Spring 2015

Assessment of the learning climate, basic psychological needs and perceived knowledge transfer in an active classroom

Sanjana Hemanth
Purdue University

Graduate School Form 30
(Revised 08/14)

PURDUE UNIVERSITY
GRADUATE SCHOOL
Thesis/Dissertation Acceptance

This is to certify that the thesis/dissertation prepared

By Sanjana Hemanth

Entitled

ASSESSMENT OF THE LEARNING CLIMATE, BASIC PSYCHOLOGICAL NEEDS AND PERCEIVED KNOWLEDGE TRANSFER IN AN ACTIVE CLASSROOM.

For the degree of Master of Science in Building Construction Management

Is approved by the final examining committee:

Dr. Daphene Koch

Dr. Mark Shaurette

Dr. Joseph Orczyk

To the best of my knowledge and as understood by the student in the Thesis/Dissertation Agreement, Publication Delay, and Certification/Disclaimer (Graduate School Form 32), this thesis/dissertation adheres to the provisions of Purdue University's "Policy on Integrity in Research" and the use of copyrighted material.

Dr. Daphene Koch

Approved by Major Professor(s): _____

Approved by: Dr. Bryan Hubbard 04/16/2015

Head of the Department Graduate Program Date

ASSESSMENT OF THE LEARNING CLIMATE, BASIC PSYCHOLOGICAL NEEDS AND PERCEIVED KNOWLEDGE TRANSFER IN AN ACTIVE CLASSROOM.

A Thesis

Submitted to the Faculty

of

Purdue University

by

Sanjana Hemanth

In Partial Fulfillment of the

Requirements for the Degree

of

Master of Science in Building Construction Management

May 2015

Purdue University

West Lafayette, Indiana

To my late grandfather Dr. S. Ranganna for being my inspiration

To Hemanth, Mamatha and Skandaa to whom I owe everything

To Sushanth for being my pillar

TABLE OF CONTENTS

Page

LIST OF TABLES

Table Page

Table Page

LIST OF FIGURES

ABSTRACT

Hemanth, Sanjana. M.S.B.C.M., Purdue University, May 2015. Assessment of the Learning Climate, Basic Psychological Needs and Perceived Knowledge Transfer in an Active Classroom. Major Professor: Dr. Daphene Koch.

The thesis analyzes the impact of introducing active learning components by measuring the learning climate, basic psychological needs and perceived knowledge transfer of one course. This thesis has utilized the data obtained by the IMPACT team to evaluate the learning climate of the classroom with the evolution of the course by measuring the cognitive presence, learning presence and teaching presence in each of the semesters. The results of this study show the impact of the different elements of active learning in a classroom. The study of data over three semesters for one class is a model for other large intake foundational courses to show the impact of infusing various active learning elements into a course on its Learning Climate, Basic Psychological Needs and Perceived Knowledge Transfer.

CHAPTER 1. INTRODUCTION

"Tell me and I forget. Teach me and I remember. Involve me and I learn."
-Benjamin Franklin (Pargellis & Farrand, 1949)

"Why can't learning be fun?" This statement has been made by many students at some point in their academic lives. As a child I remember that I always wished my classroom was similar to that of the children's cartoon series The Magic School Bus that aired on television. In one of the episodes, The Magic School Bus made learning Biology fun for students by magically transporting the entire class into the immune system of a sick student in order to watch how white blood cells react and fight off an infection. In retrospect, it made me realize that games and activities are meant to be fun and engaging but when applied in academics it can create a new approach towards learning is obtained. A game of chess, for example is canonical problem solving exercise that sharpen intellectual, strategizing and decision making abilities (Squire, 2008). History and research are testimonies to the success of cognitive education through active learning (Prince, 2004). This thesis analyzes the impact of introducing active learning components by measuring the learning climate, basic psychological needs and perceived knowledge transfer of one course. Various forms of active learning have proven to be front runners of educational methods, by allowing the students to spend time-on-task, thereby enhancing their knowledge (Linehan, Kirman, Lawson, Chan, & Lane, 2011).

Educational activities or serious games are structured in a way that allows a person to think from different perspectives and sharpen one's mental faculties in different areas (Squire, 2008).

To improve higher education pedagogies, Instruction Matters – Purdue Academic Course Transformations program (IMPACT) program was developed to assist faculty in creating more engaging classrooms. The mission of the program is "to improve student competency and confidence through redesign of foundational courses by using research findings on a sound student-centered teaching and learning" (IMPACT Management & IMPACT Assessment, 2014a). IMPACT was developed to assist with the redesign of courses to include innovation, implementation and assessment which are critical to success (Arthur & Zelda, 1987; Levesque-Bristol, Weaver, & Parker, 2012). The experts leading this initiative created tools for assessment based on The Self Determination Theory. This tool was used in all courses associated with IMPACT. A survey of students enrolled in these courses associated with IMPACT was conducted in the beginning and the end of each semester in order to collect data related to learning climate, psychological needs and perceived knowledge transfer.

1.1 Scope

A large intake foundational course with the Department of Building Construction Management (BCM) at Purdue University, West Lafayette was chosen for the study. This is the BCM 10001 course on 'Introduction to Construction Management' which is an overview of the construction industry. It includes the overall construction process, through start-up of the complete facility, career opportunities in the construction industry,

an introduction to the materials and management systems and basic of the vocabulary of the industry.

The BCM 10001 course was transformed during the fall of 2013. A team comprising of Center for Instructional Excellence (CIE), Discovery Learning Research Center (DLRC), Extended Campus, Information Technology at Purdue (iTaP) Teaching and Learning, and the Purdue Libraries was formed by IMPACT to assist the instructor in creating a more active classroom (IMPACT Management & IMPACT Assessment, 2014a). As with all IMPACT courses, data for the BCM 10001 was collected during the pre-survey handed out during 2nd - 3rd week as well as the post-survey handed out during the 13th - 14th weeks of the semester to assess the learning climate, basic psychological needs and perceived knowledge transfer of the students in the class. Utilizing the data that the IMPACT team collected over the semesters of Fall-2013, Spring-2014 and Fall-2014, the thesis has observed the impact created by the revolutionizing of teaching pedagogies on the chosen course whose classes take place at John W. Hicks Undergraduate Library (Hicks). The data obtained by the researcher from the IMPACT team is over three semesters namely Fall-2013, Spring-2014 and Fall-2014 with development of active learning in the classroom in each of the semesters as illustrated in Table 1.1.

Table 1.1

Comparison between BCM 10001 in Fall 2013, Spring 2014 and Fall 2014

Course Characteristics	Fall 2013	Spring 2014	Fall 2014
Classroom Location	B848 at Hicks undergraduate library, Purdue University.	B853 at Hicks undergraduate library, Purdue University.	B848 at Hicks undergraduate library, Purdue University.
Specifics of the classroom utilized.	Instructor station with document camera, Smart Board, Huddle Boards, whiteboards, collaborative working tables that can be moved around.	Instructor station with document camera, Smart Board, Huddle Boards, whiteboards, collaborative working tables that cannot be moved around.	Instructor station with document camera, Smart Board, Huddle Boards, whiteboards, collaborative working tables that can be moved around.
Classroom capacity and enrollment	Capacity of the classroom is 117 and enrollment was 109.	Capacity of the classroom is 90 and enrollment was 57.	Capacity of the classroom is 117 and enrollment was 96.
Type of textbook utilized	Hardcopy textbook/Paper textbook	Hardcopy textbook/Paper textbook	Online textbook
Type of assessments	Paper and Blackboard based quizzes and exams along with points for in-class learning activities and homework.	Immediate feedback assessment used for quizzes and exams along with points for attendance for every class as well as in-class activities and homework and projects.	Assessments were online and in textbook, attendance points in-class activities, homework and project. Each chapter had a pre-quiz (before a chapter) and post-quiz (after chapter)..
Active Learning Elements	Significant incorporations of activities along with lectures. In class activities every alternate week.	Increase in the number of activities and reduction in the amount of lecture time compared to Fall 2013. In class activities every week.	Reduction in lecture time and increase in the active learning time in comparison to previous semesters. . In class activities in every class session.

Note: In all of the semesters, the course syllabus and instructor has remained the same.

1.2 Research Question and Objectives of the Study

This thesis has utilized the data obtained by the IMPACT team to evaluate the learning climate of the classroom with the evolution of the course by measuring the cognitive presence, learning presence and teaching presence in each of the semesters; thereby, paving the way for the research questions to be:

1. Is there a difference in the students' perception of learning climate in BCM 10001 comparing data from Fall-2013, Spring-2014 and Fall-2014?
2. Is there a difference in the students' perception of Basic Psychological Needs in BCM 10001 comparing data from Fall-2013, Spring-2014 and Fall-2014?
3. Is there a difference in the students' perception of knowledge transfer in BCM 10001 comparing data from Fall-2013, Spring-2014 and Fall-2014?

1.3 Significance

The results of this study will show the impact of the different elements of active learning in a classroom. This study of data over three semesters for one class can be a model for other large intake foundational courses to show the impact of infusing various active learning elements into a course on its Learning Climate, Basic Psychological Needs and Perceived Knowledge Transfer. Based on the results of the study, inference can be made as to whether the active learning components can be applied to other classes.

1.4 Assumptions

The following assumptions are inherent to the pursuit of this study:

1. Only students registered in the course will be participating in the study.
2. There are no legal restrictions from the participating departments to allow their students to participate in the study.
3. Students will be willing to participate in the study and the survey all through the semester.
4. The students will answer all questions honestly and accurately to the best of their knowledge and experience.
5. Findings from the students of a few semesters can be used to draw conclusions about all the semesters.

1.5 Limitations

The following limitations are inherent to the pursuit of this study:

1. The study is driven by findings from surveys conducted by the IMPACT team and is limited by time, instruments used by the IMPACT team and existing data.
2. The study is limited to one course that is offered once every semester.
3. The amount of data obtained is limited by the number of volunteers who are willing to participate in the study.
4. The data encompassed is for 3 semesters namely Fall 2013, Spring 2014 and Fall 2014 and this is limited by the time frame available to the researcher.

5. The possibility of a survey encompassing a larger group of people is ruled out keeping in mind the paucity of time and the number of students registered for the course.

1.6 Delimitations

The following delimitations are inherent to the pursuit of this study:

1. The research will be conducted only on one course at Purdue University, West Lafayette.
2. Volunteers in the study are undergraduate students and are enrolled in the chosen BCM 10001 course.

1.7 Definition of terms

Active Learning: "Active learning is generally defined as any instructional method that engages students in the learning process. In short, active learning requires students to do meaningful learning activities and think about what they are doing."(Prince, 2004).

Learning Climate: Learning Climate refers to students' perceptions of the student-centeredness of the learning environment (IMPACT Management Team & IMPACT Assessment Team, 2014a).

Basic Psychological Need: This consists of three portion that is: The need for autonomy which refers to students' need to feel a sense of volition and self-determination in the course; the need for competence which refers to students' need to feel capable in mastering the learning activity in the course; the need for relatedness which refers to

students' need to form meaningful interpersonal relationships with people in the course. These components help determine the motivation levels and assess its Basic Psychological Need (IMPACT Management Team & IMPACT Assessment Team, 2014a).

Perceived Knowledge Transfer: Reflection about the extent students perceive that the information learned would transfer beyond the course (IMPACT Management Team & IMPACT Assessment Team, 2014a).

Serious Games: Used synonymously with the term 'activity' and is defined as "A serious game is a game in which education (in its various forms) is the primary goal, rather than entertainment" (Marsh, 2011).

Faculty Learning Communities: "A cross-disciplinary faculty and staff group who engage in an active, collaborative programs with a curriculum about enhancing teaching and learning coupled with frequent seminars and activities that provide learning, development, the scholarship of teaching, and community building" (Cox, 2004).

CHAPTER 2. LITERATURE REVIEW

The following chapter contains the review of the literature referenced during the exploration of the stated research problem. The review of literature looks into history of active learning, IMPACT team's study and the Self Determination Theory. The chapter also looks into the methods of data collection using survey and consists of the analysis of findings. This chapter aims at providing clarity on the impending study of the chosen subject.

2.1 Learning models and the IMPACT program

Instruction Matters: Purdue Academic Course Transformation (IMPACT) was launched in December 2010 by the Provost's Office. A large collaborative initiative, the IMPACT program is an integrated campus-wide effort, involving multiple key partners across campus including the President's Office, Office of the Provost and Center for Instructional Excellence (CIE) (IMPACT Management Team & IMPACT Assessment Team, 2014a). The overarching goal of IMPACT is to achieve a greater student-centered learning environment by incorporating active and collaborative learning, as well as other student-centered teaching and learning practices and technologies, into large enrollment

foundational courses. Creating a student-centered learning environment will foster student engagement and student competence, as well as increased attainment of course-specific learning outcomes (IMPACT Management Team & IMPACT Assessment Team, 2014b). The IMPACT program leaders strive to measure effectiveness of the professional development aspect, embedded support for course redesign and implementation, and the classroom effect on pedagogical approaches used. The IMPACT team leaders redesign courses in order to recognize the need of each participant while including innovation, implementation, assessment, and institutionalization which are critical to success (Arthur & Zelda,1987; Levesque-Bristol, Weaver, & Parker, 2012). It also looks into faculty-focused principles, wherein the faculty are the drivers for curriculum change being ultimately responsible for identifying the learning outcomes and providing the support needed to focus student time and attention on learning, experimenting, and implementing research-based changes in their classes (IMPACT Management Team & IMPACT Assessment Team, 2014a; Levesque-Bristol et al., 2012). The courses developed by the IMPACT team are delivered through the Faculty Learning Communities (FLCs) and educational sessions throughout a semester. It also looks into the effect IMPACT courses have on student success and retention along with the long-term results that occur due to practices by faculty, departments, and institutions (Levesque-Bristol et al., 2012). The principles on which the courses are redesigned look into where the faculty is at right now along with how and what he/she is looking to accomplish based on the genre of students taking the course. The re-design looks into faculty approach in the attainment of the set goals, keeping in mind the set goals and outcomes (IMPACT Management Team & IMPACT Assessment Team, 2014b; Levesque-Bristol et al., 2012). Currently, 120

courses have been redesigned by the IMPACT team at Purdue and the goal is maintain a transformation rate of 60 courses per year (IMPACT Management Team & IMPACT Assessment Team, 2014b).

The classes for these courses are held in IMPACT classrooms located on the lower level of Hicks at Purdue University. During Fall 2013 and Fall 2014, HICKS B848 (Figure 2.1) was used. During Spring 2014, the use of an active classroom was slightly different the room HICKS B853 (Figure 2.2) was assigned. The rooms have all of the same teacher resources, multiple projectors, document camera, multiple white boards and group tables. The difference is that the room B848 has a capacity of 117 and the tables and chairs are on wheels so they can be configured according to the assignment of the day. Room B853 with a capacity of 90 is a larger area, but the tables are not movable so the students are restricted by the number of tables and forced into larger groups.

The learnings studio formats are intended to enhance the innovative, interactive sessions of the course (IMPACT Management Team & IMPACT Assessment Team, 2014a; Levesque-Bristol et al., 2012).

Note: B848 classroom at Hicks, Purdue University. Retrieved from http://guides.lib.purdue.edu/content.php?pid=463634&sid=3931599

Figure 2.1. BCM 10001 classroom for Fall 2013 and Fall 2014

Note: B853 classroom at Hicks, Purdue University. Retrieved from http://guides.lib.purdue.edu/content.php?pid=463634&sid=3931596

Figure 2.2. BCM 10001 classroom for Spring 2014

2.2 Active Learning in the BCM 10001 course

The BCM 10001 course saw a progression in the amount of active learning elements infused each semester as well. The classes for BCM 10001 were held twice a week in all the semesters from 12:00 PM to 1:15PM. In the Fall of 2013, active learning components or activities were conducted every alternative week. Activities included the Mock Career Fair which aimed to build confidence amongst the students while approaching companies during a career fair. The mock career fair had representatives from a few companies coming in and the classroom was set up to resemble a career fair. The students had to dress appropriately and approach the companies exactly like how they would at a career fair. Eventually, the company representatives gave the students individual feedback on how the student could improve himself/herself for the actual career fair. Some of the other activities included: The Marshmallow Challenge aimed at encouraging team work, creative thinking and planning; in class estimating in order apply concepts of cost analysis and estimation; a team based commercial project involving ideating and solution finding and so on. In the Spring of 2014, the frequency of in-class active learning activities increased to once a week. Along with the activities introduced in Fall 2013, Spring 2014 saw the introduction of the Mini Design Project wherein students had to work in teams to identify one design flaw within the infrastructure of the Purdue University campus. After this identification, the students had to come up with a plan on how to fix the design flaw thereby encouraging creative thinking as well helping students apply the knowledge obtained. The other activities introduced were: Plan reading assignment wherein the students were given actual construction plans for a building in order to help them understand different components of the building are illustrated on a

plan; Peanut Butter and Jelly Sandwich Contest wherein students compete with each other in groups to make a peanut butter and jelly sandwich judged based on the difference between actual cost and time taken to make the sandwich vs the estimate and schedule prepared prior by the students and so on. In Fall of 2014, active learning elements became a component of every class. Along with the activities introduced in both Fall 2013 and Spring 2014, several new activities were introduced to the course. One such activity was the Little Free Library Project wherein the course in partnered with the West Lafayette Library on a service project related to the Little Free Library. The objective of the project was to familiarize the students with the big picture of the construction industry while applying their knowledge. The outcome of the project included designing the project based on the location of the library picked by team, identifying options related to green or sustainable materials that could be used as well the creation of an excel sheet organized based on the CSI Master format, creation of a schedule and estimate for the project, illustration of the model using any 3-D design software while emphasizing on team work. At the end of the semester, the projects designs were collected by the West Lafayette Public Library and voted upon in order to be implemented. Other activities included were the radioactive golf ball activity whose objective is work within deadlines with the activity comprising a limited timeframe within which students need to design and construct a device that can move a golf ball from one bag to another without human contact; The Architect-Builder-Owner activity whose objective is to understand the importance of communication as the activity has an owner describing his requirement, the architect designs the project based on his understanding of the owner and the Builder constructs the project using paper craft materials based on his understanding of the

Architect which may be completely different from what the owner expected in the first place and so on.

