly. It needs to be thoughtfully integrated in didactical strategies in ways that enhance student learning and similarly enrich their learning experiences. Each of the different methods of technology-assisted instruction has its merits, and it remains within the individual instructor's teaching philosophy to formulate the optimal instructional strategy that achieves learning objectives within a stimulating and active learner-centered environment. It is also equally important to recognize that a virtual learning setting requires participating students to have the necessary discipline to take responsibility for their learning by making use of the resources available as well as by timely managing the course requirements. At this given time, an implementation of instructional methods that include blended variations (those which maintain some level of face-to-face interactions in the learning environment) would be the most tactical approach in integrating technology at the Cégep level, particularly as it relates to first-year students.

As evolutions in technology will continue to further the acceptance of technology-assisted instruction at the Cégep level, the pace and extent of implementation will depend on the commitment and objectives not only of the individual instructor, but primarily of the academic institution which has the influence to encourage and drive such initiatives. For this reason it is important to continue the discussion as well as the exploration of the effects of technology-assisted instruction on Cégep students.

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APPENDIX A

STUDENT INFORMATION SHEETS AND CONSENT FORM

The Effects of Technology-Assisted & Technology-Based Instruction on Cégep Students

Researcher: Helen Stavaris (Dawson College) (September 2009)

INFORMATION SHEETS

Dear student, HELLO!

You have registered in one of the <u>two sections</u> of Introduction to Business this semester that is being included in an educational research study and **you are being INVITED TO PARTICIPATE in this study.**

The information has been arranged in a question and answer format to make it easy for you to follow and understand. Should you have any additional questions, do not hesitate to ask.

◘ WHAT IS THE PURPOSE OF THIS HANDOUT?

The goal of this handout is to provide you with the information about the research study so that you can make an informed decision with regards to your participation in this study. This handout consists of 2 parts:

1- **information sheets:** to inform you of the purpose and structure of the study, plus the extent of the involvement;
2- **consent form:** to obtain your consent for your participation in the study.

◘ WHY DO I HAVE TO GIVE MY CONSENT?

Your cooperation in any educational research study is <u>voluntary</u>, for which your consent must be provided. You have the right to decline participation, or to discontinue your cooperation in the study at any time, without penalty.
Note that declining participation in the study does not exclude you from doing the course work.

ABOUT THE STUDY...

The aim of the study is to understand how students at the Cégep level perform with and feel about different teaching methods using technology (web-based tools). This understanding is an important step in helping to assess what teaching methods are in the best interest of student learning at the Cégep level.

◘ HOW DO THESE TWO SECTIONS INVOLVED IN THE STUDY DIFFER FROM THE OTHER SECTIONS?

The best way is to compare them using the table below:

	these two sections	the other sections
GRADED COMPONENTS		
3 class tests	✓	✓
research project	✓	✓
assignments (in-class)	✓	✓
assignments (online)	✓	depends on the teacher[1]
participation	✓	✓
COURSE STRUCTURE		
course website	✓	✓
regular classes	✓	✓
online (virtual) classes	✓	depends on the teacher[1]
⇨ teaching methods	web-enhanced, hybrid, online	web-enhanced,hybrid[1],online[1]
COURSE MATERIAL		
material covered	same	
number of chapters covered	same (11)	
level of course difficulty	same	
textbook	same	

⇨ **As you can see, the only difference from the other sections is that all three teaching methods will be used. *Each method is explained on the next page.***

[1] Most teachers of the other sections use the web-enhanced method, but some teachers prefer the hybrid method. One section is even done completely online. This is why it "depends on the teacher".

◘ **HOW ARE ALL THREE TEACHING METHODS GOING TO BE APPLIED IN ONE COURSE?**

There are <u>three modules</u> in the course (one for each test). Each module will use a different method (see below).

2 sections	Module 1	Module 2	Module 3
one section	HYBRID teaching method *(alternating between in-class and online)*	ONLINE teaching method *(conducted entirely online)*	WEB-ENHANCED teaching method *(conducted entirely in class, accompanied by support materials on the course website)*
the other section	HYBRID teaching method *(alternating between in-class and online)*	WEB-ENHANCED teaching method *(conducted entirely in class, accompanied by support materials on the course website)*	ONLINE teaching method *(conducted entirely online)*
	TEST 1	TEST 2	TEST 3

◘ **HAVE THESE TEACHING METHODS BEEN APPLIED BEFORE?**

The teacher has 11 years of experience in teaching, and expertise in using technology in teaching. She has applied the different teaching methods with other students, who reported to have liked the flexibility and convenience offered by the web-based components.

◘ **WHAT'S IN IT FOR ME?**

Technology in teaching is becoming very popular. You are in a unique position to compare all the three methods in one course and stand to benefit by being able to identify your preferred teaching method. This knowledge will likely help guide you in selecting future courses that are taught partially or fully online. The study is being conducted as part of a master's degree program and no funding is available to compensate the participants. **Your contribution will play a <u>valuable role</u> in understanding the different teaching methods at the Cégep level!**

◘ **WHAT DO I HAVE TO DO TO PARTICIPATE IN THIS STUDY?**

<u>Your feedback</u> will provide valuable data for this study. In addition to filling out a general information profile, you will also be asked to complete a *brief* questionnaire at the end of each module indicating what you liked and what you did not like about each particular teaching method. For statistical purposes, the grade of each of the three tests in relation to the corresponding teaching method will be also taken into account, but there is no extra work involved for this.

◘ **WILL MY FEEDBACK BE USED AGAINST ME?**

NO. When the researcher is also the teacher of the course the possibility of bias may be a concern. However, **<u>to prevent any prejudice</u> against students of the course and to ensure that the privacy and confidentiality of participants are maintained, <u>the following measures have been taken</u>:**

• Consent forms indicating the choice of whether or not to participate in the study will be kept by a third party. The teacher/researcher will <u>not</u> be aware of who is participating in the study during the semester.

• All the data collected for the purposes of this research **WILL NOT BE SORTED OR ANALYZED <u>UNTIL AFTER</u> THE FINAL MARKS OF THE COURSE HAVE BEEN SUBMITTED TO THE COLLEGE (after mid-December).**

• For the time the information is being analyzed (after the end of the semester), all documents collected by participants will be safeguarded by the researcher and will be kept strictly **PRIVATE and CONFIDENTIAL**. They will be kept to a maximum of 5 years after the study is completed and shredded afterwards.

• **NO NAMES OR OTHER IDENTIFICATION will be used in reporting the results of the study.** Even though data collected by this project may be published, used with other data sets, and/or used in a future study, or series of studies, on the research topic, **the goal of research is to *report percentages* and *other statistical information (which is <u>collective</u> and <u>anonymous</u>... always!)***

◘ **AM I ALLOWED TO ASK QUESTIONS ABOUT THE STUDY?**

• You are **encouraged** to address questions at any time about the nature and structure of the study to the teacher/researcher, Helen Stavaris <u>hstavaris@dawsoncollege.qc.ca</u> 514-931-8731 ext. 1277 room 4H.13.

• Any questions related to the ethical conduct of the researcher should be directed to the College's Ombudsman, Ken Ekins <u>kekins@dawsoncollege.qc.ca</u> 514-931-8731 ext. 1182 room 2E.6.

• If you decide to discontinue your participation in the study, you must state your intentions in writing before the last class to the supervisor of this study, Beverly Sing <u>bsing@dawsoncollege.qc.ca</u>.

• The researcher reserves the right not to use participant feedback that is not believed to be offered in good faith.

Research Project:
The Effects of Technology-Assisted & Technology-Based Instruction on Cégep Students
Researcher: Helen Stavaris (Dawson College) **(September 2009)**

CONSENT FORM

I certify to have read the accompanying information sheets and understand the responsibilities, conditions, stakes and benefits of participation.

I freely consent to participate in this research study conducted within the Introduction to Business course (401-101-DW) during the fall 2009 semester.

Student Name (please print): _____

Student Number: | A | | | | | | |

➡ **Student's Signature:** _____ **Date:** _____

****FOR PARTICIPANTS UNDER THE AGE OF 18 YEARS, consent by a parent/guardian is required.****

I am the legal parent or guardian for _____(**Student Name**) whose date of birth is _____(**dd-mm-yyyy**).