2.3 Survey Instrument

The IMPACT program is guided by a strong theoretical framework, which has been used in several research projects over the past 40 years whose roots are based on that of the Self Determination Theory (IMPACT Management Team & IMPACT Assessment Team, 2014a). The infusion of active learning components, is a complex phenomenon consisting of multiple factors, the study of which needs to weigh the interplay of these factors over a chosen period of time. The data has been collected by the IMPACT as a part of their study using the method of Survey Research. This survey used by IMPACT is based on Self Determination Theory and the data collected was used in their research based on the learning climate, basic psychological needs and perceived knowledge transfer of several courses taught in a semester. The purpose of the survey given out by IMPACT to 120 courses was to evaluate the degree of student centeredness in a course that has been re-designed to include active learning elements across all these courses associated with the organization. The data collected by the IMPACT team was through surveys given out twice each semester. The pre-survey was given out in the 2nd-4th week of the semester and the post-survey was given out in the 13th -14th week of the semester. The same survey was given out both the times within a semester. Spring 2014 and Fall 2014 used the same survey but Fall 2013 used a different survey in comparison which measured the same basic variables. The sub-scales varied between the surveys. Measurement issues are extremely critical in scientific research as results depend

ultimately on the development of high quality measures that can assess the variable in question with a degree of accuracy (Creswell, 2003). Social and psychological variables are harder to assess as the variable of interest is not visible directly (Creswell, 2003). Without accurate and consistent measurement, the statistical tabulation and quantitative analysis of survey data would not make sense. Therefore, there was a need to validate and check for internal consistency in order to measure the reliability of the survey (Weissinger & Bandalos, 1995; Creswell, 2003).

(Morris et al., 2014) The surveys used by the IMPACT team in Fall 2013 are based on the one used by Ryan and Deci in 1985, the pioneers of SDT in their research which has been tested by Ryan and Deci and the IMPACT team for its validity by running a pilot study. IMPACT measured the same variables as this thesis but to answer different research questions pertaining to student perception amongst various active learning courses. (Morris et al., 2014) In order to conduct a pilot study, the IMPACT assessment team used trained observers who were mainly stuff and faculty at Purdue to collect data as well as self-reported data using the Fall 2013 survey (Morris et al., 2014). This study was conducted between September 2011 and November 2011 using 13 observers with 884 self-reported surveys and 72 classroom observations (Morris et al., 2014). The observers were trained on what to look for. Data was then collected in IMPACT classrooms by the observers and students self-reported data as well. The IMPACT team collected both the data types in the same class in order to establish concurrent validity of the survey (Morris et al., 2014). Both the observer data and self-reported data were collected each week from a random sample (Morris et al., 2014). The

observer data and the self-report data were then compared to determine if the self-report results of the Fall 2013 survey was a viable alternative to observation collection methods (Morris et al., 2014). The Kaiser-Meyer-Olkin (KMO) test which is "measure of sampling adequacy that test the partial correlations among factor variables" and a Bartlett's test which is "a measure of sphericity testing whether the correlation matrix is an identity matrix were conducted on the data obtained" (Morris et al., 2014). The KMO/Bartlett test showed the observer range of 0.616 to 0.804 (p=0.01) and the self-reported range of 0.556 to 0.833 (p=0.01) among all the questions in the survey (Morris et al., 2014). Based on these results, the IMPACT team found that the survey had face validity and reflected the characteristics of learner- centered instruction (Morris et al., 2014). A test for inter-rater reliability amongst the observers was conducted which resulted in an intra-class correlation (ICC) of 0.726 for single measures and 0.995 for averaged measures which confirmed that observers rated and reviewed courses the same way (Morris et al., 2014). In order to show the concurrence between the observation data and self-reported data, multiple dependence coefficients were computed using gamma, Spearman, and Pearson correlation coefficients. Strong correlation was obtained due to which it was concluded that self-reporting of data was a viable alternative to observation (Morris et al., 2014). All correlations that were obtained by the IMPACT team in the Fall 2013 survey were statistically significant and answer the research questions posed by them thereby reinforcing the construct validity of the data collection method (Morris et al., 2014).

The survey used by the IMPACT team Spring 2014 and Fall 2014 are a direct adaptation of Ryan and Deci's Basic Psychological Needs Scale (work satisfaction scale),

Self Determination Scale and Learning Climate scale (6-item version). In order to establish the reliability and validity of the Learning Climate scale, a pilot study was conducted by Black, A. E., & Deci, E. L. on students taking a university introductory course. The students were randomly assigned to a study groups (Black & Deci, 2000). The Learning Climate Scale handed out to the students during two different class meetings. During the first class meeting in which data was collected (T1), 289 responses were obtained out of 380 students present at the time (Black & Deci, 2000). During the second class meeting in which data was collected (T2), 137 responses were collected from the students who responded during the first class as well. The studies showed internal consistencies of 0.93 and 0.94 during T1 and T2 respectively (Black & Deci, 2000). The researchers also found that T1 and T2 scores were significantly correlated [r (136) = 0.50, $p < .0001$] (Black & Deci, 2000).

In order to establish the reliability and validity of the Basic Psychological Needs Scale, that consisted of the subscales of Autonomy, Relatedness and Competence as per SDT, a study was conducted by Ilardi, Leone, Kasser & Ryan (1992) consisting of a sample of employees at a shoe factory and found that the internal reliability score of .74 and this score correlated significantly with five of the subscales from the Job Description Index a well-standardized measure of job satisfaction thereby proving the criterion validity of the survey (Ilardi, Leone, Kasser, & Ryan, 1993; Smith, Kendall, & Hulin, 1969). Williams, Krusch, Papciak & Ryan (1992) used this survey in their research that measured motivation to work in a sample of individuals with chronic back pain and reported an internal consistency of 0.85 and the score correlated positively and significantly with a measure of internally self-regulated reasons for returning to work (r

= .75, p < .01) and with the general self-esteem scale of the Multidimensional Self-Esteem Inventory (r = .36, p < .05) thereby reinforcing the criterion validity (Ilardi, Leone, Kasser, & Ryan, 1993; O'Brien & Epstein, 1988; Williams, Krusch, Papciak, & Ryan, 1992). The self-determination scale had internal consistencies ranging between 0.85 to 0.93 in various samples measured by Sheldon, K. M., Ryan, R. M., & Reis, H (1996). A test-retest reliability of 0.77 over an 8 week period was obtained as well. The self-determination scale questions are generally in the same section as that of the Basic Psychological Needs as one of its sub scales (Sheldon, Ryan & Reis, 1996).

It is important to note that although the Ryan and Deci's Basic Psychological Needs Scale (work satisfaction scale), Self Determination Scale and Learning Climate scale (6-item version) were presented as is together in the Spring 2014 and Fall 2014 survey, no tests were conducted by the IMPACT team itself to ascertain the validity of the instrument. However, the IMPACT team did obtain statistically significant results both the semesters.

In the redesigning of their classes, IMPACT faculty are introduced to the following models: the supplemental model, the replacement Model (Including Hybrid and Flipped) The Fully Online Model of Active Learning. The supplemental model is defined as that which typically retains the basic structure of a traditional course but supplements lectures and textbook readings with technology-based, online, out-of-class activities. Some active learning strategies can also be integrated during the face-to-face lectures (Ryan & Deci, 2000a). The supplemental model of a classroom is synonymous to that of an active learning classroom. Today, just knowing 'how' is not sufficient to remain competitive, but the application of tools and knowledge in new domains and

situations is essential. Industry specialists report that people at every organizational level must be creative and flexible problem solvers (Prince, 2004). This calls for an instructional method that engages students in the learning process, requiring them to indulge in learning activities while giving them an opportunity to think about what they are doing, paving the way for the concept of 'Active Learning'. In practice, active learning refers to activities that, instead of transferring knowledge to students, engage students in a continuous collaborative process of building and reshaping understanding, as a natural consequence of their experiences and authentic interactions with the world to activities that are introduced into the classroom (Grabinger & Dunlap, 1995; Prince, 2004).

The replacement model of learning slightly differs from that of the supplemental model, as instructor-created video lectures or other videos and interactive lessons are reviewed by students before class. It is a step ahead of the supplemental model wherein some face-to-face class time can be eliminated and replaced by out-of-class, online, and interactive learning activities (IMPACT Management Team & IMPACT Assessment Team, 2014a; Levesque-Bristol et al., 2012; Perry & Pilati, 2011). This form of learning is synonymous to that of 'collaborative learning'. As Stewart (1988) says, philosophically, the collaborative classroom can be described as a critique of the teacher-centered classroom. In the latter, authority is vested in a teacher who disseminates knowledge to students. Class time is mostly used for working through problems and collaborative learning (Stewart, 1988). The students work together in small groups toward a common goal and the activity is a joint problem solving experience. Learning is expected to occur as a side-effect of problem solving, measured by the elicitation of new

knowledge or by the improvement of cognitive learning performance (Bruffee, 1984; Stewart, 1988). Bruffee (1984) traces the history of this model of learning to have originated in the 1950s and 1960s by a group of British secondary school teachers and also by a biologist studying British post-graduate medical education. It is said that in the American colleges, the roots of collaborative learning lie in the awareness of faculty and administrators had in the early 1970s about the difficulty students entering college faced. Students had difficulty doing as well in academic studies as their native ability suggested they should be able to do. The difficulty was then attributed to the fact that all the students seemed to have difficulty adapting to the traditional or "normal" conventions of the college classroom (Bruffee, 1984). From Mason (1970) comes the term collaborative learning, the insight that traditional learning fostered a destructive competitiveness rather than cooperation, and the practice of 'indirect' teaching in which the teacher sets the problem and organizes students to work it out collaboratively (Dillenbourg, 1999; Mason, 1970).

The 'flipped classroom model' is based on fully replacement model; wherein, what is traditionally done in class and as homework is switched or flipped. For example, instead of students listening to a lecture in class and then going home to work on an assignment, they read material and view videos on the assigned chapter before coming to class and then engage in active learning strategies such as debates on current issues during class (Gilboy, Heinerichs, Pazzaglia, & Chester, 2014). Over 20 years ago, King (1993) in his research, encouraged faculty to move from being a ''sage on the stage'' to more of a ''guide on the side'' in their teaching approaches. A sage on the stage refers to an instructor who imparts knowledge on the student through lecture alone, whereas is a

guide on the side provides students with assistance and correction to explore the content independently or within a group (King, 1993; Mazzolini & Maddison, 2003). The flipped classroom type of instruction enables the professor to be with students when they are engaging in higher levels of Bloom's taxonomy, such as application, analysis, and synthesis (Mazzolini & Maddison, 2003).

The fully online model eliminates all in-class meetings and moves all learning experiences online, using Web-based, multi-media resources, commercial software, or automatically evaluated assessments with guided feedback and alternative staffing models (IMPACT Management Team & IMPACT Assessment Team, 2014b; Levesque-Bristol et al., 2012). The fully online model is generally implemented as teaching tool for distance education courses. Online learning has become entrenched in today's scenario and is only expected to grow during the coming years with the advent of technology (Perry & Pilati, 2011). IMPACT does support courses implementing these models as a part of their research but is beyond the scope of this study. The table 2.1 provides a comprehensive comparison of the different methods of learning.

Table 2.1

Models of Learning

Supplemental model	Replacement Model	Fully Online Model
Lectures and textbook readings with technology and activities.	Instructor-created video lectures which are reviewed by students before class.	Eliminates all in-class meetings and all learning experiences online.
Active learning strategies integrated during the face-to-face lectures.	Collaborative Learning and Flipped Classroom Model.	Generally implemented as teaching tool for distance education courses.

2.4 History of Active Learning and Learning Climate

According to Garrison, Anderson, & Archer (2001), the balance of three core elements; cognitive presence, social presence, and teaching presence is absolutely essential for efficacious higher education. Cognitive presence refers to the limit to which learners are able to construct meaning and critical thinking through sustained communication. Social presence refers to the ability of individuals to project their personal characteristics into the community while teaching presence, in an educational environment, is performed mainly by the instructor (Garrison, Anderson, & Archer, 2001). An evaluation of the impact of a course hence involves examining the aforementioned indicators. The cognitive, social and teaching presence together constitute the 'learning climate' of a class (Ke, 2010).The most common form of cognitive learning, which ties in with the concept of active learning, are games. The term 'Serious Game' appears to be juxtaposed phrase with both the terms contradicting each other. 'Serious' is said to represent the purpose of the game/activity without having any bearing over its content (Michael & Chen, 2005; Susi, Johannesson, & Backlund, 2007). These types of activities or games bring in a whole new dimension to learning, allowing it to be an effective teaching or learning tool in vast areas such as healthcare, military, education, productivity etc.

Looking back as far as the stone age, there have been documentations from the Roman Empire era, of sand tables and icons being used for allowing leaders to strategize exactly like the way they would on a battlefield, allowing them to visualize and critically analyze their own ideas while pitting them against someone else as a learning activity (Smith, 2009; Weiner & Milton, 1959). Some mythologies too, like the Indian holy book

of ‘Mahabharata’ talks about ‘Pachisi’, a game that provided insights and strategies on the nuances of various subjects like gambling and military planning and also be used in today’s supply chain management (Gohn, 2012; Wu & Choi, 2013). The cognitive learning through these activities was in a relaxed atmosphere (social presence) without any pressure. A couple hundred years later, in the paper age, there have been evidences of strategic board games emerging in the Middle East, Europe and Asia. The game of ‘WeiHai’ dated back to 3000 BCE, was a meant to teach a person about how to gain territorial advantage. This activity used ‘tokens’ that player could manipulate to expand his territory thereby sharpening a leader’s political strategizing skills and is said to be basis of the modern game ‘GO’ (Smith, 2009). Chess is said to have been originated from the Indian game of ‘Chaturanga’, conceptualized for the purposes of military training in the Chandragupta Maurya era of the Indian history, dated around 500 BC. It was a two to four player activity played on a board that included the military equipment available at that point in time (By, 2011; Smith, 2009). The 13th - 14th century saw the creation of ‘Koenigspiel’ or the "King's Game" by Christopher Weikhmann of Ulam, Germany which was a predecessor of today’s chess with clear hierarchal power distribution for the pieces used. In the 17th and 18th century, games like ‘War Chess’ and ‘Kriegsspiels’, each of which furthered the detail and structure of the activity (Smith, 1995, 2009, 2014). By the 19th century, active learning was being used in some colleges, governmental organizations for various purposes. Prior to the Pearl Harbor bombing, the Japanese used this tool to train their arsenal for the impending attack (Smith, 2009). Politics, strategizing and war-fare were the major focus of serious gaming activities and history has once again proven that active learning is an effective tool for cognitive learning.

In the 20th Century, John Dewey who is considered to the father of modern-day active learning recognized several forms of active learning and their effect on cognitive presence, social presence and teaching presence (Dewey, 1916, 1985; Giles & Eyler, 1994). John Dewey (1916) is the source of the idea that there is an organic connection between experience and education and the recognition that one simply couldn't do away with authority in the classroom: it had to be relocated. He recognized that active learning strategies increase the student engagement in the learning process leaving them more satisfied with their learning experience. He encouraged the use of electronic and interactive media in learning, learning through activities, collaborative learning and problem based learning while recognizing the importance of learning climate of a classroom (Bringle & Hatcher, 1999; Dewey, 1916, 1985). There are several factors that influence the learning climate of the classroom – the primary factors being the instructor's attitude and patterns and the response by the students. The design and the orientation of the classroom space is yet another factor that plays a key role in the learning climate (Bringle & Hatcher, 2011; Hager, 1974). A teacher, regardless of his/her standing, conducts a class in a manner he/she is most comfortable with thereby establishing a certain type of pattern (Baldwin, 2009). This pattern leads a course to predominantly be that of a traditional lecture or a discussion. The students adjust to this pattern set by the faculty and their response coincides with this pattern, leading them to respond differently to different instructors (Goertz, Olah, & Riggan, 2009). This combination of instructional pattern combined with student behavior leads to a specific classroom environment which we call the 'learning climate' (Hager, 1974). Other than these factors, the content of the course, the necessity to use one's cognitive and emotional

resources, social, and spatial situations created in the classroom also play a significant role in its climate (Arndt, 2012).

2.5 Self Determination Theory and Motivation

The climate for undergraduate Science, Technology, Engineering and Mathematics (STEM) education is a collaborative effort at many levels. The arrival and proliferation of electronic resources and digital libraries have already influenced and changed the way students and scholars use print resources and traditional libraries (Baldwin, 2009; Liu, 2006). A number of factors suggest that Self Determination Theory (SDT) is an appropriate frame-work for addressing motivation in the online learning environment. First, SDT may serve as a theoretical framework that integrates issues in online learning (Chen & Jang, 2010; Ciani, Sheldon, Hilpert, & Easter, 2011). SDT addresses autonomy, relatedness, and competency as determinants of motivation. The three constructs correspond to features of online learning such as flexible learning (Moore, 1993), computer-mediated communication and social interaction (Gunawardena, 1995), and challenges for learning technical skills (Howland & Moore, 2010). The notion of contextual support is especially valuable, as online learners need a variety of support from instructors, peers, administrators, and technical support personnel (Mills, 2003; Tait, 2000, 2004). Past experimental research indicates that self-determination theory predicts a variety of learning outcomes, including performance, persistence, and course satisfaction (Ryan & Deci, 2000b). Self-determination theory has the potential to address learning problems such as student attrition in the active learning environment (Chen & Jang, 2010). As Neimiec and Ryan (2009) stated in their research:

> Self-determination theory (SDT) assumes that inherent in human nature is the propensity to be curious about one's environment and interested in learning and developing one's knowledge. All too often, however, educators introduce external controls into learning climates, which can undermine the sense of relatedness between teachers and students, and stifle the natural, volitional processes involved in high-quality learning (Niemiec & Ryan, 2009).

SDT takes into interest the factors that help student success grow by understanding theories of motivation, emotion and student development. SDT is of great importance in the domain of education, in which students' natural tendencies to learn represent the greatest resource educators can tap. This is also a domain in which external factors are imposed in order to facilitate student learning. The external factors introduced in the class are that of the components of active learning including the introduction of an online textbook (Niemiec & Ryan, 2009). SDT describes three innate basic psychological needs namely the need for autonomy, competence, and relatedness (Ryan & Deci, 2000a, 2000b). The authors defined the need for autonomy as the individuals' need to feel as the origin of their choices and decisions, the need for competence as the need to feel a sense of mastery, and the need for relatedness – the feeling of being accepted and respected by the group. According to SDT, a person is said to be motivated when the psychological needs have been met, which is when they have the feeling of being autonomous, competent, and related in life. In this case, students have the inner resources needed to fully engage with the classroom (Ryan, Connell, & Deci, 1985).

Table 2.2

Basic Psychological Needs

Autonomy	Competence	Relatedness
Individuals' need to feel as the origin of their choices and decisions.	The need to feel a sense of mastery.	The feeling of being accepted and respected by the group.

There is need to explore the areas of representation of the multiple forms of motivation proposed by SDT. Few studies have examined how these different goals combine to influence students' achievement behavior (Chen & Jang, 2010). In SDT, intrinsic motivation is defined as the act of enjoyment of the activity, and the experience is the reward. Identified motivation involves seeing the importance in an activity, even when it may not be pleasurable. In contrast, introjected motivation is the drive to engage in behavior in order to alleviate an unpleasant internal state such as guilt or anxiety; the person feels split, so that one part of the self has to compel the other part (Niemiec & Ryan, 2009). Table 2.3 helps illustrate the various forms of motivation and differences between them.

Table 2.3

Various forms of motivation

Intrinsic Motivation	External Motivation	Introjected Motivation	Amotivation
The act of enjoyment of the activity, and the experience is the reward.	Controlled state in which one is acting because she or he is compelled to do so by an outside source.	The drive to engage in behavior that alleviates an unpleasant internal state such as guilt or anxiety.	Not valuing an activity, not feeling competent to do it or not believing it will yield a desired outcome.
Involves seeing the importance in an activity, even when it may not be pleasurable.		Opposite of Intrinsic Motivation.	
Ex: Baking cookies because baking is fun for you	Ex: Working at company only because of its pay	Ex: Attending classes only because of the fear that absence might cost the student attendance points.	Ex: An athlete might be heard saying, 'I can't see the point in training any more – it just tires me out'

Vallerand and his colleagues proposed three-part taxonomy of intrinsic motivation. The first type, Knowledge, is the motivation for doing an activity for the feelings associated with exploring new ideas and developing knowledge. The second type, Accomplishment, refers to the sensations related to attempting to master a task or achieve a goal (Vallerand et al., 1992). The third type, Stimulation, refers to motivation based simply upon the sensation stimulated by performing the task, such as aesthetic appreciation or fun and excitement (Shaikholeslami & Khayyer, 2006; Vallerand et al., 1992). Intrinsic motivation results in high-quality learning and creativity; it is especially important to detail the factors and forces that engender versus undermine it (Ryan & Deci, 2000a; Vallerand et al., 1992).

External motivation is a controlled state in which one is acting because she or he is compelled to do so by an outside source. Having autonomous (internalized), as opposed to controlled (non-internalized), reasons for engaging in learning activities is associated with increased effort, persistence, achievement, and learning (Ciani, Sheldon, Hilpert, & Easter, 2011; Boiché, Sarrazin, Grouzet, Pelletier, & Chanal, 2008). The least self-determined form of extrinsic motivation is External Regulation. Such behaviors are performed to satisfy an external demand or obtain an externally imposed contingency. A second type of extrinsic motivation is Introjected Regulation; such behaviors are performed when there is a feeling of pressure to avoid guilt or anxiety or to attain ego-enhancement or pride (Ryan & Deci, 2000b; Shaikholeslami & Khayyer, 2006). A more autonomous or self-determined form of extrinsic motivation is regulation through identification. Here the individual has identified with the personal importance of a behavior and has thus accepted its regulation as his own. Understanding these different types of extrinsic motivation, and what fosters each of them, is an important issue for educators who cannot always rely on intrinsic motivation to foster learning (Ryan & Deci, 2000a, 2000b).

Ryan & Deci's (2000a) approach focuses primarily on psychological needs—namely, the innate needs for competence, autonomy, and relatedness while recognizing that basic need satisfaction accrues in part from engaging in interesting activities. Thus, when intrinsically interesting activities are spoken about, it refers to the tasks that, on average, many people find to be intrinsically interesting. There is considerable practical utility in focusing on task properties and their potential intrinsic interest, as it leads toward improved task design or selection to enhance motivation (Ryan & Deci, 2000a).

Amotivation is the state of lacking an intention to act. When amotivated, a person's behavior lacks intentionality and a sense of personal causation. Amotivation results from not believing it will yield a desired outcome (Deci, 1971; Ryan, 1995; Seligman, 1975). Theorists who have treated motivation as a unitary concept have been concerned only with the distinction between what we call amotivation and motivation (Ryan & Deci, 2000a).

2.6 Data Collection using Surveys

There are different types of quantitative research namely descriptive, experimental and correlational. One of the challenges a researchers has is to decide how data needs to be collected (Dillman, 2000). The method of survey research which is a present oriented methodology, used to collect facts and assess beliefs, interests and attitudes (Creswell, 2003). This type of research is oriented towards the determination of the status of a given phenomenon than towards the isolation of causative factors accounting for its existence.

Mail and face-to face surveys are the oldest recorded survey data collection modes. Face-to-face interview was extensively found in the fifties and sixties of the twentieth century, the telephone survey quickly became popular during the seventies and soon became the predominant mode of data collection by surveys (Dillman, 2000; Nathan 2001). The rapid growth of computers saw its influence in the data collection methods as well. The development of programs saw the introduction of computer-assisted self-interviewing (CASI) in face-to-face interviews, and became popular with interviews on sensitive topics as the respondent can answer the questions with privacy and the

interviewer remains at a respectful distance, but is available for assistance (Couper & Nicholls, 1998).

The latest development in the field of surveys is the web or Internet survey. These surveys are cost and time efficient making them very popular. They have great potential, but have limitations (e.g. nonresponse). Web surveys allow the respondent to take the survey at a location, time and place he/she is comfortable with (Couper, 2000). Studies have found that the interviewees respond better when surveys involving social and psychological needs are taken at their leisure and at an environment he/she is comfortable in. Web surveys help reach out several people simultaneously and to a very large extent help negate interviewer bias (Czaja & Blair, 1996). The data has been collected by the IMPACT team as a part of their study using the web surveys. Both the pre-surveys and post-surveys were sent by e-mail to each students of each of the semesters. The same survey was sent to the survey for both the pre-survey and the post-survey. The purpose of the survey was to establish the status of the phenomenon under investigation which was the degree of student centeredness of an active classroom. It has been established that surveys may generally be self-administered of administered in the presence of an interviewer (Leeuw & Collins, 1997). Given the number of people and also the fact that surveys have to do with psychology and social situations yield more accurate results when self-administered due to lack of peer or social pressure, handing out the survey online was the best option to collect data (Creswell, 2003).

2.7 Summary

This literature review summarizes the various aspects of learning and forms the basis of the study. Through the process of the study, the researcher found a couple of studies whose context was similar to the chosen study which provided direction to the study. It was found through the study of the literature that the course chosen for the study followed the supplemental model of teaching (active learning classroom) while progressing towards a replacement model of teaching (flipped classroom). The findings from the literature also revealed that in order to measure the effect of the infusion of active learning elements in a classroom, the factor of learning climate, basic psychological needs (autonomy, competence and relatedness) and perceived knowledge transfer are all measured by SDT which provided the framework for the study.

CHAPTER 3. METHODOLOGY

The chapter introduces the research framework and methodology adopted to study the research question. The goal of the study was to assess the effect of the infusion of active learning elements into a classroom including that of an online textbook. The methodology adopted in collaboration with the IMPACT team followed a logical pattern which leads to the identification of the same. This chapter explains the approach adopted for data collection methods, statistical analysis and data analysis techniques. It then concludes with a discussion of analyzing data and the process of drawing meaningful conclusions.

3.1 Framework

Considering inherent nature of the study, the methodology adopted for the thesis is that of a quantitative one. As Creswell (2003) says, quantitative research is a means for exploring and understanding the meaning individuals or a group ascribe to a social or a human problem. The process of research involves emerging questions and procedures, data collected typically in the participant's setting and data analysis inductively building from particulars to general themes leading to the interpretations of the data (Creswell,

2003). The data collected from a survey given out by the IMPACT team is based on SDT is used to answer the research questions of this thesis. The purpose of the survey given

out by the IMPACT team to 120 courses was to evaluate the degree of student centeredness those courses.

3.2 Hypotheses

This thesis looks into the evaluation of the following hypothesis due to the introduction of an online textbook:

$H1_0$: There is no difference in the students' perception of learning climate in BCM 10001 comparing data from Fall-2013, Spring-2014 and Fall-2014.

$H1_\alpha$: There is a difference in the students' perception of learning climate in BCM 10001 comparing data from Fall-2013, Spring-2014 and Fall-2014.

$H2_0$: There is no difference in the students' perception of Basic Psychological Needs in BCM 10001 comparing data from Fall-2013, Spring-2014 and Fall-2014.

$H2_\alpha$: There is a difference in the students' perception of Basic Psychological Needs in BCM 10001 comparing data from Fall-2013, Spring-2014 and Fall-2014.

$H3_0$: There is no difference in the students' perception of knowledge transfer in BCM 10001 comparing data from Fall-2013, Spring-2014 and Fall-2014.

$H3_\alpha$: There is a difference in the students' perception of knowledge transfer in BCM 10001 comparing data from Fall-2013, Spring-2014 and Fall-2014.

3.3 Population and Sample

The population of the study consisted of the students enrolled in the BCM 1001 course in the semester of Fall-2013, Spring-2014 and Fall-2014. The sample consisted of those who chose to reply to the survey conducted by the IMPACT team.

3.4 Reliability and Validity

As survey's given in the semester of Fall-2013 differed from that of Fall-2014 and Spring-2014, there was a need to check the internal consistency of the surveys which essentially is a measure based on the correlations between different items on the same survey (Creswell, 2003). Internal consistency is measured with Cronbach's alpha which calculated from the pairwise correlations between items. Internal consistency ranges between negative infinity and one. Higher scores indicate high internal consistencies making the survey reliable (Weissinger & Bandalos, 1995). A Chronbach's Alpha test for internal consistency was conducted on both the surveys in order to determine the reliability of the surveys. This test was done using SPSS. The results of the tests are in Table 3.1. It is clear from the tables that the Cronbach's Alpha value is higher than 0.9 which indicates that both the surveys were highly reliable. The validity of the surveys was obtained from the pilot studies conducted by IMPACT as well as literature of the SDT.

Table 3.1

Internal Consistency using Cronbach's Alpha

Semester	Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
Fall 2013	0.934	0.948	35
Spring 2014 and Fall 2014	0.912	0.926	55

Note: Cronbach's Alpha higher than 0.9 indicates high reliability

3.5 Data Collection

The data has been collected by the IMPACT team as a part of their study using the method of Survey Research with a Likert scale ranging from 1 (strongly disagree) to 7 (strongly disagree) was used. Considering the number of people and the nature of the survey, the survey was sent electronically to the students by e-mail for both the pre-surveys and post-surveys (Creswell, 2003). Table 3.2 shows the range of answers available for the survey.

Table 3.2

Likert Scale and student response correlation

Likert Scale/Raw Data	Student Response
1	Strongly disagree
2	Disagree
3	Somewhat disagree
4	Neither agree or disagree
5	Somewhat agree
6	Agree
7	Strongly agree

The questions contained in the surveys for Spring of 2014 and Fall of 2014 were the same but different from the survey given in the Fall of 2013. However, all the surveys measured the same basic parameters. The same surveys were handed out twice to the same set of students in a semester i.e. once at the beginning of the semester (pre-survey) and once at the end of the semester (post-survey). These surveys can be found in Appendix A. In each semester, the students received the pre-survey in the 2^{nd} – 4^{th} week and the post-survey in 13^{th} – 14^{th} week. The author obtained the data collected by the IMPACT team for the semesters of Fall-2013, Spring-2014 and Fall-2014 specifically for the BCM 10001 course. Information regarding the IMPACT mean across all the courses for all the questions was obtained from reports regarding BCM 10001 handed by IMPACT to the instructor of the course was collected by the author. This information was then utilized to compare by the method of descriptive statistics the mean of BCM 10001 with the IMPACT mean across all associated courses. Demographics of the different majors of the students in the class each semester as well as course standing was also obtained from the course rosters handed by the instructor of the course. The pre-survey data and the post-survey data were obtained for each of the semesters. The data received was raw data in the form of numbers between 1 & 7 on an excel sheet. These numbers represent student responses ranging from Strongly Agree to Strongly Disagree. Correlation of the raw data to the student response is seen in Table 3.2.

In order to analyze the data, the questions from the questionnaire was strategically grouped in accordance with the information obtained from the literature review and is based primarily on SDT. For Fall 2013 survey, question numbering 1 to 16 were used to analyze the learning climate, 17 to 26 were used to analyze the Basic Psychological

Needs and 27 to 34 were used to analyze the Perceived Knowledge Transfer. The Fall 2013 survey can be found in Appendix A. For Spring 2014/ Fall 2014 survey, question 1 to 6 were used to analyze Learning Climate, 7 to 43 were used to analyze Basic Psychological Needs and 44 to 51 were used to analyze Perceived Knowledge Transfer. The Spring 2014/ Fall 2014 survey can be found in Appendix B. Some of the questions had reverse-coded items, for which higher scores reflect lower satisfaction of the need. Mathematical corrections were made using Microsoft Excel to the responses obtained to these questions in order make it comparable to the other questions.

3.6 Data Analysis

The data analysis was conducted based on recommendations given by the experts at The Statistical Consulting Services (SCS), Purdue University. Demographics of the different majors of the students in the class each semester as that was obtained from the rosters were represented in the form of pie charts showing the number of students in different majors or colleges within Purdue University and percentage of the class they make up using Microsoft Excel. A bar chart was formed to show the representation of students from various class standings for each semester in comparison to the other two semesters using Microsoft Excel. The data obtained by the researcher from the IMPACT team is in the form of numbers ranging from 1 to 7 and the amount of data received is based on the number of students that responded to the questionnaire each semester (IMPACT Management Team & IMPACT Assessment Team, 2014c). In order to analyze the data, an average score per respondent per section was then taken for the purpose of inferential statistics. Owing to the nature of data obtained, a test of Analysis of Variance

(ANOVA) are conducted in order to get statistical significance for the data. This is a procedure that helps determining the differences between mean scores of factors to determine statistical significance (Gall, Gall, & Borg, 1999). The One way ANOVA test was used to reveal significant differences between the data's of pre and post surveys each semester as well as differences between the post-surveys of all the semesters. Also, an average score per question was then taken for the purpose of the differential statistics which helped obtained the standard deviation per question in each section. The standard deviation of all the responses for a question enables us to measure the size of the measurement error (Bland & Altman, 1996). In order to calculate the standard deviation from the average, each response for a question is squared and subtracted from the average of all responses and the result is squared resulting in the squared difference for that response. The average of all the squared differences is then calculated to obtain the standard deviation (Nunnally, Bernstein & Berge, 1967). The descriptive analysis was provided and calculated for the questions in which at least 15 students and 25% of the students enrolled in the BCM 10001 responded to the survey in order to prevent statistical anomalies. The results obtained from the descriptive analysis was compared with the average value obtained by the IMPACT team. The analysis procedure was based on the recommendation and guidance given by the Statistical Consultants at The Department of Statistics, Purdue University. Software packages are used for the analysis owing to the volume of data; SPSS has been used for the descriptive statistics and ANOVA while Microsoft Excel is used to produce charts and tables to display data, accordingly (Mills, 2002). The questionnaire is categorized into three parts, namely:

1. Learning Climate

The combination of instructional pattern combined with student behavior leads to a specific classroom environment called the 'learning climate' (Hager, 1974). The content of the course, the necessity to use one's cognitive and emotional resources, social, and spatial situations created in the classroom also play a significant role in the learning climate (Arndt, 2012). With the infusion of active learning elements, there is a change in the learning climate and it is necessary to determine the students' perception of the degree of student centeredness of the course in order to measure the effects of the active learning elements. The first part of the questionnaire helps assess the learning climate of the course with its questions pertaining to the student perception of the instructor and the course. The questions that were used to determine the learning climate are numbers 1 to 16 in the Fall 2013 survey found in Appendix A and 1 to 6 in the Spring 2014/Fall 2014 survey found in Appendix B. Although the complete questionnaire can be found in the appendices, in order to provide clarity to the reader, some of the questions from the first part of the questionnaire have been chosen at random and presented below:

> My instructor conveyed confidence in my ability to do well in the course.
>
> My instructor listens to how I would like to do things.
>
> My instructor tries to understand how I see things before suggesting a new way to do things.

The comparison between the data obtained from both the pre-survey and post-survey of one semester in order to determine the change in the learning climate within that semester was made by analyzing the learning climate portions of the questionnaire using the inferential method of One-Way ANOVA using SPSS in order to reveal

statistically significant differences. Comparison between the results obtained in the pre-survey and post-survey helps identify as to whether there were changes in the Learning Climate as perceived by the students in the beginning of the semester as compared to the end of the semester. Descriptive statistical assessments along with One Way ANOVA test that finds statistically significant differences, for the post-survey of all the semesters assesses as to whether the learning climate of the students were met thereby answering the first hypothesis.

2. Basic Psychological Needs

The second part of the questionnaire pertains to the basic psychological needs of the students looking into the feelings of volition and choice when given choices and options about how to perform or present their work, the extent to which students are confident about mastery of content material as well as the feelings of being connected, intellectually and emotionally, to other students in the class, as well as to their instructor (IMPACT Management Team IMPACT Assessment Team, 2014c; Niemiec & Ryan, 2009; Ryan & Deci, 2000a). The questions that were used to determine the Basic Psychological Needs are numbers 17 to 26 in the Fall 2013 survey found in Appendix A and 7 to 43 in the Spring 2014/Fall 2014 survey found in Appendix B. Some of the questions on this section contained questions that had reverse-coded items, for which higher scores reflect lower satisfaction of the need. Mathematical corrections using Microsoft Excel were made to the responses obtained to these questions in order make it comparable to the other questions. Comparison between the results obtained in the pre-survey and post-survey helps identify as to whether there were changes in the Basic

Psychological Needs as perceived by the students in the beginning of the semester as compared to the end of the semester was made by analyzing the Basic Psychological Needs portions of the questionnaire using the inferential method of One-Way ANOVA using SPSS in order to reveal statistically significant differences. Descriptive statistical assessments along with the One Way ANOVA test that finds statistically significant differences, for the post-survey of all the semesters assesses as to whether the basic psychological needs of the students were met thereby answering the second hypothesis. Although the complete questionnaire can be found in the appendices, in order to provide clarity to the reader, some of the questions from the second part of the questionnaire have been chosen at random and presented below:

Autonomy

a. I am free to express my ideas and opinions in this course.

b. When I am in this course, I have to do what I am told.