I certify to have read the accompanying information sheets and understand the responsibilities, conditions, stakes and benefits of participation.

Name of Parent or Guardian (please print): _____

➡ **Signature of Parent or Guardian:** _____ **Date:** _____

Student Number: | A | | | | | | |

INSTRUCTIONS for submitting the consent form:

✦ Place this CONSENT FORM in the envelope provided and SEAL IT.

✦ SUBMIT IT to the person collecting these envelopes **on** or **before SEPTEMBER 3, 2009**.
These envelopes will be safeguarded until the end of the semester and will only be given them to the researcher AFTER the final marks for the course have been submitted.

Optional: If you would like a copy of the study's findings (the report), please provide your email address (below). It will be sent to you at the completion of the study (expected: end of 2010). Email address:

APPENDIX B

GENERAL PROFILE QUESTIONNAIRE

Student Number: | A | | | | | | |

General Profile [A]

ALL QUESTIONNAIRES WILL BE LOOKED AT ONLY AFTER THE END OF THE SEMESTER!
So please answer honestly. The intention is to understand how you work... NOT to judge you.

A. My Comfort with Technology

1. My computer access is best described as -

- ☐ I have my own laptop.
- ☐ I have my own computer at home.
- ☐ I share a computer with others at home.
- ☐ I don't have a computer. I only have access to a computer at school or elsewhere.

2. When it comes to learning new technology -

- ☐ I welcome any opportunity to learn and master new technologies.
- ☐ I like to learn.
- ☐ I get nervous around new technologies,
- ☐ I get very nervous around technology and would rather not try it.

3. When it comes to dealing with technology problems -

- ☐ I can handle any problem with technology.
- ☐ I like trying to solve technology problems on my own.
- ☐ I can follow directions but I don't feel comfortable solving technology problems on my own.
- ☐ I'll ask for help as soon as something goes wrong.

4. This is how often I -

	VERY OFTEN	OFTEN	SOMETIMES	RARELY	NEVER
• EMAIL	❑	❑	❑	❑	❑
• SURF THE NET.....	❑	❑	❑	❑	❑
• FACEBOOK.....	❑	❑	❑	❑	❑
• TWITTER.....	❑	❑	❑	❑	❑
• CHAT ONLINE.....	❑	❑	❑	❑	❑
• BLOG.....	❑	❑	❑	❑	❑
• DOWNLOAD.....	❑	❑	❑	❑	❑

5. My feeling about doing some of the course online is -

- ☐ I am very much looking forward to it.
- ☐ I am curious to see how this works.
- ☐ I am not sure, but willing to try.
- ☐ I prefer to switch to another class.

B. My Skills, Habits and Attitude towards School

1. My attitude towards being in Cégep is -

- ☐ I am happy to be here.
- ☐ I would rather be in a different program. *Which?* Specify >_____
- ☐ My parents have forced me to come to Cégep. I would rather be working full time.
- ☐ Other. *Please specify:*

2. My attitude towards going to my classes is -

- ☐ I would never miss class.
- ☐ It depends on how interesting the teacher is.
- ☐ It's OK to miss a few classes.
- ☐ Other. *Please specify:*

3. My attitude towards working with others students -

- ☐ I really like working with others.
- ☐ I don't mind working with others, but not all the time.
- ☐ I prefer to work alone.
- ☐ Other. *Please specify:*

4. When it comes to class discussions, I find them -

- ☐ Useful in helping me learn. I almost always participate in class discussions.
- ☐ Somewhat important to my learning. I sometimes participate in class discussions.
- ☐ Not very useful to me. I don't usually participate in class discussions.
- ☐ Other. *Please specify:*

5. When it comes to deadlines -

- ☐ I am very organized and self-disciplined. I hate leaving things to the last minute.
- ☐ I try to organize my time, but I need reminders for assignments' due dates.
- ☐ I always leave everything to the last minute.
- ☐ Other. *Please specify:*

6. When I need help with school work -

- ☐ I feel comfortable asking the instructor questions or asking for help when I need it.
- ☐ I hesitate to ask questions in class, but I will ask the instructor for help if I need it.
- ☐ I don't like to ask questions or ask for help.
- ☐ Other. *Please specify:*

7. My reading and writing abilities are -

- ☐ I enjoy reading and writing and have confidence in my abilities.
- ☐ I read well but I'm not comfortable expressing myself in writing.
- ☐ I don't like reading. I prefer classes without a lot of writing assignments.
- ☐ Other. *Please specify:*

8. Class discussions are -

- ☐ Useful in helping me learn. I almost always participate in class discussions.
- ☐ Somewhat important to my learning. I sometimes participate in class discussions.
- ☐ Not very useful to me. I don't usually participate in class discussions.
- ☐ Other. *Please specify:*

C. About you

1. Gender? ❑ Male ❑ Female

2. Age? _____

3. What other business courses have you taken before this one? Please specify:

4. What is you intention after finishing Cégep? *(check one)*

- ☐ go to university
- ☐ go work first, then maybe go to university
- ☐ go directly to work
- ☐ start my own business/ or work with someone else
- ☐ not sure yet

5. Have you transferred to Social Science from another program? _____ *If yes, which program was it?* > _____

6. How many courses are you taking this semester? _____

7. a) What was your high school average? *(check one)*

❑ under 60 ❑ 60-69 ❑ 70-79 ❑ 80-89 ❑ 90 or over

b) What is your cumulative CRC? *(check one)* *If this is your first year at Cégep go to the next question.*

❑ under 19.99 ❑ 20 to 23.99 ❑ 24 to 26.99 ❑ 27 to 29.99 ❑ 30 or over ❑ no idea

8. In which language did you study in high school? _____

9. What language do you primarily speak at home? _____

10. How many <u>hours PER WEEK</u> do you spend on each of the following activities?

HOURS	0	1-5	6-10	11-15	16-20	21-25	26-29	31+
• working for pay at a job (off campus)	❑	❑	❑	❑	❑	❑	❑	❑
• working for pay at the College	❑	❑	❑	❑	❑	❑	❑	❑
• participating in sports	❑	❑	❑	❑	❑	❑	❑	❑
• participating in co-curricular activities (student government, student clubs, college newspaper, etc.)	❑	❑	❑	❑	❑	❑	❑	❑
• relaxing and socializing	❑	❑	❑	❑	❑	❑	❑	❑
•providing care for dependents living with you (children, parents, spouse)	❑	❑	❑	❑	❑	❑	❑	❑

APPENDIX C

HYBRID MODULE QUESTIONNAIRE

Student Number: | A | | | | | | | **Hybrid** [1]

ALL QUESTIONNAIRES WILL BE LOOKED AT ONLY AFTER THE END OF THE SEMESTER!
So please answer honestly. The intention is to understand how you work... NOT to judge you.

1. On a scale of 1 to 5, how did you feel about having an online class once a week ? *(circle one)*

1	2	3	4	5
Hate it		Don't care		Love it

On a scale of 1 to 5, how do you feel the different approaches used in this course have affected your learning?