Competence

a. I have been able to learn interesting new skills in this course.

b. Most days I feel a sense of accomplishment from this course.

Relatedness

a. I really like the people in this course.

b. I pretty much keep to myself when in this course.

Self-Regulation Scale

The questions below are related to your feelings of why you are taking the BCM 10001 course:

a. Intrinsic Regulation

Because I really enjoy it

b. Integration

Because acquiring all kinds of knowledge is fundamental for me

3. Perceived Knowledge Transfer

The third and final part of the questionnaire looks into the perceived knowledge transfer along with the student perception of the course module on whole in terms of its importance and future applicability (IMPACT Management Team & IMPACT Assessment Team, 2014a; Levesque-Bristol, 2014; Niemiec & Ryan, 2009). The questions that were used to determine the Perceived Knowledge Transfer are numbers 27 to 34 in the Fall 2013 survey found in Appendix A and 44 to 51 in the Spring 2014/Fall 2014 survey found in Appendix B. The comparison between the data obtained between the pre-survey and post-survey within a semester for this portion of the questionnaire was made by the inferential statistical method of One-Way ANOVA using SPSS in order to reveal statistically significant differences. Comparison between the results obtained in the pre-survey and post-survey helps identify as to whether there were changes in the Knowledge Transfer scale as perceived by the students in the beginning of the semester as compared to the end of the semester. Descriptive statistical assessments along with the One Way ANOVA test that finds statistically significant differences, for the post-survey of all the semesters assesses as to whether the basic psychological needs of the students were met thereby answering the third hypothesis. Although the complete questionnaire can be found in the Appendices A and B, in order to provide clarity to the reader, some of

the questions from the third part of the questionnaire have been chosen at random and presented below:

Perceived Knowledge Transfer Scale

I feel confident in my ability to apply the course material in other classes that I have.

I understand how I will use the information learned in this class in my professional life.

Information learned in this course will inform my future learning experiences.

It is necessary to note that the same questionnaire, for both pre-survey and post-survey, was given out to the responders of the chosen semesters.

An illustration of the method of analysis has been shown in Table 3.2.

Table 3.3

Analysis methods used

What was analyzed	Difference in the students' perception of learning climate in BCM 10001	Difference in the students' perception of Basic Psychological Needs in BCM 10001	Difference in the students' perception of knowledge transfer in BCM 10001
Between the pre-survey and post-survey of each semester (Fall 2013, Spring 2014, Fall 2014).	One-Way ANOVA test.	One-Way ANOVA test.	One-Way ANOVA test.
Among the post-surveys of the all the semesters (Fall 2013, Spring 2014 and Fall 2014)	Descriptive analysis and One-Way ANOVA tests.	Descriptive analysis and One-Way ANOVA tests.	Descriptive analysis and One-Way ANOVA tests.

CHAPTER 4. RESULTS AND ANALYSIS

The goal of this study was to examine the effects of infusing active learning elements into a classroom consisting of students in the BCM 10001 'Introduction to Construction Management' course at The Department of Building Construction Management in Purdue University. The instrument consisted of three sections that align with the objectives of the study:

1. Learning Climate
2. Basic Psychological Needs
3. Perceived knowledge transfer

Descriptive and inferential statistics and selected variables were used to explore the research questions. Analyses were conducted to examine the experiences of the students who had chosen the course. The results, therefore, were organized around each research question posited for the study and arranged by semester concluding with the comparison post-survey results of each of the sections through all the semester. The statistics of the number of respondents to the surveys each semester is shown in table 4.1.It is very important to note that these numbers represent the number of people who attempted the survey – not necessarily answered all the questions. The incomplete surveys have not been eliminated as the response to one question is independent of the

response or lack of it to the other questions therefore the incomplete surveys do not impact the results. However, the lack of data due to incomplete surveys and lack of responses may impact the results which is a limitation of the study

Table 4.1

Survey Respondent Statistics

	Fall-2013 Course Enrollment = 109		Spring-2014 Course Enrollment = 59		Fall-2014 Course Enrollment = 97	
	N	%	N	%	N	%
Pre-Survey	8	7.33%	20	35%	63	65.6%
Post-Survey	46	42.2%	18	31%	46	47.9%

N = Number of Respondents % = Percentage of respondents based on total enrollment

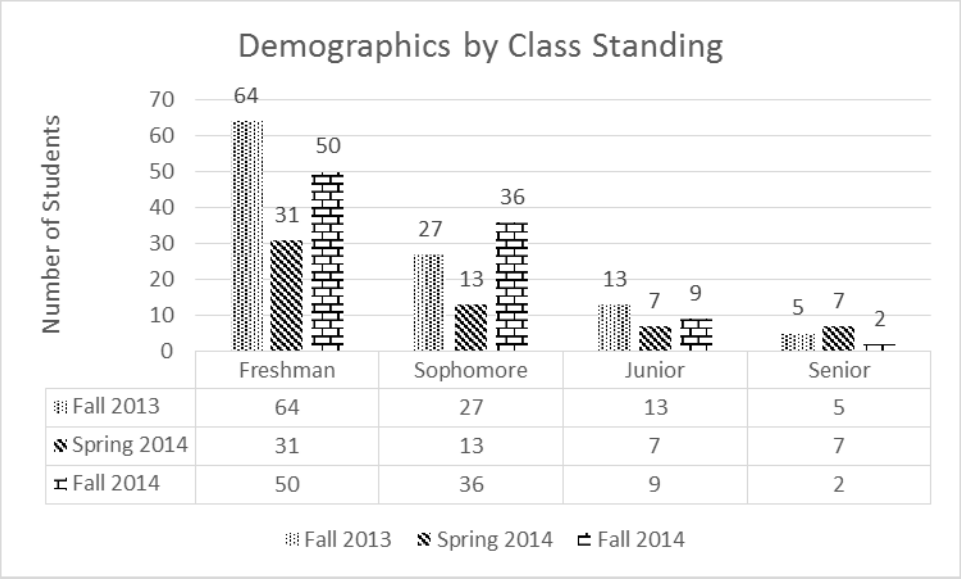
It is important to understand the demographics of the students in course in semester as BCM 10001 is a large intake foundational course that has students from a myriad of majors from different schools and colleges within the university enrolling in it. These demographics were obtained from the rosters of the course for each semester. Table 4.2 presents the demographics of the class from each of the semesters.

Table 4.2

Demographics by Major for Fall-2013, Spring2014 and Fall-2014

	Fall 2013 Intake = 109		Spring 2014 Intake = 57		Fall 2014 Intake = 97	
	N	%	N	%	N	%
College of Agriculture	2	1.83%	-	-	-	-
School of Agr and Bio Engr	-	-	1	1.69%	-	-
College of Health & Human Sci	3	2.75%	-	-	-	-
College of Liberal Arts	11	10.09%	9	15.25%	7	7.21%
Building Construction Management	63	57.69%	19	32.20%	66	68.04%
First Year Engineering	1	0.91%	2	3.38%	2	2.06%
Exploratory Studies	18	16.51%	13	22.03%	10	10.30%
School of Management	4	3.66%	6	10.16%	6	10.16%
College of Science	-	-	-	-	2	2.06%
Other College of Technology Majors	7	6.42%	9	15.25%	5	5.15%
Pre-Pharmacy	-	-	-	-	1	1.03%

Note: N represents the number of respondents.



Note: The total number of students in Fall 2013 was 107; Spring 2014 was 57; Fall 2014 was 97

Figure 4.1. Demographics of Fall 2013, Spring 2014 and Fall 2014 by Class Standing

Fall-2013 had 109 students enrolled in the course. From the Figure 4.2 illustrating the demographics of Fall 2013 semester, it is seen that majority of the students belonged

to the Department of Building Construction Management at the College of Technology itself and had chosen the BCM program as their major. The second highest number of students were freshmen students who had not decided their major (Exploratory Studies). This class would be one amongst the classes they take in order to decide their field of study. The rest of the students belonged to various other colleges and majors within the university providing diversity to the class.

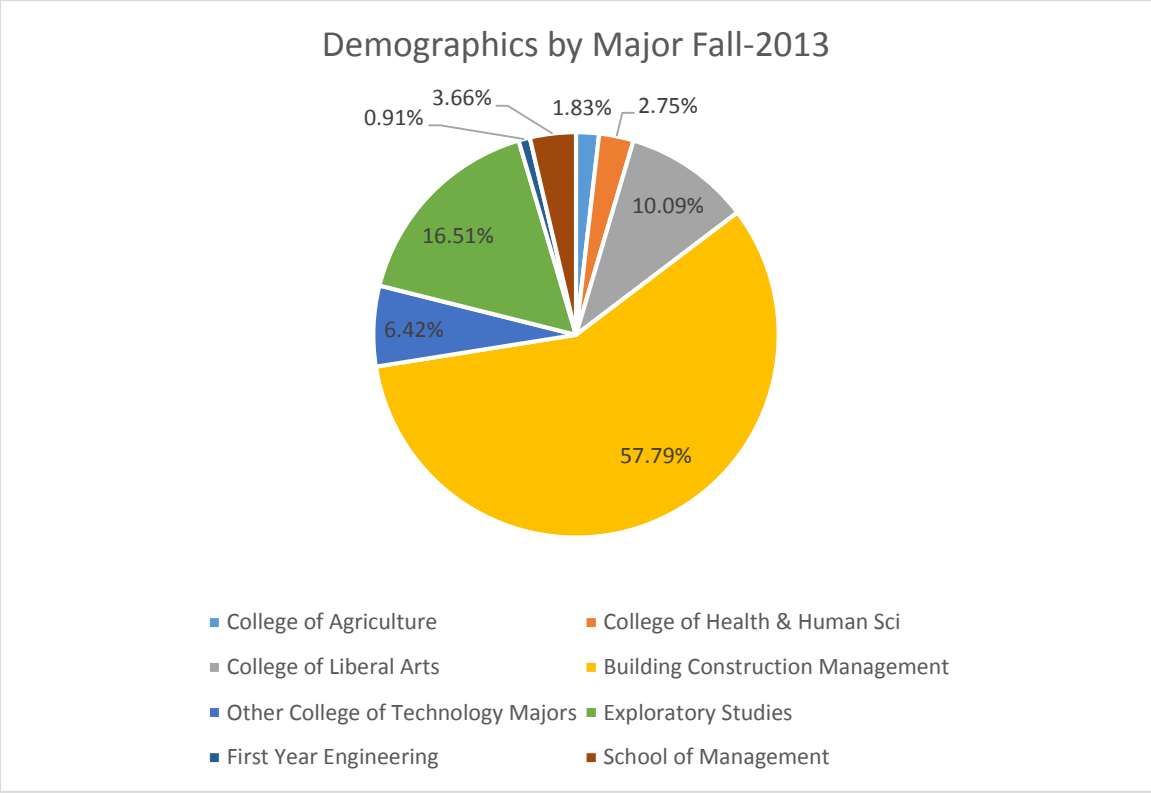


Figure 4.2. Demographics by Majors for Fall-2013

The Spring of 2014 saw demographics illustrated in the Figure 4.3. It was seen that majority of the students belonged to the Department of Building Construction

Management at the College of Technology itself and had chosen the BCM program as their major. The second highest number of students were freshmen students who had not decided their major (Exploratory Studies). This class would be one amongst the classes they take in order to decide their field of study. However, Spring-2014 had a more diverse environment in terms of majors in comparison to Fall 2013 as just 33% of the students belonged to BCM. Spring 2014 had just 59 students enrolled in the course while Fall-2013 had 109 students enrolled. The rest of the students belong to various other colleges and majors within the university providing diversity to the class.

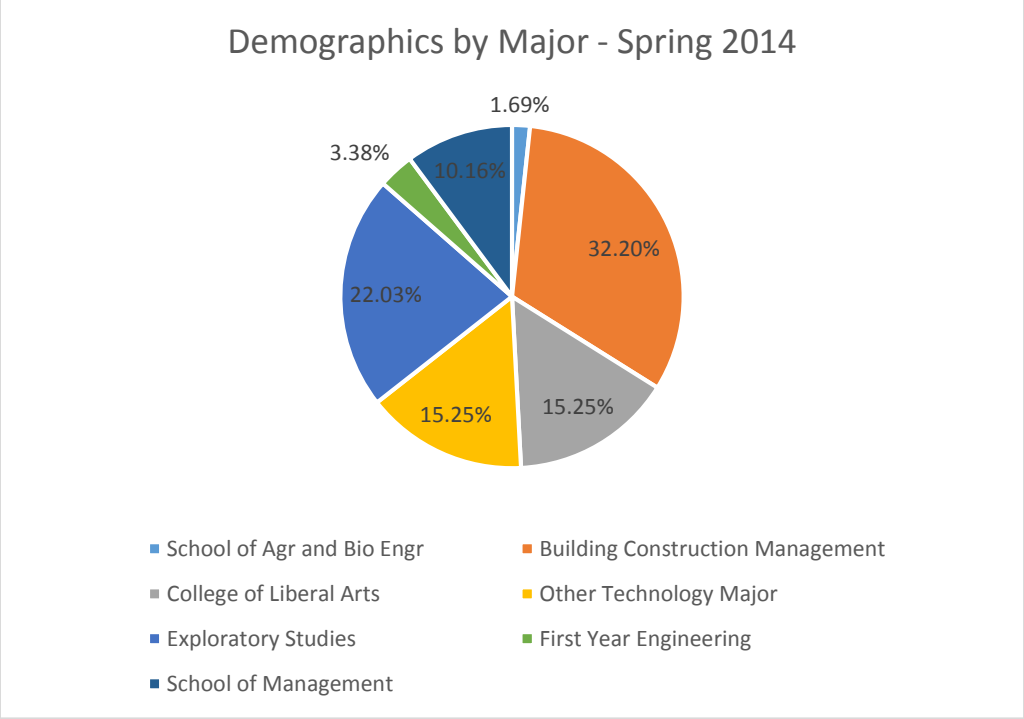


Figure 4.3. Demographics by Major for Spring-2014

The Fall of 2014 saw demographics similar to that of Fall 2013 and is illustrated in Figure 4.4. Similar to Fall of 2013 and Spring of 2014, from the figure, it is seen that

majority of the students belonged to the Department of Building Construction Management at the College of Technology itself and had chosen the BCM program as their major in Fall of 2014 as well. The second highest number of students were freshmen students who had not decided their major (Exploratory Studies). The rest of the students belong to various other colleges and major within the university providing diversity to the class. This class would be one amongst the classes they take in order to decide their field of study. This demographic is very similar to that of Fall-2013 than Spring-2014. It is important to note that the intake between the semesters varied. Spring 2014 had just 59 students enrolled in the course while Fall-2013 had 109 students enrolled. Fall 2014 had 97 students enrolled in the course. Therefore, it can be concluded that Spring-2014 had much lower course enrollment when compared to Fall-2013 and Fall-2014 but had the highest diversity by major.

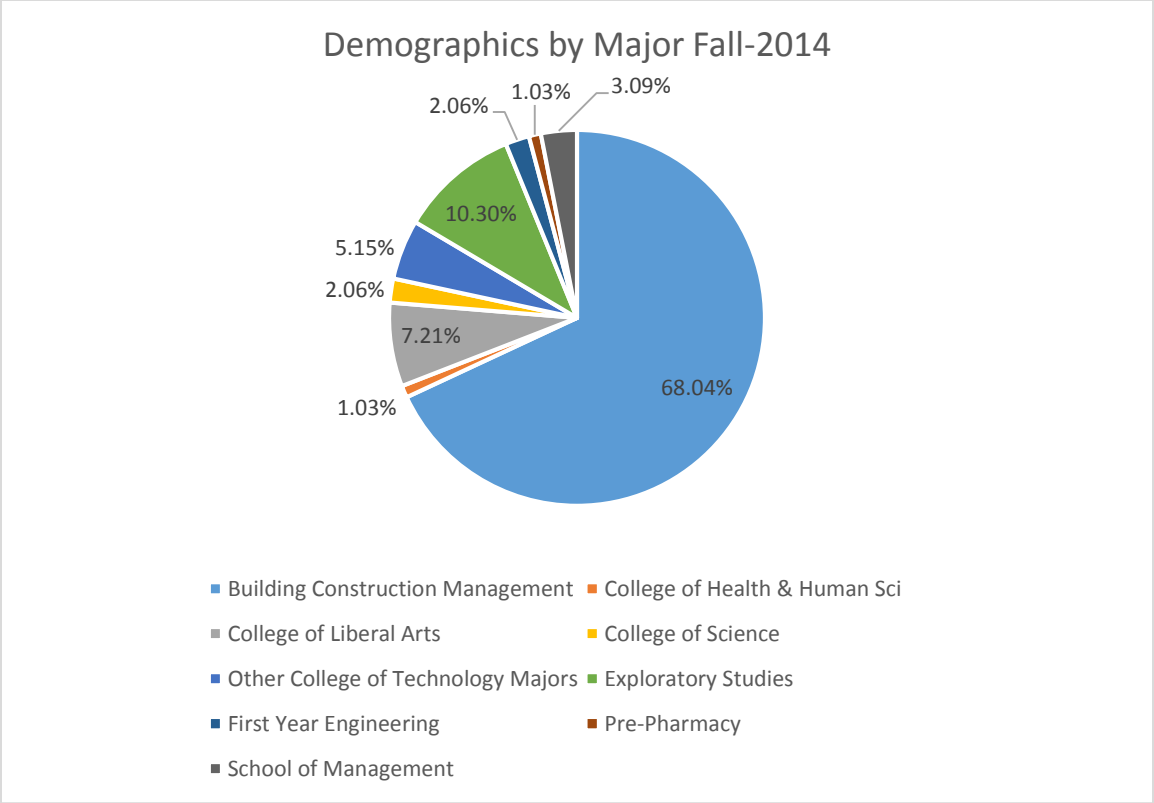


Figure 4.4. Demographics by Major for Fall-2014

4.1 Research Question 1

Is there a difference in the students' perception of learning climate in BCM 10001 comparing data from Fall-2013, Spring-2014 and Fall-2014?

The hypotheses for this research question are:

$H1_0$: There is no difference in the students' perception of learning climate in BCM 10001 comparing data from Fall-2013, Spring-2014 and Fall-2014.

$H1_\alpha$: There is a difference in the students' perception of learning climate in BCM 10001 comparing data from Fall-2013, Spring-2014 and Fall-2014.