2. in-class info & activities *(circle one)* 1 2 3 4 5

Not helpful Somewhat helpful Very helpful

3. online info & activities *(circle one)* 1 2 3 4 5

4. What did you LIKE about having an online class once a week? *(check as many as apply)*

- ☐ Being able to learn without having to be in class so often.
- ☐ Being able to work at my own pace.
- ☐ Having a more flexible schedule.
- ☐ Having the opportunity to do both: work online *and* meet in class.
- ☐ Other. Please specify >_____

5. What did you NOT LIKE about having an online class once a week? *(check as many as apply)*

- ☐ Not having live interaction with the teacher.
- ☐ Not having the teacher to answer questions immediately.
- ☐ Not having live interaction with other students.
- ☐ It is too complicated to follow.
- ☐ Other. Please specify >_____

6. What kind of questions have you asked the teacher so far *(and how)*? *(check as many as apply)*

- ☐ To ask for help/clarification with course material >> ***how?*** >> ☐ in class ☐ by email or online
- ☐ To ask for help/clarification with online activities >> ☐ in class ☐ by email or online
- ☐ To ask for help/clarification with the project >> ☐ in class ☐ by email or online
- ☐ To ask about the test >> ☐ in class ☐ by email or online
- ☐ To ask for help with Moodle >> ☐ in class ☐ by email or online
- ☐ Other >_____ >> ☐ in class ☐ by email or online

7. On a scale of 1 to 10, how difficult do YOU find this course compared to your other courses. *(circle one)*

much easier 1 2 3 4 5 6 7 8 9 10 much more difficult

8. How long did you study for this test? (*circle one)*

• *Less than 1 hour* • *1-2 hours* • *3-4 hours* • *4-5 hours* • *more than 6 hours*

9. What do you expect your grade to be for this test? *(circle one)*

• *a failing grade* • *in the 60's* • *in the 70's* • *in the 80's* • *in the 90's*

10. If you could do this course again, how would you prefer it? *(Check ONLY ONE)*

- ☐ entirely online
- ☐ entirely in class
- ☐ keep as is: one class online and the other in the classroom

11. Do you have any other courses this semester for which you have assignments online? *(circle one)* ***Yes No***

12. What ADDITIONAL COMMENTS would you like to make about having an online class once a week?

- - - **THANK YOU** - - -

Please put your completed questionnaire in the large envelope which will be sealed before being given to me.

APPENDIX D

WEB-ENHANCED (IN-CLASS) MODULE QUESTIONNAIRE

Student Number: | A | | | | | | | **Web-enhanced** [2nd or 3rd]

ALL QUESTIONNAIRES WILL BE LOOKED AT ONLY AFTER THE END OF THE SEMESTER!
So please answer honestly. The intention is to understand how you work... NOT to judge you.

---

1. On a scale of 1 to 5, how did you feel about having BOTH CLASSES held IN CLASS during the week? *(circle one)*

1	2	3	4	5
Hate it		Neutral		Love it

2. Compared to the first part of the course (where one class was in-class and the other was online),
how do you feel NOW about the ONLINE CLASS ONCE A WEEK? *(circle one)*

1	2	3	4	5
I prefer both classes in-class		Either way is fine		I prefer online once a week

3. Compared to the first part of the course (where one class was in-class and the other was online),
how do you feel your LEARNING has been affected by having BOTH CLASSES held IN CLASS

1	2	3	4	5
Worse		No difference		Better

4. What did you LIKE about having BOTH CLASSES held IN CLASS? *(check as many as apply)*

- ☐ Having live interaction with the teacher.
- ☐ Having the teacher to answer questions immediately.
- ☐ Having live interaction with other students.
- ☐ Feeling more secure about what I am learning.
- ☐ Being able to complete the learning activities/assignments in class so as not to have homework.
- ☐ Being able to make friends with others in the class.
- ☐ Other. Please specify >_____

5. What did you NOT LIKE about having BOTH CLASSES held IN CLASS? *(check as many as apply)*

- ☐ Having to be in class so often.
- ☐ Not being able to work at my own pace.
- ☐ Not having enough time to complete the learning activities/assignments in class.
- ☐ Feeling the social pressure of class or group discussions.
- ☐ Having less flexibility in my schedule.
- ☐ Having to get up for the 8:30 morning class OR having a class during the lunch hour (11:30am-1:00pm).
- ☐ Other. Please specify >_____

6. Did you ask the teacher any questions during this part of the course (either online or by email)? ***Yes No***

7. On a scale of 1 to 10, how difficult do YOU find this course compared to your other courses. *(circle one)*

much easier 1 2 3 4 5 6 7 8 9 10 much more difficult

8. How long did you study for this test? (*circle one)*

• *Less than 1 hour* • *1-2 hours* • *3-4 hours* • *4-5 hours* • *more than 6 hours*

9. What do you expect your grade to be for this test? *(circle one)*

• *a failing grade* • *in the 60's* • *in the 70's* • *in the 80's* • *in the 90's*

10. If you could do this course again, how would you prefer it? *(Check ONLY ONE)*

- ☐ entirely online
- ☐ entirely in class
- ☐ one class online and the other in the classroom

11. My level of motivation to learn in THIS COURSE is - *(circle one)* • *low* • *medium* • *high*

12. What ADDITIONAL COMMENTS would you like to make about having BOTH classes in-class? >*back >*

APPENDIX E

ONLINE MODULE QUESTIONNAIRE

Student Number: | A | | | | | | |

Online 2nd or 3rd

ALL QUESTIONNAIRES WILL BE LOOKED AT ONLY AFTER THE END OF THE SEMESTER!
So please answer honestly. The intention is to understand how you work... NOT to judge you.

---

1. On a scale of 1 to 5, how did you feel about having BOTH CLASSES ONLINE during the week? *(circle one)*

1	2	3	4	5
Hate it		Neutral		Love it

2. Compared to the first part of the course (where one class was in-class and the other was online),
on a scale of 1 to 5, how do you feel NOW about the ONLINE CLASS ONCE A WEEK? *(circle one)*

1	2	3	4	5
I prefer both classes online		Either way is fine		I prefer online once a week

3. Compared to the first part of the course (where one class was in-class and the other was online),
how do you feel your LEARNING has been affected by having BOTH CLASSES ONLINE *(circle one)*

1	2	3	4	5
Worse		No difference		Better

4. What did you LIKE about having BOTH CLASSES ONLINE? *(check as many as apply)*

- ☐ Being able to learn without having to be in class.
- ☐ Being able to work at my own pace.
- ☐ Being able to contribute to discussions without the social pressure.
- ☐ Being able to do the learning activities/assignments whenever I wanted to before the deadline.
- ☐ Having more flexibility in my schedule.
- ☐ Having the opportunity to finish earlier in the day.
- ☐ Other. Please specify >_____

5. What did you NOT LIKE about having BOTH CLASSES ONLINE? *(check as many as apply)*

- ☐ Not having live interaction with the teacher.
- ☐ Not having the teacher to answer questions immediately.
- ☐ Not having live interaction with other students.
- ☐ Feeling more insecure about what I am learning.
- ☐ Having to be more self-disciplined about deadlines.
- ☐ Not being able to make friends with others in the class.
- ☐ Other. Please specify >_____

6. Did you ask the teacher any questions during this part of the course (either online or by email)? ***Yes No***

7. On a scale of 1 to 10, how difficult do YOU find this course compared to your other courses. *(circle one)*

much easier 1 2 3 4 5 6 7 8 9 10 much more difficult

8. How long did you study for this test? (*circle one)*

• Less than 1 hour • 1-2 hours • 3-4 hours • 4-5 hours • more than 6 hours

9. What do you expect your grade to be for this test? *(circle one)*

• a failing grade • in the 60's • in the 70's • in the 80's • in the 90's

10. If you could do this course again, how would you prefer it? *(Check ONLY ONE)*

- ☐ entirely online
- ☐ entirely in class
- ☐ one class online and the other in the classroom

11. My level of motivation to learn in THIS COURSE is - *(circle one)* *• low • medium • high*

12. What ADDITIONAL COMMENTS would you like to make about having BOTH classes online? *>back >*

APPENDIX F

KOLB'S LEARNING STYLE QUESTIONNAIRE

Student Number: | A | | | | | | |

Kolb [B]

How to answer this self-assessment

Below are 10 statements. For each statement distribute 5 points between the A and B alternatives.

Put more points on the statement that describes you more. Try to recall situations at work/ school.