Comparison between the results obtained in the pre-survey and post-survey within a semester was conducted for Fall of 2013, Spring 2014 and Fall 2014 in order to identify the change of the learning climate of the course with the semester. The comparison between the pre-survey and post-survey was made by the inferential statistical method of One-way ANOVA using the SPSS software and the results are as shown in Table 4.3, Table 4.4 and Table 4.5 for Fall 2013, Spring 2014 and Fall 2014 respectively. A 95% confidence level is taken and since p is greater than 0.05 and it is seen in the table that a p-value greater than 0.05 is obtained for all three semesters. Therefore, we can conclude that there is no statistical evidence that there was a significant difference between the results obtained for the Learning Climate in the pre-survey as compared to that of the post-survey for the semesters of Fall-2013, Spring-2014 and Fall-2014. However, this can also be attributed to the fact there was insufficient data available in the pre-surveys of all the semesters (Less than 25% responses).

Table 4.3

One way ANOVA for pre-test vs post-survey in Fall 2013

	Sum of squares	Degrees of freedom	Mean square	Fs	P	Variance component (%)
Among groups	0.304	1	0.304	0.654	0.422	-
Between groups	24.175	52	0.465			-
Total	24.479	53				

Note: Significant at $p<0.05$ level

Table 4.4

One way ANOVA for pre-survey vs post-survey in Spring-2014

	Sum of squares	Degrees of freedom	Mean square	Fs	p	Variance Component (%)
Among groups	2.27291	1	2.27291	2.12344	0.15373	-
Between groups	38.5341	36	1.07039			-
Total	40.807	37				

Note: Significant at $p<0.05$ level

Table 4.5

One way ANOVA for pre-survey vs post-survey in Fall 2014

	Sum of squares	Degrees of freedom	Mean square	Fs	P	Variance component (%)
Among groups	0.071	1	0.071	0.076	0.784	-
Between groups	102.076	108	0.945			-
Total	102.148	109				

Note: Significant at $p<0.05$ level

For Fall 2013, descriptive analysis tests were conducted on the post-survey data to measure the average learning climate and overall standard deviations at the end of the semester, the results of which are shown in Table 4.6. The descriptive analysis provided and calculated for the questions in which at least 15 students, and 25% of the students enrolled in the section responded to in order to prevent statistical anomalies. Learning Climate refers to students' perceptions of the student-centeredness of the learning

environment. Higher scores reflect a more student-centered environment, while lower scores are reflective of a more instructor-centered. The average Learning Climate score is 5.716 while the overall standard deviation is 0.77 indicating that the students mildly to moderately agree about the learning climate being student centered. The average score of the Fall-2013 learning climate for the BCM 10001 course is significantly higher than the average learning climate obtained by the IMPACT team which is 5.11 across several courses for the same semester.

Table 4.6.

Descriptive Analysis for Learning Climate in Fall-2013

Learning Climate	N	Likert Mean	Standard Deviation	IMPACT Mean
My instructor provided me with choices and options on how to complete the work.	46	5.67	0.92	4.93
My instructor understood my perspective.	46	5.78	0.99	5.08
My instructor encouraged me to ask questions.	46	5.91	1.11	5.57
My instructor listened to how I would like to do things.	46	5.63	1.25	4.96
My instructor tried to understand how I saw things before suggesting a new way to do things.	46	5.59	0.98	5.01
Learning Climate Scores Fall 2013	**46**	**5.716**	**0.77**	**5.11**

Note: N represents the number of respondents. Higher scores for the Likert and IMPACT mean reflect higher satisfaction of the need.

For Spring 2014, descriptive analysis tests were conducted on the post-survey data to measure the average learning climate and overall standard deviations at the end of the

semester, the results of which are shown in Table 4.7. The descriptive analysis provided and calculated for the questions in which at least 15 students, and 25% of the students enrolled in the section responded to in order to prevent statistical anomalies. Learning Climate refers to students' perceptions of the student-centeredness of the learning environment. Higher scores reflect a more student-centered environment, while lower scores are reflective of a more instructor-centered. The average Learning Climate score is 6.4 and overall standard deviation is 0.5 indicating that the students moderately to strongly agree about learning climate being student centered. This is a considerable increase from the Learning Climate scores of Fall 2013 which saw an average score of 5.716 with an overall standard deviation of 0.77. The average score in Spring-2014 for the learning climate for BCM 10001 course is significantly higher than the average learning climate obtained by the IMPACT team which is 5.51 across several courses for the same semester. The IMPACT mean has seen a significant increase in the Spring 2014 semester in comparison to Fall of 2013 where the average was 5.11.

Table 4.7

Descriptive Analysis for the Learning Climate in Spring-2014

Learning Climate	N	Likert Mean	Standard Deviation	IMPACT Mean
I feel that my instructor provides me choices and options.	18	6.06	0.73	5.41
I feel understood by my instructor.	18	6.44	0.7	5.48
My instructor conveyed confidence in my ability to do well in the course.	18	6.61	0.61	5.64
My instructor encouraged me to ask questions.	18	6.56	0.62	5.83
My instructor listens to how I would like to do things.	18	6.44	0.7	5.35
My instructor tries to understand how I see things before suggesting a new way to do things.	18	6.28	0.75	5.38
Learning Climate Scores for Spring 2014	**18**	**6.4**	**0.5**	**5.51**

Note: N represents the number of respondents. Higher scores for the Likert and IMPACT mean reflect higher satisfaction of the need.

For Fall 2014, descriptive analysis tests were conducted on the post-survey data to measure the average learning climate and overall standard deviations at the end of the semester, the results of which are shown in Table 4.8. The descriptive analysis provided and calculated for the questions in which at least 15 students, and 25% of the students enrolled in the section responded to in order to prevent statistical anomalies. Learning Climate refers to students' perceptions of the student-centeredness of the learning environment. Higher scores reflect a more student-centered environment, while lower scores are reflective of a more instructor-centered. The average Learning Climate score is

5.85 with an overall standard deviation of 1.04 students mildly to strongly agree about learning climate being student centered. This score is a slight decrease in comparison to Spring-2014 which saw an average Learning Climate score of 6.4 with an overall standard deviation of 0.5. However, the Learning Climate scores of Fall 2014 are higher than the Learning Climate scores of Fall 2013 which saw an average score of 5.716 with an overall standard deviation of 0.77. The average score in Fall-2014 for the learning climate for BCM 10001 course is significantly higher than the average learning climate obtained by the IMPACT team which is 5.32 across several courses for the same semester. The IMPACT mean has seen a significant decrease in the Fall of 2014 semester in comparison to Spring of 2013 where the average was 5.51.

Table 4.8

Descriptive analysis for Learning Climate in Fall-2014

Learning Climate	N	Likert Mean	Standard Deviation	IMPACT Mean
I feel that my instructor provides me choices and options.	64	5.83	1.18	5.21
I feel understood by my instructor.	64	5.89	1.07	5.22
My instructor conveyed confidence in my ability to do well in the course.	64	6.06	1.11	5.45
My instructor encouraged me to ask questions.	64	6.02	1.18	5.68
My instructor listens to how I would like to do things.	64	5.67	1.22	5.15
My instructor tries to understand how I see things before suggesting a new way to do things.	64	5.64	1.28	5.22
Learning Climate Scores for Fall 2014	**64**	**5.85**	**1.04**	**5.32**

Note: N represents the number of respondents. Higher scores for the Likert and IMPACT mean reflect higher satisfaction of the need.

A One way ANOVA analysis was conducted on the Learning Climate data obtained from the post-surveys of Fall-2013, Spring-2014 and Fall-2014 in order to inferentially compare the results obtained. It is seen from Table 4.9 that a significance or p-value of 0.026 is obtained. Since a confidence level of 95% was taken in and the obtained p value is less than 0.05, it is concluded that there is a significant difference between the data obtained in each of the semesters.

Table 4.9

One way ANOVA test on Learning Climate of Fall-2013, Spring-2014 and Fall-2014.

	Sum of Squares	Degrees of Freedom	Mean Square	F	P
Between Groups	4.014	2	2.007	3.787	.026
Within Groups	57.238	108	.530		
Total	61.252	110			

Note: Significant at $p<0.05$ level

In order to find out which semester gave out better results, further post-hoc testing using the Tukey Kramer tests are conducted and the results obtained are as seen in Table 4.10. It is clear from the table that the results obtained from Spring-2014 are significantly higher than that of Fall-2013 and Fall-2014. It is also seen that results of Fall-2014 is higher than of Fall-2013 but not significantly different.

Table 4.10

Tukey Kramer Post-Hoc tests for Learning Climate

(I) VAR00002	(J) VAR00002	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
1	Spring 2014	-.5313003*	.2023981	.027	-1.012291	-.050310
	Fall 2014	-.0338614	.1509890	.973	-.392680	.324958
2	Fall 2013	.5313003*	.2023981	.027	.050310	1.012291
	Fall 2014	.4974389*	.2017916	.040	.017890	.976988
3	Fall 2013	.0338614	.1509890	.973	-.324958	.392680
	Spring 2014	-.4974389*	.2017916	.040	-.976988	-.017890

*. The mean difference is significant at the 0.05 level.

	N	Subset for alpha = 0.05	
		1	2
Fall-2013	46	5.866848	
Fall-2014	47	5.900709	
Spring-2014	18		6.398148
Sig.		.982	1.000

Means for groups in homogeneous subsets are displayed.
a. Uses Harmonic Mean Sample Size = 30.435.
b. The group sizes are unequal. The harmonic mean of the group sizes is used. Type I error levels are not guaranteed.

Figure 4.5 provides a comparison of the average learning climate scores of BCM 10001 and the IMPACT Mean for each of semesters.

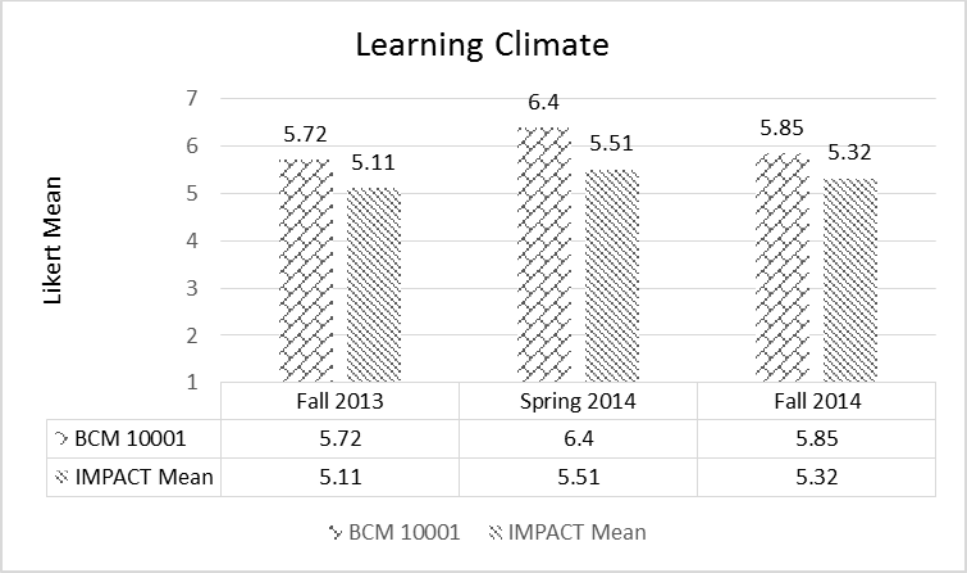


Figure 4.5. Comparison of average Learning Climate score

It is concluded that the alternate hypothesis stated below is true.

$H1_{\alpha}$: There is a difference in the students' perception of learning climate in BCM 10001 comparing data from Fall-2013, Spring-2014 and Fall-2014.

Therefore, there is a change in the learning climates with the infusion of active learning elements as perceived by the students of each semester in comparison to the other two semesters. Further, it is seen that Spring-2014 had higher score indicating higher student centered learning in comparison to Fall-2013 and Fall-2014, although Fall 2014 had higher amounts of active learning elements in comparison between to the other two semesters.

4.2 Research Question 2

Is there a difference in the students' perception of Basic Psychological Needs in BCM 10001 comparing data from Fall-2013, Spring-2014 and Fall-2014?

The hypotheses for this research question are:

$H2_0$: There is no difference in the students' perception of Basic Psychological Needs in BCM 10001 comparing data from Fall-2013, Spring-2014 and Fall-2014.

$H2_\alpha$: There is a difference in the students' perception of Basic Psychological Needs in BCM 10001 comparing data from Fall-2013, Spring-2014 and Fall-2014.

Comparison between the results obtained in the pre-survey and post-survey within a semester was conducted for Fall of 2013, Spring 2014 and Fall 2014 in order to identify the change in the student perception of the basic psychological needs within a semester was made by the inferential statistical method of One-way ANOVA using SPSS and the results are as shown in Table 4.11, Table 4.12 and Table 4.13 for Fall-2013, Spring-2014 and Fall-2014 respectively (Gall, Gall, & Borg, 1999). A 95% confidence level is taken and it is seen that p is greater than 0.05, we can conclude that there is no statistical evidence that there was a significant difference between the results obtained for between the results obtained for the Basic Psychological Needs in the pre-survey as compared to that of the post-survey for each of the semesters. However, the extremely large p value can also be attributed to the fact there was insufficient data available in the pre-survey (Less than 25%).

Table 4.11

One way ANOVA for pre-survey vs post-survey in Fall 2013

	Sum of squares	Degrees of freedom	Mean square	Fs	P	Variance component (%)
Among groups	0.003309	1	0.003309	0.007844	0.929768	-
Between groups	21.93736	52	0.421872			-
Total	21.94067	53				

Note: Significant at p<0.05 level

Table 4.12

One way ANOVA for pre-survey vs post-survey in Spring 2014

	Sum of squares	Degrees of freedom	mean square	F	p	Variance component (%)
Among groups	0.9723	1	0.9723	2.1213	0.1539	-
Between groups	16.5007	36	0.4583			-
Total	17.4731	37				

Note: Significant at p<0.05 level

Table 4.13

One way ANOVA for Basic Psychological Needs in Fall-2014

	Sum of squares	Degrees of freedom	Mean square	Fs	P	Variance component (%)
Among groups	0.072073	1	0.072073	0.198506	0.65683	-
Between groups	38.84928	107	0.363077			-
Total	38.92136	108				

Note: Significant at p<0.05 level

For Fall-2013, descriptive analysis tests were conducted on the post-survey data to measure the average values for the basic psychological needs and the overall standard deviations at the end of the semester, the results of which are shown in Table 4.14. The descriptive analysis provided and calculated for the questions in which at least 15 students, and 25% of the students enrolled in the section responded to in order to prevent statistical anomalies. Higher scores reflect higher satisfaction of the need; (R) denotes reverse-coded items, for which higher scores reflect lower satisfaction of the need. The average Basic Psychological Needs score is 5.25 and overall standard deviation is 1.06 indicating that the students mildly to moderately agree about the course satisfying their Basic Psychological Needs. The average score in Fall-2013 for the Basic Psychological Needs for the BCM 10001 course is significantly higher than the average basic psychological needs obtained by the IMPACT team which is 4.66 across several courses for the same semester.

Table 4.14

Basic Psychological Needs Fall-2013

Basic Psychological Needs	N	Likert Mean	Standard Deviation	IMPACT Mean
People in this course told me I was good at what I was doing.	46	5.13	1.28	4.59
I was able to learn interesting new skills in this course.	46	5.61	0.98	4.98
Most days I felt a sense of accomplishment from being in this course.	46	5.02	1.48	4.41
Basic Psychological Needs in Fall-2013	**46**	**5.25**	**1.06**	**4.66**

Note: N represents the number of respondents. Higher scores for the Likert and IMPACT mean reflect higher satisfaction of the need; (R) denotes reverse-coded items, for which higher scores reflect lower satisfaction of the need. Both the IMPACT scores and scores for BCM 10001 have been reported as is in this table. However, the scores were converted to a positive score while calculating the average reported.

For the Spring of 2014, descriptive analysis tests were conducted on the post-survey data to measure the average values for the basic psychological needs and the overall standard deviations at the end of the semester, the results of which are shown in Table 4.15. The descriptive analysis provided and calculated for the questions in which at least 15 students, and 25% of the students enrolled in the section responded to in order to prevent statistical anomalies. Higher scores reflect higher satisfaction of the need; (R) denotes reverse-coded items, for which higher scores reflect lower satisfaction of the need. The average Basic Psychological Need score for Spring-2014 is 4.9 and overall standard deviation is 0.86 indicating that the students range from being neutral to moderately agreeing about the course satisfying their Basic Psychological Needs. This is a reduction from that of Fall 2013 which saw an average score of 5.25 and a standard deviation of 1.06. The average score in Spring-2014 for the Basic Psychological Needs for the BCM 10001 course is significantly higher than the Basic Psychological Needs satisfaction obtained by the IMPACT team which is 4.71 across several courses for the same semester. The IMPACT average saw a significant increase as well in comparison to the Fall-2013 score of 4.66.

Table 4.15

Descriptive Analysis for Basic Psychological Needs for Spring 2014

Basic Psychological Needs Spring-2014	N	Likert Mean	Standard Deviation	IMPACT Mean
I feel like I can make a lot of inputs in deciding how my coursework gets done.	18	5.44	1.38	4.79
I feel pressured in this course. (R)	18	3.28	1.67	5.22
I am free to express my ideas and opinions in this course.	18	5.44	1.1	3.33
When I am in this course, I have to do what I am told.(R)	18	5.06	0.87	4.59
My feelings are taken into consideration in this course.	18	4.89	1.23	3.76
I feel like I can pretty much be myself in this course.	18	5.56	1.25	5.43
There is not much opportunity for me to decide for myself how to go about my coursework. (R)	18	3.61	1.46	4.08
I do not feel very competent in this course. (R)	18	2.83	1.47	5.3
People in this course tell me I am good at what I do.	18	4.61	1.46	4.8
I have been able to learn interesting new skills in this course.	18	5.22	1	4.99
Most days I feel a sense of accomplishment from this course.	18	4.61	1.09	5.02
In this course I do not get much of a chance to show how capable I am. (R)	18	3.83	1.86	4.44
I often do not feel very capable in this course. (R)	18	3.11	1.78	4.76
I really like the people in this course.	18	5.22	1.11	3.63
I get along with people in this course.	18	5.50	1.15	4.69
I pretty much keep to myself when in this course. (R)	18	4.06	1.86	4.25
I consider the people in this course to be my friends.	18	5.00	1.24	5.12
People in this course care about me.	18	5.00	1.14	3.06
There are not many people in this course that I am close to. (R)	18	4.22	1.99	3.30
The people in this course do not seem to like me much. (R)	18	3.17	1.54	3.69
People in this course are pretty friendly towards me.	18	5.50	0.92	5.45
Basic Psychological Needs for Spring-2014	**18**	**4.9**	**0.86**	**4.71**

Note: N represents the number of respondents. Higher scores for the Likert and IMPACT mean reflect higher satisfaction of the need; (R) denotes reverse-coded items, for which higher scores reflect lower satisfaction of the need. Both the IMPACT scores and scores for BCM 10001 have been reported as is in this table. However, the scores were converted to a positive score while calculating the average reported.

Descriptive analysis tests were conducted on the post-survey data to measure the average values for the basic psychological needs and the overall standard deviations at the end of the semester, the results of which are shown in Table 4.16. The descriptive analysis provided and calculated for the questions in which at least 15 students, and 25% of the students enrolled in the section responded to in order to prevent statistical anomalies. Higher scores reflect higher satisfaction of the need; (R) denotes reverse-coded items, for which higher scores reflect lower satisfaction of the need. The average Basic Psychological Need score for Fall-2014 is 4.92 and overall standard deviation is 0.83 indicating that the students range from being neutral to moderately agreeing about the course satisfying their Basic Psychological Needs. This result is not significantly different from that of Spring-2014 which saw an average of 4.9 along with a standard deviation of 0.86 but is a reduction from the Fall-2013 semester which saw an average score of 5.25 and a standard deviation of 1.06. The average Basic Psychological Need score for Spring-2014 is 4.9 and overall standard deviation is 0.86 indicating that the students range from being neutral to moderately agreeing about the course satisfying their Basic Psychological Needs. This is a reduction from that of Fall 2013 which saw an average score of 5.25 and a standard deviation of 1.06. The average score in Fall-2014 for the Basic Psychological Needs for the BCM 10001 course is significantly higher than the average basic psychological needs satisfaction obtained by the IMPACT team which is 4.60 across several courses for the same semester. However, the IMPACT score significantly reduced from that of Spring-2014 score of 4.71.

Table 4.16

Descriptive Analysis for the Basic Psychological Needs in Fall-2014

Basic Psychological Needs Fall-2014	N	Likert Mean	Standard Deviation	IMPACT Mean
I feel like I can make a lot of inputs in deciding how my coursework gets done.	64	5.33	1.09	4.63
I feel pressured in this course. (R)	64	3.13	1.76	3.54
I am free to express my ideas and opinions in this course.	64	5.53	1.11	5.17
When I am in this course, I have to do what I am told. (R)	64	4.86	1.46	4.96
My feelings are taken into consideration in this course.	64	4.92	1.35	4.55
I feel like I can pretty much be myself in this course. There is not much opportunity for me to decide for myself how to go about my coursework. (R)	64	5.3	1.43	5.03
I do not feel very competent in this course. (R)	64	3.28	1.8	3.3
People in this course tell me I am good at what I do.	64	4.88	1.33	4.49
I have been able to learn interesting new skills in this course.	64	5.39	1.2	4.98
Most days I feel a sense of accomplishment from this course.	64	4.77	1.55	4.33
In this course I do not get much of a chance to show how capable I am. (R)	64	3.83	1.64	3.68
I often do not feel very capable in this course. (R)	64	2.67	1.64	3.17
I really like the people in this course.	64	5.67	1.04	5.11
I get along with people in this course.	64	5.77	1.05	5.41
I pretty much keep to myself when in this course. (R)	64	3.87	1.72	4.06
I consider the people in this course to be my friends.	64	5.31	1.28	4.81
People in this course care about me.	64	5.05	1.22	4.6
There are not many people in this course that I am close to. (R)	64	3.89	1.73	4.15
The people in this course do not seem to like me much. (R)	64	3.25	1.67	3
People in this course are pretty friendly towards me.	64	5.81	0.97	5.4
Basic Psychological Needs for Fall-2014	**64**	**4.92**	**0.83**	**4.60**

Note: N represents the number of respondents. Higher scores for the Likert and IMPACT mean reflect higher satisfaction of the need; (R) denotes reverse-coded items, for which higher scores reflect lower satisfaction of the need. Both the IMPACT scores and scores for BCM 10001 have been reported as is in this table. However, the scores were converted to a positive score while calculating the average reported.

A One way ANOVA analysis was conducted on the Basic Psychological Needs data obtained from the post-surveys of Fall-2013, Spring-2014 and Fall-2014 in order to inferentially compare the results obtained. The results obtained from the One-way ANOVA test are shown in Table 4.17. From the table, it is seen that a significance or p-value of 0.01 is obtained. Since a confidence level of 95% was taken in and the obtained p value is less than 0.05, it is concluded that there is a significant difference between the data obtained in each of the semesters.

Table 4.17

One way ANOVA comparing Basic Psychological Needs for Fall-2013, Spring-2014 and Fall-2013

	Sum of Squares	Degrees of Freedom	Mean Square	F	P
Between Groups	4.954	2	2.477	7.21	.001
Within Groups	36.400	107	.340		
Total	41.353	109			

Note: Significant at $p<0.05$ level

In order to find out which semester gave out better results, further post-hoc testing using the Tukey Kramer tests are conducted and the results obtained are as seen in Table 4.18. It is clear that the results obtained from Fall-2013 are significantly higher than that of Spring 2014 and Fall-2014. It is also seen that results of Fall-2014 is higher than of Spring-2014 but not significantly different.

Table 4.18

Tukey Kramer Post-Hoc tests for Basic Psychological Needs

Tukey HSD

(I) VAR00002	(J) VAR00002	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
1	2	.43832*	.16216	.022	.0529	.8237
	3	.42696*	.12162	.002	.1379	.7160
2	1	-.43832*	.16216	.022	-.8237	-.0529
	3	-.01136	.16216	.997	-.3968	.3740
3	1	-.42696*	.12162	.002	-.7160	-.1379
	2	.01136	.16216	.997	-.3740	.3968

*. The mean difference is significant at the 0.05 level.

VAR00002	N	Subset for alpha = 0.05	
		1	2
Spring-2014	18	4.8783	
Fall-2014	46	4.8896	
Fall-2013	46		5.3166
Sig.		.997	1.000

Means for groups in homogeneous subsets are displayed.

a. Uses Harmonic Mean Sample Size = 30.293.

b. The group sizes are unequal. The harmonic mean of the group sizes is used. Type I error levels are not guaranteed.

Figure 4.6 provides a visual comparison of the average Basic Psychological Needs score for each of semesters thereby providing a pictorial representation of the results of BCM 10001 and the IMPACT Mean for each of semesters. It can be seen that the scores of Fall-2013 were higher than the other two semesters. It is also seen that the average score in Spring-2014 was slightly lower than that of Fall-2014 although it was not significantly different.

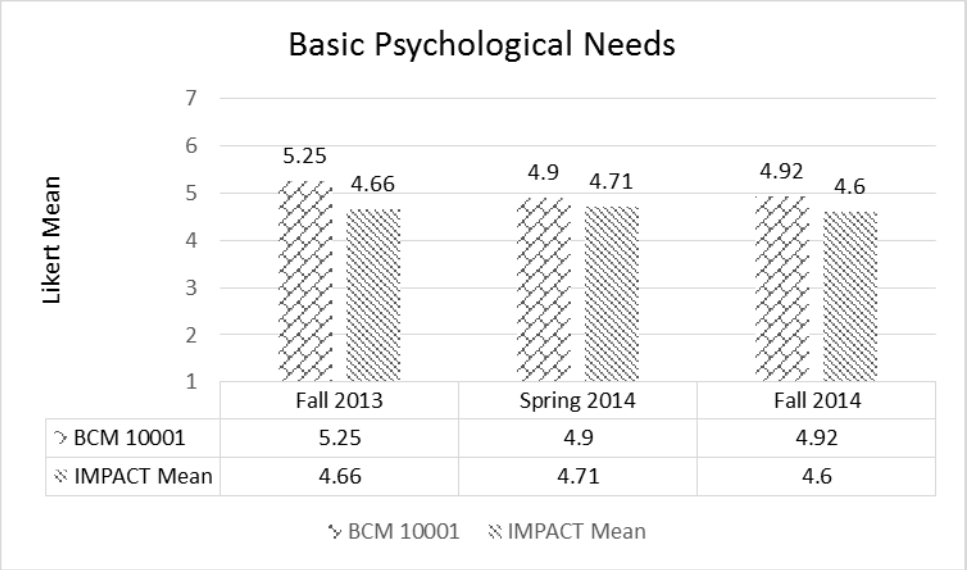


Figure 4.6. Comparison of Average Basic Psychological Needs Score

It is concluded that the alternate hypothesis stated below is true:

$H2_{\alpha}$: There is a difference in the students' perception of Basic Psychological Needs in BCM 10001 comparing data from Fall-2013, Spring-2014 and Fall-2014.

Therefore, there is a change in the Basic Psychological Needs with the infusion of active learning elements as perceived by the students of each semester in comparison to the other two semesters. Further, it is seen that Fall-2013 had a higher score indicating better motivation and psychological satisfaction in comparison to that of Fall-2013 and Spring-2014.

4.3 Research Question 3

Is there a difference in the students' perception of knowledge transfer in BCM 10001 comparing data from Fall-2013, Spring-2014 and Fall-2014?

The hypotheses for this research question are:

$H3_0$: There is no change in the student perception of transfer of knowledge perceived by the students of each semester in comparison to the other two semesters (Fall-2013, Spring-2014 and Fall-2014)

$H3_\alpha$: There is a change in the perception of transfer of knowledge as perceived by the students of each semester in comparison to the other two semesters (Fall-2013, Spring-2014 and Fall-2014)

Comparison between the results obtained in the pre-survey and post-survey within a semester was conducted for Fall of 2013, Spring 2014 and Fall 2014 in order to identify the change of the Perceived Knowledge Transfer within a semester was made by the inferential statistical method of One-way ANOVA using SPSS and the results are as shown in Table 4.19, Table 4.20 and Table 4.21 for Fall 2013, Spring 2014 and Fall 2014 respectively. A 95% confidence level is taken and it is seen that p is greater than 0.05 for each of the semesters. Therefore it can be concluded that there is no statistical evidence that there was a significant difference between the results obtained for between the results obtained for the Perceived Knowledge Transfer in the pre-survey as compared to that of the post-survey for each of the semesters. However, the extremely large p value can also be attributed to the fact there was insufficient data available in both the pre-survey as well as post-surveys (Less than 30).

Table 4.19

One way ANOVA for pre-survey vs post-survey in Fall 2013

	Sum of squares	Degrees of freedom	Mean square	Fs	P	Variance component (%)
Among groups	0.3220	1	0.3220	0.5101	0.4782	-
Between groups	32.8260	52	0.6312			-
Total	33.1481	53				

Note: Significant at p<0.05 level

Table 4.20

One way ANOVA for pre-survey vs post-survey in Spring 2014

	Sum of squares	Degrees of freedom	mean square	Fs	P	Variance component (%)
Among groups	1.7718	1	1.7718	1.6331	0.2058	-
Between groups	69.4317	64	1.0848			-
Total	71.2036	65				

Note: Significant at p<0.05 level

Table 4.21

One way ANOVA for pre-survey vs post-survey in Spring 2014

	Sum of squares	Degrees of freedom	mean square	Fs	P	Variance component (%)
Among groups	0.7624	1	0.7624	0.7668	0.3831	-
Between Groups	106.389	107	0.9942			-
Total	107.1514	108				

Note: Significant at p<0.05 level

For Fall of 2013, descriptive analysis tests were conducted on the post-survey data to measure the average values for the perceived knowledge transfer and the overall standard deviations at the end of the semester, the results of which are shown in Table 4.22. The descriptive analysis provided and calculated for the questions in which at least 15 students, and 25% of the students enrolled in the section responded to in order to prevent statistical anomalies. Perceived Knowledge Transfer reflects that to what extent students perceive that the information learned would transfer beyond the course. Higher scores reflect better perceived knowledge transfer ability. The average Perceived Knowledge Transfer score is 5.72 while the overall standard deviation is 0.62 indicating that the students mildly to moderately agree about the perception that the information learned would transfer beyond the course. The average score in Fall-2013 for the Perceived Knowledge Transfer for the BCM 10001 course is significantly higher than the average learning climate obtained by the IMPACT team which is 5.08 across several courses for the same semester.

Table 4.22

Descriptive analysis for Perceived Knowledge Transfer in Fall-2013

Perceived Knowledge Transfer	N	Likert Mean	Standard Deviation	IMPACT Mean
I feel confident in my ability to apply the course material in other classes that I have.	46	5.54	0.94	5.1
I feel confident in my ability to apply the course material in my professional life.	46	5.65	0.92	5.15
I feel as if the material covered in this course is relevant to my future career.	46	5.8	0.96	5.04
Given the future career that I have chosen, it is important for me to learn the information covered in this class.	46	5.85	0.94	4.97
I understand how I will use the information learned in this class in my professional life.	46	5.7	1.05	4.98
Information learned in this course will inform my future learning experiences.	46	5.72	0.75	5.04
I believe that it is important for me to learn the information included in this course.	46	5.85	0.97	5.14
The information learned in this course will help me become a better-rounded individual.	46	5.63	1.08	5.21
Perceived Knowledge Transfer Score for Fall-2013	**46**	**5.72**	**0.69**	**5.08**

Note: N represents the number of respondents. Higher scores for the Likert and IMPACT mean reflect higher satisfaction of the need.

For the Spring of 2014, descriptive analysis tests were conducted on the post-survey data to measure the average values for the perceived knowledge transfer and the overall standard deviations at the end of the semester, the results of which are shown in Table 4.23. The descriptive analysis provided and calculated for the questions in which at least 15 students, and 25% of the students enrolled in the section responded to in order to prevent statistical anomalies. Perceived Knowledge Transfer reflects that to what extent

students perceive that the information learned would transfer beyond the course. Higher scores reflect better perceived knowledge transfer ability. The average Perceived Knowledge Transfer score is 5.66 while the overall standard deviation is 1.23 indicating that the students mildly to strongly agree about the perception that the information learned would transfer beyond the course. Comparing just the average with the average of Fall 2013 which was 5.72, there is a reduction in the perceived knowledge transfer in Spring Transfer. The average score in Spring-2014 for the Perceived Knowledge Transfer for the BCM 10001 course is significantly higher than the average learning climate obtained by the IMPACT mean which is 5.09 across several courses for the same semester. However, the IMPACT score slightly increased from that of Fall-2014 score of 5.08.

Table 4.23

Descriptive analysis for Perceived Knowledge Transfer in Spring-2014

Perceived Knowledge Transfer	N	Likert Mean	Standard Deviation	IMPACT Mean
I feel confident in my ability to apply the course material in other classes that I have.	18	5.39	1.65	5.09
I feel confident in my ability to apply the course material in my professional life.	18	5.78	1.11	5.16
I feel as if the material covered in this course is relevant to my future career.	18	5.61	1.65	5.04
Given the future career that I have chosen, it is important for me to learn the information covered in this class.	18	5.5	1.54	5.02
I understand how I will use the information learned in this class in my professional life.	18	5.72	1.32	5.07
Information learned in this course will inform my future learning experiences.	18	5.72	1.53	5
I believe that it is important for me to learn the information included in this course.	18	5.78	1.17	5.12
The information learned in this course will help me become a more well-rounded individual.	18	5.78	0.94	5.24
Perceived Knowledge Transfer Score for Spring 2014	**18**	**5.66**	**1.23**	**5.09**

Note: N represents the number of respondents. Higher scores for the Likert and IMPACT mean reflect higher satisfaction of the need.

For Fall of 2014, descriptive analysis tests were conducted on the post-survey data to measure the average values for the perceived knowledge transfer and the overall standard deviations at the end of the semester, the results of which are shown in Table 4.24. The descriptive analysis provided and calculated for the questions in which at least 15 students, and 25% of the students enrolled in the section responded to in order to prevent statistical anomalies. Perceived Knowledge Transfer reflects that to what extent students perceive that the information learned would transfer beyond the course. Higher scores reflect better perceived knowledge transfer ability. The average Perceived Knowledge Transfer score is 5.63 overall and the standard deviation is 1.01 indicating that the students mildly to strongly agree about the perception that the information learned would transfer beyond the course. Comparing just the average of Fall-2014 with the average of Spring-2014 as well as Fall-2013 there is a reduction in the perceived knowledge transfer. However, the difference is not significant and it is important to observe that the there is a significant difference in the standard deviation indicating the presence of data at both ends of the spectrum. The average score in Fall 2014 for the Perceived Knowledge Transfer for the BCM 10001 course is significantly higher than the average learning climate obtained by the IMPACT team which is 5.06 across several courses for the same semester. However, the IMPACT score slightly decreased from that of Spring-2014 score of 5.09.

Table 4.24

Descriptive analysis for Perceived Knowledge Transfer in Fall-2014

Perceived Knowledge Transfer	N	Likert Mean	Standard Deviation	IMPACT Mean
I feel confident in my ability to apply the course material in other classes that I have.	64	5.39	1.32	5.07
I feel confident in my ability to apply the course material in my professional life.	64	5.69	1.05	5.15
I feel as if the material covered in this course is relevant to my future career.	64	5.66	1.3	5.03
Given the future career that I have chosen, it is important for me to learn the information covered in this class.	64	5.7	1.22	4.99
I understand how I will use the information learned in this class in my professional life.	64	5.56	1.27	5.03
Information learned in this course will inform my future learning experiences.	64	5.67	1.1	5
I believe that it is important for me to learn the information included in this course.	64	5.73	1.16	5.06
The information learned in this course will help me become a better-rounded individual.	64	5.64	1.13	5.14
Perceived Knowledge Transfer Score for Fall 2014	**64**	**5.63**	**1.01**	**5.06**

Note: N represents the number of respondents. Higher scores for the Likert and IMPACT mean reflect higher satisfaction of the need.

Therefore in order to compare means of the Perceived Knowledge Transfer between Fall-2013, Spring-2014 and Fall-2014, a One Way ANOVA test is conducted and its results are presented in Table 4.25. From the table, it is seen that a p-value of 0.839 is obtained. A 95% confidence level is taken and since p is greater than 0.05, we can conclude that there was no significant difference between the results obtained for the Perceived Knowledge Transfer between the semesters of Fall-2013, Spring-2014 and Fall-2014.