EXAMPLE Q: When hearing a new song for the first time:

_____ A. I pay attention to the lyrics (the words).

_____ B . I pay attention to the melody (the music).

► **How to answer – IF YOU FEEL VERY STRONGLY ABOUT ONE ANSWER**

>… I don' t care about the lyrics ; >… it's all about the music! ► **your allocation would show A = 0; B = 5**

► **How to answer – IF YOU FEEL BOTH ARE IMPORTANT (but you lean a little more towards one)**

>… the lyrics are important; >… but so is the music ► **your allocation would show A = 3; B = 2**

*Note** **you can also assign 4 & 1 OR 2.5 & 2.5** (only if you feel the same about both statements)

► START

1. When learning: _____ A. I watch and listen. _____ B .I get involved and participate. (the allocation must total 5)	2. When learning: _____ A. I rely on my hunches (instinct) & feelings. _____ B. I rely on logical and rational thinking. (the allocation must total 5)
3. When making decisions: _____ A. I take my time. _____ B. I make them quickly. (the allocation must total 5)	4. When making decisions: _____ A. I make them based on my "gut feelings" _____ B. I make them based on a logical analysis of the situation. (the allocation must total 5)
5. When doing things: _____ A. I am careful. _____ B. I am practical. (the allocation must total 5)	6. When doing things: _____ A. I have strong feelings and reactions. _____ B. I reason things out. (the allocation must total 5)
7. I would describe myself in the following way: _____ A. I am a reflective person. _____ B. I am an active person. (the allocation must total 5)	8. I would describe myself in the following way: _____ A. I am influenced by my emotions. _____ B. I am influenced by my thoughts. (the allocation must total 5)
9. When interacting in small groups: _____ A. I listen, watch, and get involved slowly. _____ B. I am quick to get involved. (the allocation must total 5)	10. When interacting in small groups: _____ A. I express what I am "feeling" _____ B. I say what I am "thinking" (the allocation must total 5)

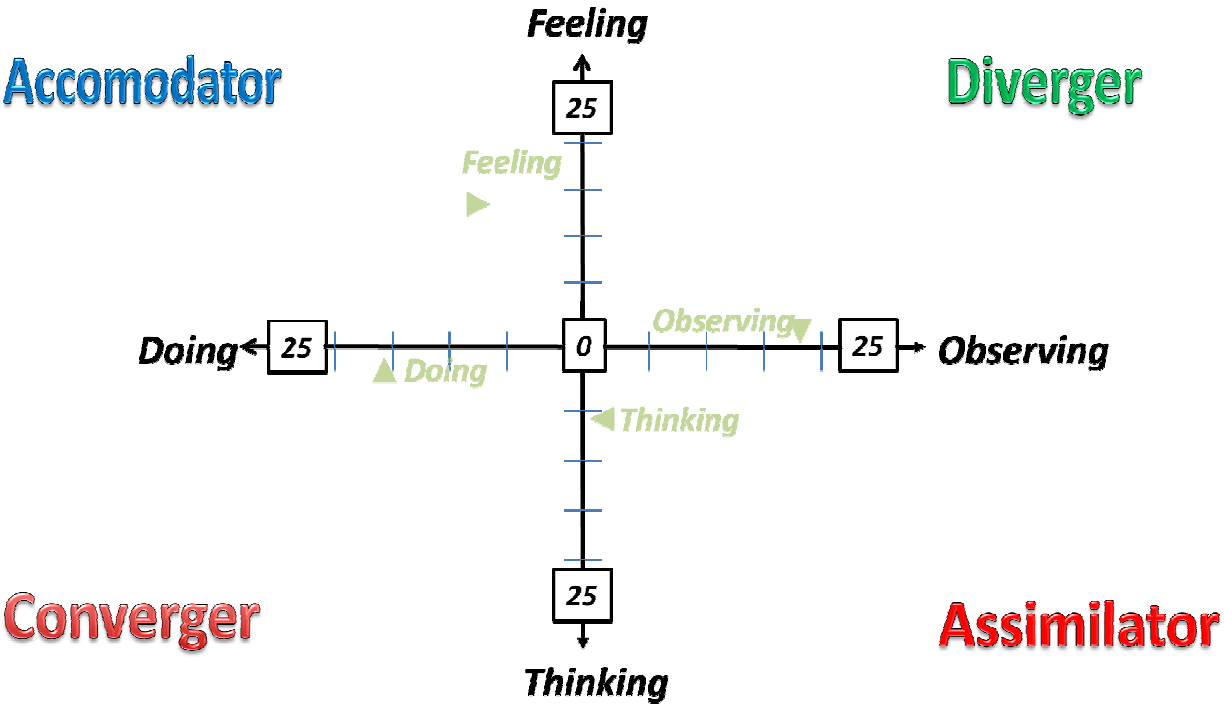
Kolb SCORING

1) COPY your answers from the previous page - be sure the numbers correspond.

2) ADD the numbers in each column vertically. Each of the 4 columns should have a number between 0 and 25 AND the total of the two A and B columns on each side should equal 25.

1.	_____ A.	_____ B.		2.	_____ A.	_____ B.	
3.	_____ A.	_____ B.		4.	_____ A.	_____ B.	
5.	_____ A.	_____ B.		6.	_____ A.	_____ B.	
7.	_____ A.	_____ B.		8.	_____ A.	_____ B.	
9.	_____ A.	_____ B.		10.	_____ A.	_____ B.	
Totals:	**_____ A.**	**_____ B. (/25)**		**Totals:**	**_____ A.**	**_____ B. (/25)**	
	Observing	Doing			Feeling	Thinking	

3) GRAPH EACH of the SCORES by putting an "X" along the corresponding axis.

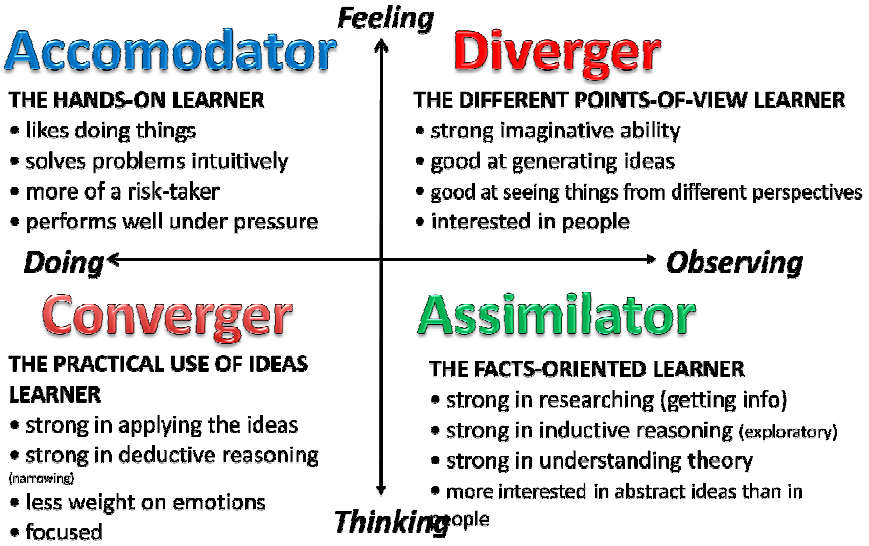


4) CONNECT THE "X"s - form a "kite"

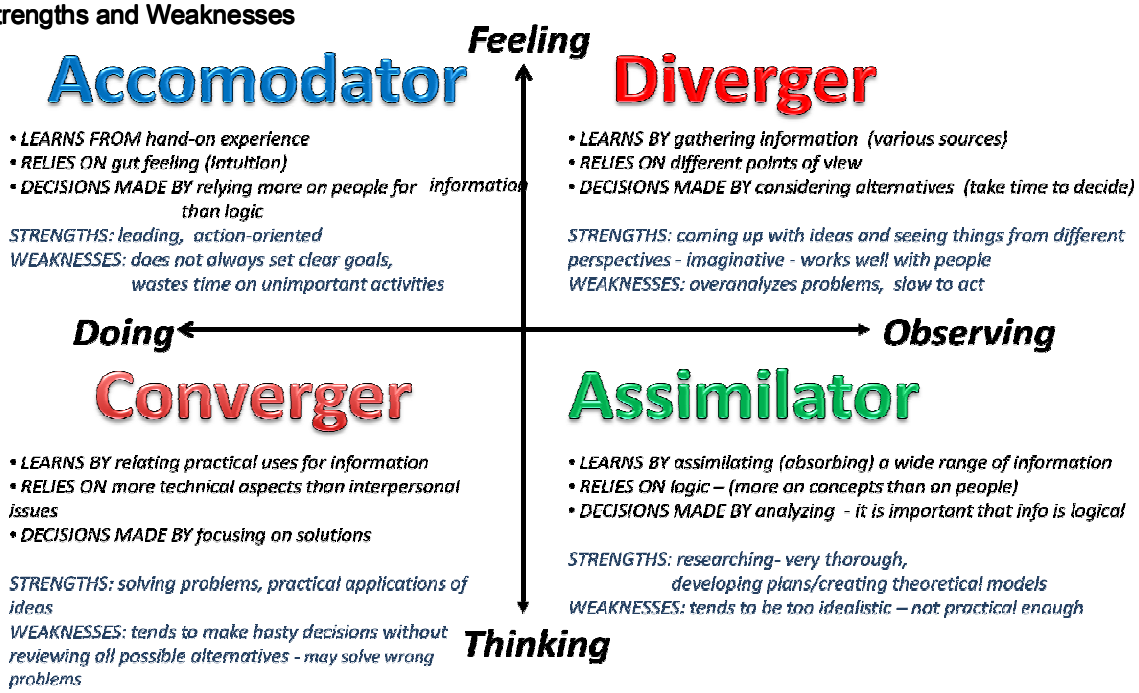
5) IDENTIFY your PREDOMINATE and Secondary Learning Style

INTERPRETING the SCORES

The Descriptions



The Strengths and Weaknesses



A few more points...