Table 4.25

One way ANOVA tests on post-surveys of Fall-2013, Spring-2014 and Fall-2014.

	Sum of squares	Degrees of freedom	mean square	Fs	P	Variance component (%)
Between Groups	0.301	2	0.151	0.175	0.839	
Within Groups	91.02	106	0.859			
Total	91.321	108				

Note: Significant at $p<0.05$ level

Figure 4.7 provides a comparison of the Perceived Knowledge Transfer of BCM 10001 and the IMPACT Mean for each of semesters. It is clear from the figure as well that there is no significant difference in the Perceived Knowledge Transfer between one semester and another.

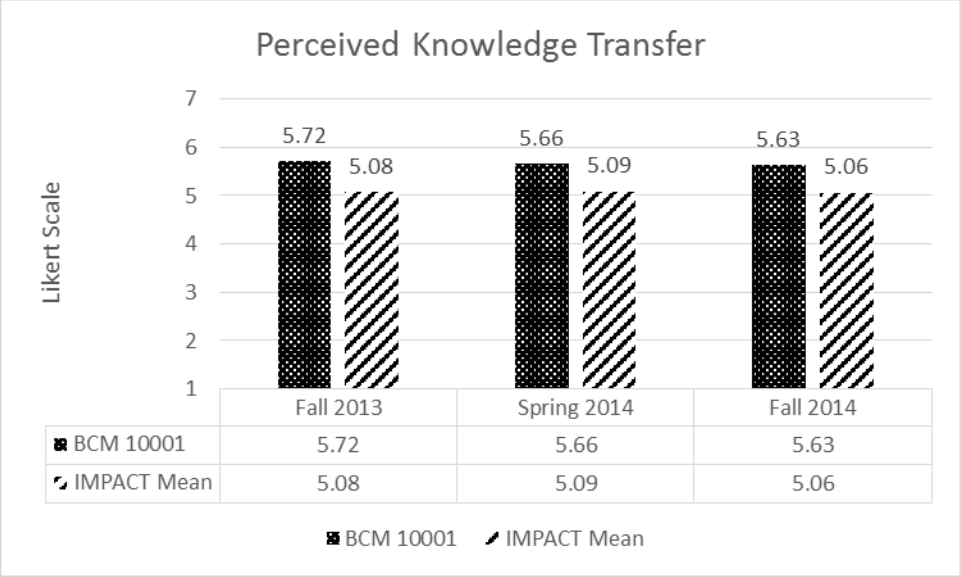


Figure 4.7. Comparison of average Perceived Knowledge Transfer Score

Therefore, the following null hypothesis is true:

$H3_0$: There is no change in the student perception of transfer of knowledge perceived by the students of each semester in comparison to the other two semesters (Fall-2014, Fall-2013 and Spring-2014)

It can be concluded that there is no change in the perceived knowledge transfer with the infusion of active learning element in each semester as compared to the other two semesters.

4.4 Summary

The scores for Learning Climate, Basic Psychological Needs and Perceived Knowledge transfer were calculated by the methods of One-Way ANOVA and Descriptive Statistics. It is seen from Table 4.26 that two of the three null hypotheses were proven to be false. It is important to note that, for each semester, the BCM 10001 mean was significantly higher than that of the IMPACT mean. Also, it is seen that Spring-2014 had the best learning climate while Fall-2013 had better perception of the Basic Psychological Needs transfer. However, there was no significant difference in the perceived knowledge transfer amongst the three semesters.

Table 4.26

Comparison of results

	Fall 2013	Spring 2014	Fall 2014
Learning Climate	Low Scores	High Scores	Low score in comparison to Spring 2014. Higher than Fall 2013 but not significantly different.
	Null hypothesis was proven to be false as p = 0.026. There was a change in the learning climate.		
Basic Psychological Needs	High Score	Low Score.	Low Score.
	Null hypothesis was proven to be false p = 0.001. There was a change in the Basic Psychological Needs Score.		
Perceived Knowledge Transfer	Moderate Score.	Moderate Score.	Moderate Score.
	Null hypothesis was proven to be true p = 0.839. There was no change in the Perceived Knowledge Transfer Score		

Note: Hypothesis analyzed using One-Way ANOVA with a significance level of 95%. Therefore p>0.05 indicates that null hypothesis is false.

CHAPTER 5. DISCUSSIONS, CONCLUSIONS & RECOMMENDATIONS

This thesis looked into evaluating the impact of infusing the development of active learning elements into a large intake foundational course at Purdue University over the course of three semesters to assess the learning climate, basic psychological needs and the perceived knowledge transfer of the students in the class. Utilizing the data that the IMPACT team collected over the semesters of Fall-2013, Spring-2014 and Fall-2014, the results of this study helps understand the impact of the different elements of active learning in a classroom. The results obtained each semester are compared to the overall IMPACT results as well. Based on the results of the study, inference can be made as to whether the active learning components can be applied to other classes.

5.1 Discussion

The author was present in the class all three semesters and some of the observations have been discussed along with the results obtained from the data analysis. The discussion for the thesis has been arranged into three sections and is as follows:

1. Learning Climate:

The comparison between pre-survey and post-survey for every semester to measure the learning climate revealed no significant difference between the results obtained in two

surveys within a semester. This can attributed to the lack of responses to the pre-surveys of all the semesters. Upon comparing the post-survey descriptive analysis results it was seen that the learning climate in the Fall-2013 semester was lower than the other two semesters indicating a more faculty centered learning than student centered learning inthe Fall-2013 semester. Fall 2013 had the least amount of active learning elements infused into the course in comparison to the other two semesters. Although the classes were being held in an IMPACT classroom B848 at Hicks undergraduate library that had a capacity of 117 with the semester's enrollment being 109. The classroom consisted of various facilities including that of an instructor station, collaborative working tables that could be moved around projector, etc., the assessments were made through conventional paper/blackboard exams and quizzes as well as in class activities which were graded. This result is consistent with literature findings.

It is seen in both the descriptive analysis and One-Way ANOVA tests that Spring-2014 had a better learning climate than Fall-2014 although Fall 2014 had higher amounts of active learning. During Spring 2014, the classes were held at the IMPACT classroom B853 located at Hicks undergraduate library. The room included 3 projectors, one instructor station with document camera, and several whiteboards, collaborative working tables that could not be moved around. The room also had a lower capacity of 90 and the enrollment for the semester was 57 resulting in higher faculty-student ratio. Immediate feedback assessment used for quizzes and exams. The author observed that the students enjoyed taking quizzes using this technique and there was a sense of enthusiasm to take a test that was not observed in Fall 2013. Spring 2014 had lower intake and used a different

classroom and assessment methods in comparison to that of Fall 2013 and Fall 2014 which may be factors that resulted in a better learning climate.

Fall 2014 had the highest amount of active learning yet saw results much lower than Spring 2014 and comparable to that of Fall 2013 which had the least amount of active learning. One of the possible reasons for the low learning climate maybe due to the fact that both Fall 2013 and Fall 2014 used the same classroom that is IMPACT classroom B848 at Hicks undergraduate library that had a capacity of 117 with the enrollments in Fall 2013 and Fall 2014 being 109 and 96 respectively. These enrollments are significantly higher than that of Spring 2014 leading to a lower student-faculty ratio. Both Fall 2013 and Fall 2014 had assessment methods that were different from each other as well as that of Spring 2014. Also, Fall 2014 implemented the use of an online textbook in comparison to the conventional textbook used in the other two semester which may have caused the reduction in learning climate despite the increase in active learning elements in the course. The author also observed that the students were not used to the online textbook. Also, since it was the first time the online textbook was being implemented, there was a lot of confusion in the classroom pertaining to the textbook and the assessment within them. In order to ascertain the effect of the online textbook on the learning climate, data from a future semester utilizing the book may be analyzed. The above reasons and discussions are mere speculations and future research must be conducted to ascertain the exact cause of the reduction in learning climate.

The average for each of the semesters for this section were significantly higher than the IMPACT mean obtained for the learning climate across several courses indicating that BCM 10001 had higher student centeredness than most courses associated with

IMPACT. The IMPACT mean is measured across around 120 large enrollment foundational courses similar to that of BCM 10001. However, the exact differences between the learning climates of these courses with that of BCM 10001 is not known.

2. Basic Psychological Needs:

The comparison between pre-survey and post-survey for every semester to measure the Basic Psychological Needs revealed no significant difference between the results obtained in two surveys within a semester. This can attributed to the lack of responses to the pre-surveys. Upon comparing the post-survey results of Fall-2013, Spring-2014 and Fall-2014, it was found that Fall-2013 provided the highest Basic Psychological Needs satisfaction. Fall 2013 had the lowest amount of active learning elements infused into the course which means that the course was more faculty centered than the other two semesters. The reason behind the high satisfaction may be due to the fact that most courses that a student attends through the day would be similar to that of Fall 2013 providing a sense of familiarity to the students allowing them to feel more psychologically satisfied with the course.

Spring-2014 provided the lowest Basic Psychological Needs satisfaction although the result was not significantly different from that of Fall-2014. Spring 2014 had the highest amount of student centeredness measured in terms of learning climate as compared to the other two semesters. The reason for the low satisfaction maybe due to the fact that the course was significantly different from the normal courses the students attend which are highly faculty centered. Although Fall 2014 had higher amounts of active learning, the results are not significantly different from that of Spring 2014. This may be due to the

introduction of the online textbook or the assessment method which is different from the other two semesters. Assessments for the semester were done within the textbook. These discussion are mere speculations and further research needs to be conducted in order to ascertain the exact cause low basic psychological needs satisfaction in the semesters that have higher student centeredness and active learning elements. The average for each of the semesters for this section were significantly higher than the IMPACT mean obtained for the learning climate across several courses indicating that BCM 10001 had higher satisfaction of the basic psychological need than most courses associated with IMPACT. The IMPACT mean is measured across around 120 large enrollment foundational courses similar to that of BCM 10001. However, the exact differences between the basic psychological needs of these courses with that of BCM 10001 is not known.

3. Perceived Knowledge Transfer:

The comparison between pre-survey and post-survey for every semester to measure the Perceived Knowledge Transfer revealed no significant differences between the results obtained in two surveys within a semester. This can attributed to the lack of responses to the pre-surveys. Upon comparing the post-survey results of Fall-2013, Spring-2014 and Fall-2014, there was no significant difference in the way the students perceived their knowledge transferred. This may be due to the fact the instructor and the content of the course remained the same although method of content delivery varied. In all three semesters, the author observed in class that the students recognized the importance of the course and were enthusiastic about the knowledge gained. The average for each of the semesters for this section were significantly higher than the IMPACT mean obtained

across several courses indicating that students BCM 10001 had better perception of the knowledge being transferred than most courses associated with IMPACT. The IMPACT mean is measured across around 120 large enrollment foundational courses similar to that of BCM 10001. However, the exact differences between the perceived knowledge transfer of these courses with that of BCM 10001 is not known.

5.2 Conclusions

The conclusions for the thesis have been arranged into three sections and are as follows:

1. Learning Climate

Learning Climate refers to students' perceptions of the student-centeredness of the learning environment. The results of this thesis show that the Learning Climate in Fall-2013 semester was lower than the other two semesters indicating a more faculty centered learning than student centered learning in the Fall-2013 semester. This indicated that the other two semesters had a better learning climate than Fall-2013 which had the least amount of active learning elements infused into the course.

However, Spring-2014 had higher learning climate scores in comparison to Fall-2014 although the latter had higher amounts of active learning elements in class along with the inclusion of an online textbook. It is not clear as to what caused the reduction of the learning climate and further testing is necessary to determine the exact cause making the students perceive the course to be faculty centered when the intent of the infusion is to increase the student centeredness in the Fall of 2014. If the infusion of active learning in Fall-2014 improved the student centeredness of the course, then it can be concluded that

the replacement of a conventional textbook with an online textbook would be the cause of reduction in learning climate from Spring-2014 to Fall-2014 although Fall-2014 had higher active learning components in comparison to the other two semesters. This is a speculation based on the author's observation in class. Further research needs to be conducted on data obtained from the future semesters utilizing the online book as well as the impact of introducing an online textbook into an active learning classroom in order to ascertain the stated speculation. As discussed earlier, Spring 2014 had the lowest enrollment in comparison to the other two semesters leading to a better faculty to student ratio, better diversity and different classroom being utilized for the course which may also have been factors that influenced a better learning climate in comparison to the other two semesters.

2. Basic Psychological Need

The Basic Psychological Need in the form measured in this thesis and by the IMPACT team is based on the Self Determination Theory as mentioned earlier. SDT addresses autonomy, relatedness, and competency as determinants of motivation. However, Niemiec & Ryan did make mention in their research that educators introduce external controls into learning climates, which can undermine the sense of relatedness between teachers and students, and stifle the natural, volitional processes involved in high-quality learning (Niemiec & Ryan, 2009). It was interesting to find that the semester with the least amount of Active Learning elements provided the highest amount of motivation and psychological satisfaction. It was also interesting to find that the semester (Spring-2014) with the highest learning climate provided the lowest Basic Psychological

Needs satisfaction although the result was not significantly different from that of Fall-2014. This is finding is in accordance with Niemiec & Ryan's research and indicates that the infusion of active learning elements into learning climates can possibly undermine the Basic Psychological Needs of the students (Niemiec & Ryan, 2009).

3. Perceived Knowledge Transfer

It was seen in the literature review that engagement in higher levels of Bloom's taxonomy may improve the students' perception of knowledge transfer (King, 1993; Mazzolini & Maddison, 2003). Upon comparing the results of Fall-2013, Spring-2014 and Fall-2014, it was found that there was no significant difference in the way the students perceived their knowledge to be transferred. This may be due to the fact that the instructor and the content of the course remained the same for all three semesters. However, it is important to note that in three semesters, the perceived knowledge transfer ranged between mildly to strongly agree indicating that the students in all semesters understood, to a very large extent, the importance and applicability of the knowledge obtained in the course.

However, the average for each of the semesters for each of the sections were significantly higher than the IMPACT mean obtained for the learning climate across several courses. As seen in Figure 5.1, it can be concluded that the BCM 10001 course is doing much better than most courses associated with IMPACT undergoing a transformation in order to be more student centered.

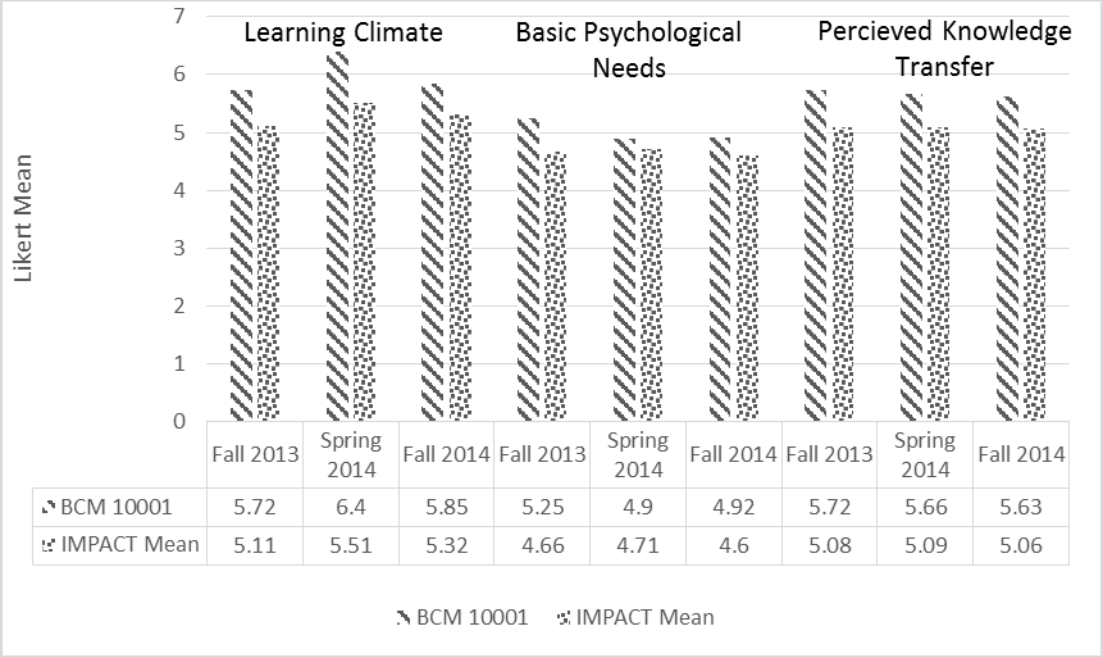


Figure 5.1. Comparison between BCM 10001 and other courses associated with IMPACT

5.3 Recommendations and Future Research

Infusion of active learning elements into the classroom improved the learning climate from Fall-2013 to Spring-2014 for the BCM 10001 course. The active learning elements infused in Spring-2014 were that classes were being held in IMPACT classrooms that support active learning by incorporating collaborative working tables, interactive smart-boards, and multiple projector facilities. There was also a reduction in the amount lecture time and quizzes were now taken using an immediate feedback assessment technique instead. It is recommended to continue having the above active learning elements infused in these two semesters throughout the course although there was reduction in the Basic Psychological Needs perception.

The third semester, Fall-2014, utilized an online textbook in place of a conventional textbook used in the previous semesters and all assessments were done online, within the textbook. There was a reduction in the amount of lecture time and a significant increase in the active learning time and reduction of lecture time in comparison to previous semesters but this also led to a reduction in the Learning Climate and Basic Psychological Needs. This reduction in the learning climate may be due to the classroom utilized, high enrollment during the semester leading to lower faculty-student ratio and/or the introduction of an online textbook. This is however a speculation drawn from the results obtained and therefore, till future research has been made, it is recommended that the classes be conducted in B853 with lower enrollment, elements of an online textbook be replaced with the conventional textbook and the assessments done within the textbook be switched back to using the immediate feedback assessment methods. The perceived knowledge transfer remained the same throughout all the semesters. In order to see a change in the perceived knowledge transfer, a change in the course content and instructor would need to be made. However, the average score obtained for the BCM 10001 course in each of the semesters for all the sections were significantly higher than the IMPACT mean obtained for the corresponding sections across several courses indicating that the course is doing much better than most IMPACT courses.

In a nutshell, the recommendations are as follows:

1. Infusion of Active Learning Elements made in Spring-2014 must be continued as they increased the learning climate of the course and classes must be conducted in the low capacity classroom B853 which led to higher faculty-student ratio.