• No one is a "pure" learning style. But, if your intersection point falls in a far corner of the grid, you tend to rely heavily on that particular learning style. • The closer the scores to the axis, the more flexible your learning style.

• "Kites" such as  indicate more flexibility to ALL the learning styles.

Sources: 1. *Human Relations in Organizations: Applications and Skill Building* , *Robert N. Lussier, McGraw-Hill Irwin*

2. HAYGroup *http://www.haygroup.com/tl/Questionnaires_Workbooks/Kolb_Learning_Style_Inventory.aspx*

APPENDIX G

THE VARK QUESTIONNAIRE

Student Number: | A | | | | | | |

VARK [C]

How to answer this self-assessment

- *Choose the answer which **best explains your preference**.*
- *If more than one answer applies **check-off as many as apply.***
- *If **none** of the available answers apply, **leave blank.***

► START

1. I like websites that have:

a. things I can click on and do.
b. audio channels for music, chat and discussion.
c. interesting information and articles in print.
d. interesting design and visual effects.

2. You are not sure whether a word should be spelled 'dependent' or 'dependant'. You would:

a. see the words in your mind and choose by how they look.
b. hear them in your mind or out loud.
c. find them in the dictionary.
d. write both words on paper and choose one.

3. You want to plan a surprise party for a friend. You would:

a. invite friends and just let it happen.
b. imagine the party happening.
c. make lists of what to do and what to buy for the party.
d. talk about it on the phone or text others.

4. You are going to make something special for your family. You would:

a. make something you have made before.
b. talk it over with your friends.
c. look for ideas and plans in books and magazines.
d. find written instructions to make it.

5. You have been put in charge of organizing a weekend camp for your friends. You would:

a. describe the activities you will be doing at camp.
b. show them the map of where it will be held and photos about it.
c. start practising the activities you will be doing.
d. show them the list of activities in the program.

6. You are about to buy a new digital camera or mobile phone. Other than price, what would most influence your decision?

a. trying it.
b. reading the details about its features.
c. it is the latest design and looks good.
d. the salesperson telling me about it.

7. Remember when you learned how to play a new computer or board game. You learned best by:

a. watching others do it first.
b. listening to somebody explaining it and asking questions.
c. clues from the diagrams in the instructions.
d. reading the instructions.

8. After reading a play (or a novel) you need to do a project. Would you prefer to -

a. write about the play.
b. act out a scene from the play.
c. draw or sketch something that happened in the play.
d. read a speech from the play.

9. You are about to hook up your parents' new computer. You would:

a. read the instructions that came with it.
b. phone, text or email a friend and ask how to do it.
c. unpack the box and start putting the pieces together.
d. follow the diagrams that show how it is done.

10.Someone is asking you for directions to go to a house in the neighbourhood. You would:

a. walk with them.
b. draw a map on a piece of paper or get a map online.
c. write down the directions as a list.
d. tell them the directions.

11.You have a problem with your knee. Would you prefer that the doctor:

a. showed you a diagram of what was wrong.
b. gave you an article or brochure that explained knee injuries.
c. described to you what was wrong.
d. demonstrated what was wrong using a model of a knee.

12. A new movie was released last week. What would most influence your decision to go (or not go)?

a. you hear friends talking about it.
b. you read what others say about it online or in a magazine.
c. you see a preview of it.
d. it is similar to others you have liked.

13. You prefer a teacher who likes to use:

a. demonstrations, models or practical sessions.
b. class discussions, online discussion, online chat and guest speakers.
c. a textbook and plenty of handouts.
d. an overview diagram, charts, labelled diagrams and maps.

14.You are learning to take photos with your new digital camera or mobile phone. You would like to have:

a. examples of good and poor photos and how to improve them.
b. clear written instructions with lists and bullet points.
c. a chance to ask questions and talk about the camera's features.
d. diagrams showing the camera and how to use it.

15. How would you like to have feedback about a big project/assignment:

a. be given examples of what you did right/wrong.
b. have the teacher discuss it with you.
c. receive a written description your results.
d. receive a graph showing how you did compared to the expectations.

16. You have to present your ideas to the class. You would:

a. make diagrams or get graphs to help explain my ideas.
b. write a few key words and practice what to say again and again.
c. write out your speech and learn it by reading it again and again.
d. gather examples and stories to make it real and practical.

Student Number: | A | | | | | | |

VARK SCORING CHART

Circle the letters that correspond to your answers

Fold

					A	B	C	D
1 .	A	B	C	D	K	A	R	V
2 .	A	B	C	D	V	A	R	K
3 .	A	B	C	D	K	V	R	A
4 .	A	B	C	D	K	A	V	R
5 .	A	B	C	D	A	V	K	R
6 .	A	B	C	D	K	R	V	A
7 .	A	B	C	D	K	A	V	R
8 .	A	B	C	D	R	K	A	V
9.	A	B	C	D	R	A	K	V
10.	A	B	C	D	K	V	R	A
11 .	A	B	C	D	V	R	A	K
12 .	A	B	C	D	A	R	V	K
13 .	A	B	C	D	K	A	R	V
14 .	A	B	C	D	K	R	A	V
15 .	A	B	C	D	K	A	R	V
16 .	A	B	C	D	V	A	R	K

Calculating your scores

Unfold

Using just the right side of the page,

count and mark the number of each of the VARK letters you have circled to get your score for each VARK category.

Total number of **V**s circled = 

Total number of **A**s circled = 

Total number of **R**s circled = 

Total number of **K**s circled = 

- **V VISUAL learner**
- **A AUDIO learner**
- **R READING learner**
- **K KINESTHETIC learner**

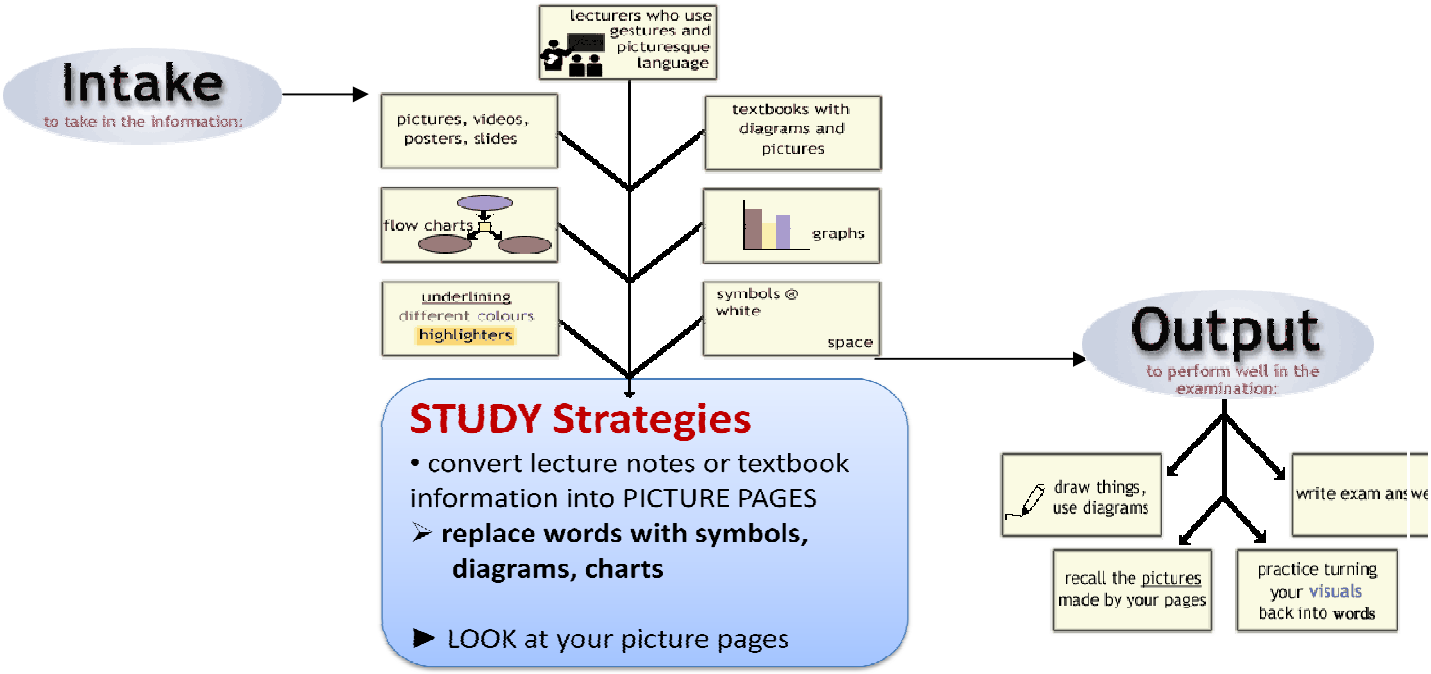
► *see the handout for explanations and study strategies*

Interpreting your VARK scores *Source: http://www.vark-learn.com/english/page.asp?/*

The higher your score in a category, the more your rely on the particular style to learn or work.
► Consider how you take in the information (INTAKE) and the best STUDY STRATEGIES and the best approach to perform well in exams (OUTPUT).

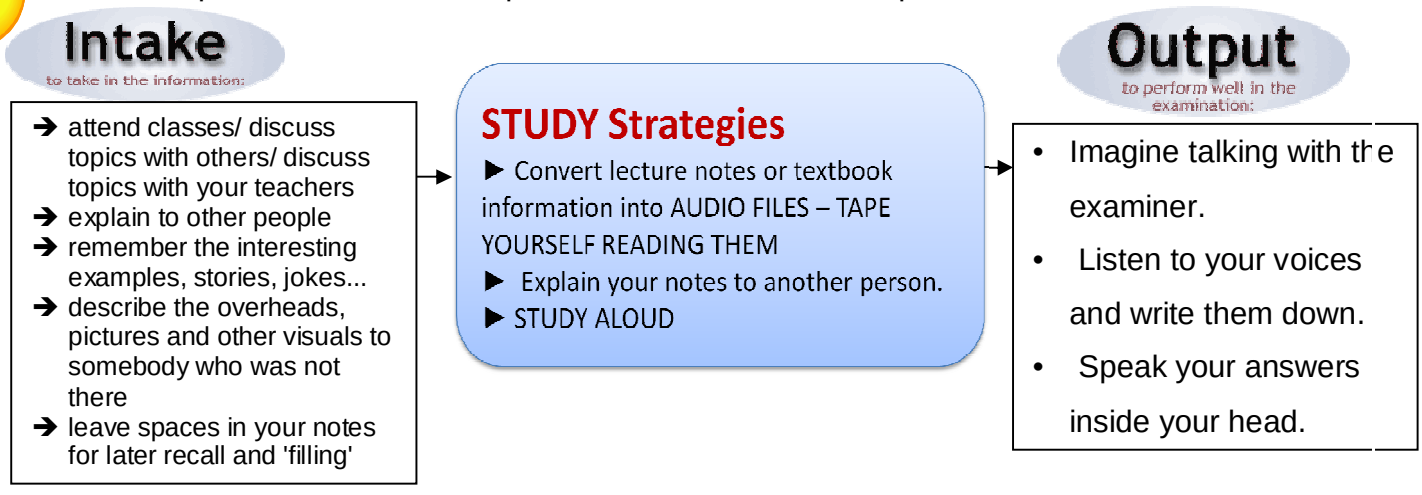
V VISUAL learners

- absorb information more through visual aids > diagrams, graphs, maps, photos
- describe things in terms of appearances
- perform well on written assignments



A AUDIO learners *(read this out loud)*

- absorb information more through discussions, teachings, sounds, music
- reading aloud helps them to retain information
- perform better on oral presentations than written reports



R READING learners

- absorb information more through reading

Intake
to take in the information:

- ➔ make notes / lists / headings
- ➔ use dictionaries / glossaries
- ➔ read handouts / textbooks
- ➔ read your notes (silently) again and again.
- ➔ organize any diagrams, graphs ... into statements, e.g. "The trend is...

STUDY Strategies

- ▶ REWRITE lecture notes or textbook information
- ▶ WRITE ideas and principles into other words.
- ▶ Convert diagrams, charts and flows INTO WORDS.

Output
to perform well in the examination:

- Write out thoughts on your befor answering a multiple choice test.
- Jot down key points/thoughts before answering an essay test.

K KINESTHETIC learners

- absorb information more through hands-on tasks
- tend to become frustrated when sitting for too long
- perform better when exploring, performing tasks, conducting experiments

Intake
to take in the information:

- ➔ Look for examples in the notes or textbook
- ➔ Trial and error
- ➔ Applications

STUDY Strategies

- ▶ consider the examples in the notes/text
- ▶ recall examples given in class
- ▶ try to give your own example think of practical uses for the info
- ▶ do PRACTICE EXERCISES

Output
to perform well in the examination:

- ➔ connect the test question to the examples studied
- ➔ think of practical uses for the info provided in the question

APPENDIX H

STATISTICAL ANALYSES (SPSS OUTPUT)

Descriptive Statistics - Frequencies:

Gender

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	F	39	52.0	52.0	52.0
	M	36	48.0	48.0	100.0
	Total	75	100.0	100.0	

Age

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	16	4	5.3	5.3	5.3
	17	68	90.7	90.7	96.0
	18	3	4.0	4.0	100.0
	Total	75	100.0	100.0	

High School Average

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	70s	26	34.7	34.7	34.7
	80s	49	65.3	65.3	100.0
	Total	75	100.0	100.0	

Goal after Graduation from Cégep

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	university	68	90.7	90.7	90.7
	own business	1	1.3	1.3	92.0
	not sure	6	8.0	8.0	100.0
	Total	75	100.0	100.0	

Language of High School Studies

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	English	36	48.0	48.0	48.0
	French	27	36.0	36.0	84.0
	Both	12	16.0	16.0	100.0
	Total	75	100.0	100.0	

Chi Square Test:

LANGUAGE OF STUDY and TEST PERFORMANCE

Language of Study with ►	HYBRID Module Test Grades			ONLINE Module Test Grades			IN-CLASS Module Test Grades		
	Value	df	Asymp. Sig. (2-sided)	Value	df	Asymp. Sig. (2-sided)	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	12.544(a)	6	.051	4.970(b)	6	.548	10.034(c)	6	.123
Likelihood Ratio	15.549	6	.016	7.073	6	.314	10.428	6	.108
Linear-by-Linear Association	.311	1	.577	2.168	1	.141	1.057	1	.304
N of Valid Cases	75			75			75		

(a) 6 cells (50.0%) have expected count less than 5. The minimum expected count is 1.44.
(b) 4 cells (33.3%) have expected count less than 5. The minimum expected count is 2.24.
(c) 6 cells (50.0%) have expected count less than 5. The minimum expected count is 1.76.

Chi Square Test:

WORK/EXTRACURRICULAR HOURS PER WEEK and TEST PERFORMANCE

Hours with ►	HYBRID Module Test Grades			ONLINE Module Test Grades			IN-CLASS Module Test Grades		
	Value	df	Asymp. Sig. (2-sided)	Value	df	Asymp. Sig. (2-sided)	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	10.910(a)	15	.759	14.799(b)	15	.466	21.547(c)	15	.120
Likelihood Ratio	12.565	15	.636	17.181	15	.308	23.631	15	.072
Linear-by-Linear Association	.170	1	.680	.007	1	.931	1.140	1	.286
N of Valid Cases	75			75			75		

(a) 19 cells (79.2%) have expected count less than 5. The minimum expected count is .12.
(b) 18 cells (75.0%) have expected count less than 5. The minimum expected count is .19.
(c) 19 cells (79.2%) have expected count less than 5. The minimum expected count is .15.

Test of Correlation:

DEGREE OF COMFORT WITH ONLINE ENVIRONMENT and TEST PERFORMANCE

		► degree of comfort with online apps	test grade ONL	test grade CLA	test grade HYB
degree of comfort with online apps	**Pearson Correlation**	**1**	-.100	-.079	.039
	Sig. (2-tailed)		.393	.499	.741
	N	**75**	75	75	75
► test grade ONL	**Pearson Correlation**	**-.100**	1	.341(**)	.237(*)
	Sig. (2-tailed)	**.393**		.003	.040
	N	**75**	75	75	75
► test grade CLA	**Pearson Correlation**	**-.079**	.341(**)	1	.132
	Sig. (2-tailed)	**.499**	.003		.261
	N	**75**	75	75	75
► test grade HYB	**Pearson Correlation**	**.039**	.237(*)	.132	1
	Sig. (2-tailed)	**.741**	.040	.261	
	N	**75**	75	75	75

** Correlation is significant at the 0.01 level (2-tailed).
* Correlation is significant at the 0.05 level (2-tailed).

Descriptive Statistics - Frequencies:

STUDENTS' PREFERRED METHOD OF INSTRUCTION
AFTER THE HYBRID MODULE

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	entirely online	5	6.7	6.7	6.7
	entirely in class	7	9.3	9.3	16.0
	50-50 hybrid	63	84.0	84.0	100.0
	Total	75	100.0	100.0	

STUDENTS' PREFERRED METHOD OF INSTRUCTION
AFTER THE ONLINE MODULE

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	entirely online	12	16.0	16.0	16.0
	entirely in class	7	9.3	9.3	25.3
	50-50 hybrid	56	74.7	74.7	100.0
	Total	75	100.0	100.0	

STUDENTS' PREFERRED METHOD OF INSTRUCTION
AFTER THE WEB-ENHANCED (IN-CLASS) MODULE

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	entirely online	6	8.0	8.0	8.0
	entirely in class	5	6.7	6.7	14.7
	50-50 hybrid	64	85.3	85.3	100.0
	Total	75	100.0	100.0	

STUDENTS' PREFERRED METHOD OF INSTRUCTION
FINAL SURVEY

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	**entirely online**	**8**	**10.7**	**10.7**	**10.7**
	entirely in class	**5**	**6.7**	**6.7**	**17.3**
	50-50 hybrid	**62**	**82.7**	**82.7**	**100.0**
	Total	**75**	**100.0**	**100.0**	

Cross tabulation: section * method preference FINALSURVEY

Count		method preference FINAL			
		entirely online	entirely in class	50-50 hybrid	Total
section	1	3	0	37	40
section	2	5	5	25	35
Total		8	5	62	75

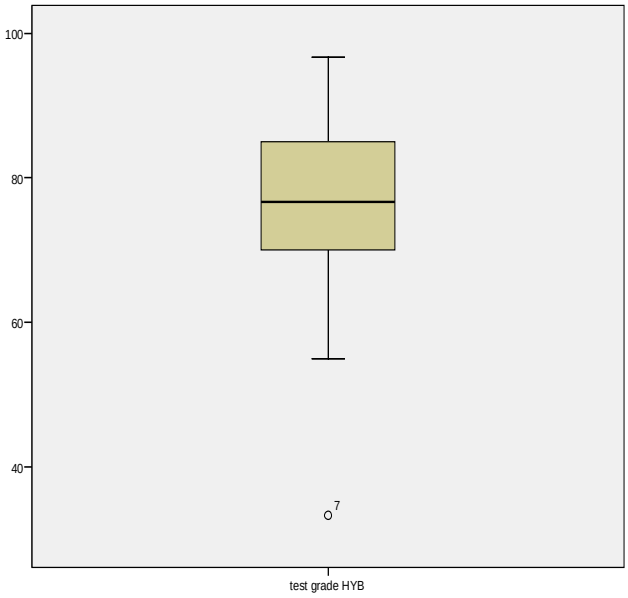
COMBINED TEST GRADES

	N	Minimum	Maximum	Mean	Std. Deviation
test grade HYB	75	33.30	96.70	76.3347	10.72626
test grade ONL	75	53.30	100.00	79.7787	11.07710
test grade CLA	75	53.30	96.70	79.2911	9.60797
Valid N (listwise)	75				

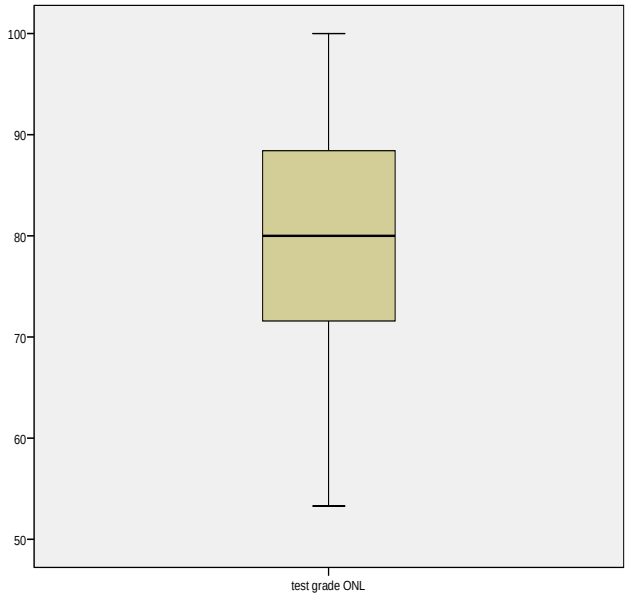
			Statistic	Std. Error
test grade HYB	Mean		76.3347	1.23856
	95% Confidence Interval for Mean	Lower Bound	73.8668	
		Upper Bound	78.8026	
	5% Trimmed Mean		76.7304	
	Median		76.7000	
	Variance		115.053	
	Std. Deviation		10.72626	
	Minimum		33.30	
	Maximum		96.70	
	Range		63.40	
	Interquartile Range		15.00	
	Skewness		-.845	.277
	Kurtosis		2.210	.548
test grade ONL	Mean		79.7787	1.27907
	95% Confidence Interval for Mean	Lower Bound	77.2301	
		Upper Bound	82.3273	
	5% Trimmed Mean		80.0256	
	Median		80.0000	
	Variance		122.702	
	Std. Deviation		11.07710	
	Minimum		53.30	
	Maximum		100.00	
	Range		46.70	
	Interquartile Range		20.00	
	Skewness		-.441	.277
	Kurtosis		-.665	.548
test grade CLA	Mean		79.2911	1.10943
	95% Confidence Interval for Mean	Lower Bound	77.0806	
		Upper Bound	81.5017	
	5% Trimmed Mean		79.5465	
	Median		80.0000	
	Variance		92.313	
	Std. Deviation		9.60797	
	Minimum		53.30	
	Maximum		96.70	
	Range		43.40	
	Interquartile Range		13.40	
	Skewness		-.401	.277
	Kurtosis		-.304	.548

COMBINED TEST GRADES - STEM & LEAF PLOT

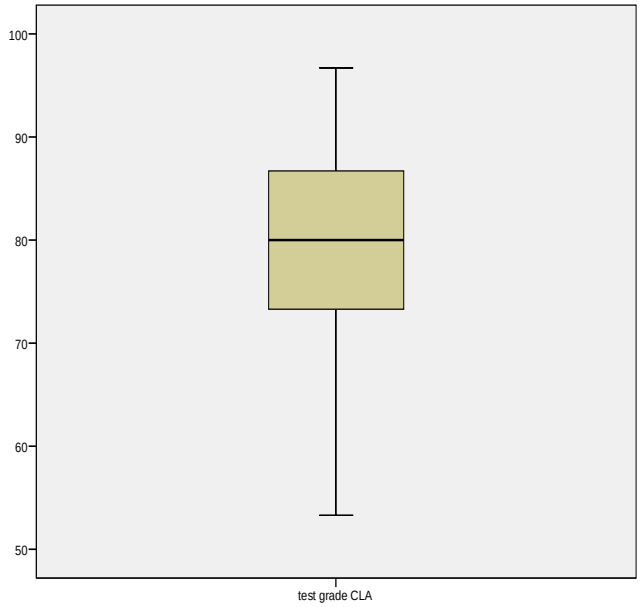
HYBRID



ONLINE



IN-CLASS (WEB-ENHANCED)



TEST GRADES BY SECTION (WITHIN ANALYSIS)

SECTION 1

	N	Minimum	Maximum	Mean	Std. Deviation
test grade 1 HYB	40	33.30	96.70	77.5425	11.94682
test grade 2 ONL	40	53.30	100.00	79.4200	11.42939
test grade 3 CLA	40	53.30	96.70	75.5884	9.94645
Valid N (listwise)	40				

PAIRED SAMPLE t-TESTS

SECTION 1 PAIRED SAMPLES STATISTICS

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	test 1 grade	77.543	40	11.9468	1.8890
	test 2 grade	79.420	40	11.4294	1.8071
Pair 2	test 1 grade	77.543	40	11.9468	1.8890
	test 3 grade	75.588	40	9.9464	1.5727
Pair 3	test 2 grade	79.420	40	11.4294	1.8071
	test 3 grade	75.588	40	9.9464	1.5727

SECTION 1 PAIRED SAMPLES CORRELATIONS

		N	Correlation	Sig.
Pair 1	test 1 grade & test 2 grade	40	.381	.015
Pair 2	test 1 grade & test 3 grade	40	.239	.138
Pair 3	test 2 grade & test 3 grade	40	.491	.001

SECTION 1 PAIRED SAMPLES TEST

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference		Mean	Std. Deviation	Std. Error Mean
		Lower	Upper	Lower	Upper	Lower	Upper	Lower	Upper
Pair 1	test 1 grade - test 2 grade	-1.8775	13.0099	2.0571	-6.0383	2.2833	-.913	39	.367
Pair 2	test 1 grade - test 3 grade	1.9541	13.6005	2.1504	-2.3956	6.3038	.909	39	.369
Pair 3	test 2 grade - test 3 grade	3.8316	10.8571	1.7167	.3593	7.3039	2.232	39	.031

TEST GRADES BY SECTION (WITHIN ANALYSIS)

SECTION 2

	N	Minimum	Maximum	Mean	Std. Deviation
test grade 1 HYB	35	55.00	90.00	74.9543	9.11125
test grade 2 CLA	35	63.30	93.30	83.5229	7.27134
test grade 3 ONL	35	56.70	96.70	80.1886	10.81167
Valid N (listwise)	35				

PAIRED SAMPLE t-TESTS

SECTION 2 PAIRED SAMPLES STATISTICS

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	test 1 grade	74.954	35	9.1113	1.5401
	test 2 grade	83.523	35	7.2713	1.2291
Pair 2	test 1 grade	74.954	35	9.1113	1.5401
	test 3 grade	80.189	35	10.8117	1.8275
Pair 3	test 2 grade	83.523	35	7.2713	1.2291
	test 3 grade	80.189	35	10.8117	1.8275

SECTION 2 PAIRED SAMPLES CORRELATIONS

		N	Correlation	Sig.
Pair 1	test 1 grade & test 2 grade	35	.125	.475
Pair 2	test 1 grade & test 3 grade	35	.028	.872
Pair 3	test 2 grade & test 3 grade	35	.146	.402

SECTION 2 PAIRED SAMPLES TEST

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference		Mean	Std. Deviation	Std. Error Mean
		Lower	Upper	Lower	Upper	Lower	Upper	Lower	Upper
Pair 1	test 1 grade - test 2 grade	-8.5686	10.9241	1.8465	-12.3211	-4.8160	-4.640	34	.000
Pair 2	test 1 grade - test 3 grade	-5.2343	13.9412	2.3565	-10.0233	-.4453	-2.221	34	.033
Pair 3	test 2 grade - test 3 grade	3.3343	12.1155	2.0479	-.8275	7.4961	1.628	34	.113

COMPARISON OF TEST GRADES BY SECTION (BETWEEN ANALYSES)

1) BY TEST NUMBER

INDEPENDENT SAMPLE t-TESTS

Group Statistics

	section	N	Mean	Std. Deviation	Std. Error Mean
test 1 grade	1	40	77.543	11.9468	1.8890
	2	35	74.954	9.1113	1.5401
test 2 grade	1	40	79.420	11.4294	1.8071
	2	35	83.523	7.2713	1.2291
test 3 grade	1	40	75.588	9.9464	1.5727
	2	35	80.189	10.8117	1.8275

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
		Lower	Upper	Lower	Upper	Lower	Upper	Lower	Upper	Lower
test 1 grade	Equal variances assumed	1.323	.254	1.043	73	.300	2.5882	2.4812	-2.3567	7.5332
	Equal variances not assumed			1.062	71.727	.292	2.5882	2.4372	-2.2706	7.4470
test 2 grade	Equal variances assumed	8.718	.004	-1.824	73	.072	-4.1029	2.2490	-8.5851	.3794
	Equal variances not assumed			-1.877	66.985	.065	-4.1029	2.1855	-8.4652	.2594
test 3 grade	Equal variances assumed	.572	.452	-1.919	73	.059	-4.6002	2.3975	-9.3784	.1781
	Equal variances not assumed			-1.908	69.686	.061	-4.6002	2.4110	-9.4092	.2089

COMPARISON OF TEST GRADES BY SECTION (BETWEEN ANALYSES)

2) BY MODE OF INSTRUCTION

INDEPENDENT SAMPLE t-TESTS

Group Statistics

	section	N	Mean	Std. Deviation	Std. Error Mean
test grade HYB	1	40	77.5425	11.94682	1.88896
	2	35	74.9543	9.11125	1.54008
test grade ONL	1	40	79.4200	11.42939	1.80714
	2	35	80.1886	10.81167	1.82751
test grade CLA	1	40	75.5884	9.94645	1.57267
	2	35	83.5229	7.27134	1.22908

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
		Lower	Upper	Lower	Upper	Lower	Upper	Lower	Upper	Lower
test grade HYB	Equal variances assumed	1.323	.254	1.043	73	.300	2.58821	2.48117	-2.35675	7.53318
	Equal variances not assumed			1.062	71.727	.292	2.58821	2.43722	-2.27060	7.44703
test grade ONL	Equal variances assumed	.088	.767	-.298	73	.767	-.76857	2.57978	-5.91007	4.37293
	Equal variances not assumed			-.299	72.537	.766	-.76857	2.57013	-5.89138	4.35423
test grade CLA	Equal variances assumed	3.758	.056	-3.895	73	.000	-7.93446	2.03732	-11.99484	-3.87408
	Equal variances not assumed			-3.975	70.866	.000	-7.93446	1.99598	-11.91446	-3.95446

COMPARISON OF LEARNING ACTIVITY GRADES (SWOT ASSIGNMENT [#2])

CROSS TABULATION : SECTION * SWOT ASSIGNMENT GRADES

Count		SWOT gr category				
		60-69	70-79	80-89	90-99	Total
section	1	0	4	9	27	40
section	2	3	9	13	10	35
Total		3	13	22	37	75

CHI-SQUARE TESTS OF SWOT ASSIGNMENT GRADES

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	13.186(a)	3	.004
Likelihood Ratio	14.642	3	.002
Linear-by-Linear Association	12.341	1	.000
N of Valid Cases	75		

(a) 2 cells (25.0%) have expected count less than 5. The minimum expected count is 1.40.