2. The elements introduced in Fall-2014 lowered the learning climate as well and the Basic Psychological needs. Therefore the presence of an online textbook and excess reduction of lecture time and increase in active learning time must be looked into.
3. There may be a measured change in the perception of knowledge transfer with a change in the instructor and/or syllabus. In order to see an increase in the perception, a change in either of them or both is recommended.

The future research needed to be conducted is as follows:

1. Future research should look into finding the right amount of active learning elements that can be infused without lowering the learning climate.
2. Further research needs to be done by collecting data from future semesters which utilize the online textbook to check if the learning climate improved with the increase in instructor and student comfort for utilizing the textbook.
3. It is recommended that in the future, it should be ascertained whether the introduction of an online textbook lowered the learning climate. Also, it should be studied as to what can be done to balance the learning climate with the introduction of an online textbook within an active classroom. Research should look into assessing as to whether the online nature of the textbook itself caused the reduction in the learning climate or whether it was an issue with this particular textbook and the way it was designed or adapted that caused the reduction.
4. Future research should investigate as to what could be done to increase the Basic Psychological Needs within an active classroom and identify the exact causes of

the current reduction. Impact of each of the sub-factors of the Basic Psychological Need namely Autonomy, Competence and Relatedness in order to determine the type of motivation within the classroom.

5. Research should further investigate as to how the perceived knowledge transfer of a course can be increased through active learning elements without changing the syllabus of the course or the instructor. Investigation on whether a change in either the syllabus or the instructor or both causes a change in the perceived knowledge transfer needs to be made.

Overall, this study helps faculty evaluate the learning climate of the classroom, understand as to whether the basic psychological needs of the classroom were met and if there is perception of knowledge transfer. Based on the results of the study, a large enrollment foundational course similar to that of BCM 10001 can infer from this study that the learning climate of a course can be improved with the infusion of active learning elements within a classroom along with reduction in conventional lecture. It can also be inferred that a lower enrollment leading to higher faculty student-ratio may be beneficial for the learning climate. However, the increase in learning climate through active learning element may cause a significant reduction the satisfaction of the students' Basic Psychological Needs but will not alter the students' perception of the knowledge transfer as long as the instructor and the course content remain the same.

REFERENCES

REFERENCES

Arndt, P. A. (2012). Design of learning spaces: Emotional and cognitive effects of learning environments in relation to child development. *Mind, Brain, and Education*, *6*(1), 41-48.

Arthur, W., & Zelda, F. (1987). Seven Principles for Good Practice in Undergraduate Education. *American Association for Higher Education, Washington, D.C.*, (080), 3–7.

B848 [Print Photo]. Retrieved from [Print Photo]. Retrieved from http://guides.lib.purdue.edu/content.php?pid=463634&sid=3931599

B853 [Print Photo]. Retrieved from http://guides.lib.purdue.edu/content.php?pid=463634&sid=3931596

Baldwin, R. G. (2009). The climate for undergraduate teaching and learning in STEM fields. *New Directions for Teaching and Learning*, *2009*(117), 9-17.

Black, A. E., & Deci, E. L. (2000). The effects of instructors' autonomy support and students' autonomous motivation on learning organic chemistry: A self-determination theory perspective. *Science education*, *84*(6), 740-756.

Blair, J., Czaja, R. F., & Blair, E. A. (2013). *Designing surveys: A guide to decisions and procedures*. Sage Publications.

Bland, J. M., & Altman, D. G. (1996). Statistics notes: measurement error. *Bmj*, *313*(7059), 744.

Boiché, J., Sarrazin, P. G., Grouzet, F. M., Pelletier, L. G., & Chanal, J. P. (2008). Students' motivational profiles and achievement outcomes in physical education: A self-determination perspective. *Journal of Educational Psychology*, *100*(3), 688.

Bringle, R. G., & Hatcher, J. A. (1999). Reflection in service learning: Making meaning of experience. *Educational Horizons*, *77*, 179-185.

Bringle, R. G., & Hatcher, J. A. (2011). International service learning. In R. G. Bringle, J. A. Hatcher, & S. G. Jones (Eds.), *IUPUI Series on Service Learning Research: International Service Learning: Conceptual Frameworks and Research* (pp. 21–46).

Broeck, A., Vansteenkiste, M., Witte, H., Soenens, B., & Lens, W. (2010). Capturing autonomy, competence, and relatedness at work: Construction and initial validation of the Work-related Basic Need Satisfaction scale. *Journal of Occupational and Organizational Psychology*, *83*(4), 981-1002.

Bruffee, K. A. (1984). Collaborative learning and the" conversation of mankind". *College English*, 635-652.

By, T. (2011). Formalizing Game-play. *Simulation & Gaming*, 1046878110388239.

Chen, K. C., & Jang, S. J. (2010). Motivation in online learning: Testing a model of self-determination theory. *Computers in Human Behavior*, *26*(4), 741-752.

Chickering, A. W., & Gamson, Z. F. (1987). Seven principles for good practice in undergraduate education. *AAHE bulletin*, *3*, 7.

Ciani, K. D., Sheldon, K. M., Hilpert, J. C., & Easter, M. A. (2011). Antecedents and trajectories of achievement goals: A self-determination theory perspective. *British Journal of Educational Psychology*, *81*(2), 223-243.

Couper, M. P. (2000). Review: Web surveys: A review of issues and approaches. *Public opinion quarterly*, 464-494.

Couper, M. P., & Nicholls, W. L. II (1998). The history and development of computer assisted survey information collection methods. *Computer assisted survey information collection. New York: Wiley*.

Cox, M. D. (2004). Introduction to faculty learning communities. New directions for teaching and learning, 2004(97), 5-23

Creswell, J. W. (2003). *Research design: Qualitative, quantitative, and mixed methods approaches*. Sage.

Deci, E. L. (1971). Effects of externally mediated rewards on intrinsic motivation. *Journal of personality and Social Psychology*, *18*(1), 105.

Dewey, J. (1916). Democracy and education. New York: Free P

Dewey, J. (1985). *Democracy and education, 1916*. J. A. Boydston, & P. Baysinger (Eds.). Carbondale: Southern Illinois University Press.

Dillenbourg, P. (1999). What do you mean by collaborative learning? *Collaborative-learning: Cognitive and Computational Approaches.*1-19.

Dillman, D. A. (2000). Mail and internet surveys: The tailored design method (Vol. 2). New York: *Wiley*.

Epstein, M. L., Lazarus, A. D., Calvano, T. B., Matthews, K. A., Hendel, R. A., Epstein, B. B., & Brosvic, G. M. (2010). Immediate feedback assessment technique promotes learning and corrects inaccurate first responses. *The Psychological Record*, *52*(2), 5.

Gall, J. P., Gall, M. D., & Borg, W. R. (1999). Applying educational research: A practical guide.

Garrison, D. R., Anderson, T., & Archer, W. (2001). Critical thinking, cognitive presence, and computer conferencing in distance education. *American Journal of distance education*, *15*(1), 7-23.

Gilboy, M. B., Heinerichs, S., & Pazzaglia, G. (2014). Enhancing Student Engagement Using the Flipped Classroom. *Journal of nutrition education and behavior*.

Giles, D. E., & Eyler, J. (1994). The theoretical roots of service-learning in John Dewey: Toward a theory of service-learning. *Michigan Journal of Community Service Learning*, *1*(1), 77-85.

Goertz, M. E., Oláh, L. N., & Riggan, M. (2009). From Testing to Teaching: The Use of Interim Assessments in Classroom Instruction. CPRE Research Report# RR-65. *Consortium for Policy Research in Education*.

Gohn, C. (2012). Gambling culture in China as compared to that of India. In *Asia Pacific Gambling Studies Conferences*.

Grabinger, R. S., & Dunlap, J. C. (1995). Rich environments for active learning: A definition. *Research in learning Technology*, *3*(2).

Gunawardena, C. N. (1995). Social presence theory and implications for interaction and collaborative learning in computer conferences. *International journal of educational telecommunications*, *1*(2), 147-166.

Hager, W. R. (1974). An Investigation of Verbal Behavior and Learning Climate in Undergraduate Engineering Classrooms. *Journal of Research in Science Teaching*, *11*(2), 121–131.

Howland, J. L., & Moore, J. L. (2002). Student perceptions as distance learners in Internet-based courses. *Distance education*, *23*(2), 183-195.

Ilardi, B. C., Leone, D., Kasser, T., & Ryan, R. M. (1993). Employee and Supervisor Ratings of Motivation: Main Effects and Discrepancies Associated with Job Satisfaction and Adjustment in a Factory Setting1. Journal of Applied Social Psychology, 23(21), 1789-1805.

IMPACT Management Team & IMPACT Assessment Team. (2014a). IMPACT Data Collection and Analysis Team, Part 1. *IMPACT Reports, Paper 2*. Retrieved from http://docs.lib.purdue.edu/impactreps/2

IMPACT Management Team & IMPACT Assessment Team. (2014b). IMPACT Data Collection and Analysis Team, Part 2. *IMPACT Reports, Paper 3*. Retrieved from http://docs.lib.purdue.edu/impactreps/3

IMPACT Management Team & IMPACT Assessment Team. (2014c). IMPACT Data Collection and Analysis Team, Part 3. *IMPACT Reports, Paper 4*.

Ke, F. (2010). Examining online teaching, cognitive, and social presence for adult students. *Computers & Education*, *55*(2), 808–820. doi:10.1016/j.compedu.2010.03.013

King, A. (1993). From Sage on the Stage to Guide on the Side. *College Teaching*.

Leeuw, E. D., & Collins, M. (1997). Data collection methods and survey quality: an overview. *Survey measurement and process quality*, 197-220.

Levesque-Bristol, C. (2014). *Annual IMPACT Report 2014: A report by the IMPACT Data Collection and Analysis Team, Part 2*.

Levesque-Bristol, C., Weaver, G., & Parker, L. C. (2012). Developing, Implementing and Assessing Large- Scale Redesign Effort at a Research University : Tales from the IMPACT Initiative at Purdue University.

Linehan, C., Kirman, B., Lawson, S., & Chan, G. (2011, May). Practical, appropriate, empirically-validated guidelines for designing educational games. In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems* (pp. 1979-1988). ACM.

Liu, Z. (2006). Print vs. electronic resources: A study of user perceptions, preferences, and use. *Information Processing & Management*, *42*(2), 583-592.

Marsh, T. (2011). Serious games continuum: Between games for purpose and experiential environments for purpose. *Entertainment Computing*, *2*(2), 61-68.

Mason, E. (1970). *Collaborative learning*. London: Ward Lock Educational.

Mazzolini, M., & Maddison, S. (2003). Sage, guide or ghost? The effect of instructor intervention on student participation in online discussion forums. *Computers & Education*, *40*(3), 237-253.

Michael, D. R., & Chen, S. L. (2005). *Serious games: Games that educate, train, and inform*. Muska & Lipman/Premier-Trade.

Mills, J. D. (2002). Using computer simulation methods to teach statistics: A review of the literature. *Journal of Statistics Education*, *10*(1), 1-20.

Mills, R. (2003). The centrality of learner support in open and distance learning: A paradigm shift in thinking. *Rethinking learner support in distance education: Change and continuity in an international context*, 102-113.

Moore, M. G. (1993). 2 Theory of transactional distance. *Theoretical principles of distance education*, 22.

Morris, R. C., Parker, L. C., Nelson, D., Pistilli, M. D., Hagen, A., Levesque-Bristol, C., & Weaver, G. (2014). Development of a Student Self-Reported Instrument to Assess Course Reform. Educational Assessment, 19(4), 302-320.

Nathan, G. (2001). Telesurvey Methodologies for Household Surveys-A Review and Some Thoughts for the Future?. *Survey Methodology*, *27*(1), 7-32.

Niemiec, C. P., & Ryan, R. M. (2009). Autonomy, competence, and relatedness in the classroom: Applying self-determination theory to educational practice. *Theory and Research in Education*, *7*(2), 133-144.

Nunnally, J. C., Bernstein, I. H., & Berge, J. M. T. (1967). *Psychometric theory*(Vol. 226). New York: McGraw-Hill.

O'Brien, E. J., & Epstein, S. (1988). The multidimensional self-esteem inventory: Professional manual. Psychological Assessment Resources.

Pargellis, S., & Farrand, M. (1949). The Autobiography of Benjamin Franklin. *The Mississippi Valley Historical Review*, *36*(3), 504.

Perry, E. H., & Pilati, M. L. (2011). Online learning. *New Directions for Teaching and Learning*, *2011*(128), 95-104.

Prince, M. (2004). Does active learning work? A review of the research. *Journal of engineering education*, *93*(3), 223-231.

Ryan, R. M. (1995). Psychological needs and the facilitation of integrative processes. *Journal of personality*, *63*(3), 397-427.

Ryan, R. M., Connell, J. P., & Deci, E. L. (1985). A motivational analysis of self-determination and self-regulation in education. *Research on motivation in education: The classroom milieu, 2*, 13-51.

Ryan, R. M., & Deci, E. L. (2000a). Intrinsic and Extrinsic Motivations: Classic Definitions and New Directions. Contemporary Educational Psychology, 25(1), 54–67. http://doi.org/10.1006/ceps.1999.1020

Ryan, R. M., & Deci, E. L. (2000b). Self-determination theory and the facilitation of intrinsic motivation, social development, and well-being. American Psychologist, 55(1), 68–78. http://doi.org/10.1037//0003-066X.55.1.68

Seligman, M. (1975). Helplessness San Francisco.

Shaikholeslami, R., & Khayyer, M. (2006). INTRINSIC MOTIVATION, EXTRINSIC MOTIVATION AND LEARNING ENGLISH AS A FOREIGN LANGUAGE 1. Pyschological Reports, 99(3), 813–818.

Sheldon, K. M., Ryan, R. M., & Reis, H. T. (1996). What makes for a good day? Competence and autonomy in the day and in the person. Personality and Social Psychology Bulletin, (22), 1270-1279.

Smith, P. C, Kendall, L. M., & Hulin, C. L. (1969). The measurement of satisfaction in work and retirement. Chicago: Rand McNally

Smith, R. (1995). Essential techniques for military modelling & simulation. In Proceedings of the 30th conference on winter simulation (pp. 805–812). IEEE Computer Society Press.

Smith, R. (2009). The Long History of Gaming in Military Training. Simulation & Gaming, 41(1), 6–19. http://doi.org/10.1177/1046878109334330

Smith, R. (2014). The oxford handbook of virtual reality. (M. Grimshaw, Ed.).

Squire, K. D. (2008). Video Games and Education : Designing Learning Systems for an Interactive Age. Educational Technology, 48(2), 17–26.

Stewart, D. C. (1988). Collaborative and Composition : Learning Boon or Bane ? Rhetoric Review, 7(1), 58–83.

Susi, T., Johannesson, M., & Backlund, P. (2007). Serious Games – An Overview.

Tait, A. (2000). Planning Student Support for Open and Distance Learning. Open Learning: The Journal of Open and Distance Learning, 15(3), 287–299. http://doi.org/10.1080/713688410

Tait, A. (2004). Re-thinking Learner Support in Distance Education: Change and Continuity in an International Context (p. 232). Routledge.

Vallerand, R. J., Pelletier, L. G., Blais, M. R., Briere, N. M., Senecal, C., & Vallieres, E. F. (1992). The Academic Motivation Scale: A Measure of Intrinsic, Extrinsic, and Amotivation in Education. Educational and Psychological Measurement, 52(4), 1003–1017. http://doi.org/10.1177/0013164492052004025

Weissinger, E., & Bandalos, D. L. (1995). Development, reliability and validity of a scale to measure intrinsic motivation in leisure. Journal of Leisure Research, 27(4), 379.

Weiner, M. ., & Milton, G. (1959). An introduction to war games.

Williams, G. C., Krusch, D., Papciak, A., & Ryan, R. M. (1992). Motivation in a pain rehabilitation program. Unpublished manuscript, University of Rochester.

Wu, Z., & Choi, T. Y. (2013). Triadic Relations in a Game of Pachisi, 11(4), 305–312.

APPENDICES

Appendix A Fall 2013 Survey

Fall 2013 IMPACT Student Survey Questions and Constructs

Are you still enrolled in BCM 1001 being taught in ...
What is your age in years? (Please use a numerical / response, for example, 25)
Do any elements of BCM 1001 meet in-person, or is the entire...
Classroom Space
Use the scale below to indicate / your level of agreement with each of the items below...
1. The classroom physical space met my needs for learning.
2. The instructor utilized classroom technologies which further engaged my interest in the class.
About the Learning Experience
The questions below are related to your learning experience in ...
1. My instructor provided me with choices and options on how to complete the work.
2. My instructor understood my perspective.
3. My instructor encouraged me to ask questions.
4. My instructor listened to how I would like to do things.
5. My instructor tried to understand how I saw things before suggesting a new way to do things.
6. My instructor stimulated my interest in the subject.
7. My instructor made sure I really understood the goals of the course and what I needed to do.
8. The instructor encouraged students to learn from each other.
9. The instructor provided opportunities for students to challenge opinions expressed in the course.
10. The instructor connected course content to students' experience and knowledge.
11. The instructor asked students to explain their ideas.
12. The instructor encouraged students to participate actively in class.
13. The instructor provided opportunities for students to ask questions.
14. The instructor provided opportunities for students to process new information.
15. The instructor allowed students to answer a question or solve a problem in more than one way.
16. The instructor maintained a climate of respect within the course for what others had to say.
Your Overall Experience
The following questions concern your feelings about your experience in ...
17. I did not feel very competent in this course.
18. People in this course told me I was good at what I was doing.
19. I was able to learn interesting new skills in this course.

20. Most days I felt a sense of accomplishment from being in this course.
21. In this course I did not get much of a chance to show how capable I was.
22. When I was in this course I often did not feel very capable.
23. I felt confident in my ability to learn this material.
24. I was capable of learning the material in this course.
25. I was able to achieve my goals in this course.
26. I felt able to meet the challenge of performing in this course.

Please consider the following questions as they relate to BCM 1001: …

27. I feel confident in my ability to apply the course material in other classes that I have
28. I feel confident in my ability to apply the course material in my professional life
29. I feel as if the material covered in this course is relevant to my future career
30. Given the future career that I have chosen, it is important for me to learn the information covered in this class
31. I understand how I will use the information learned in this class in my professional life
32. Information learned in this course will inform my future learning experiences
33. I believe that it is important for me to learn the information included in this course
34. The information learned in this course will help me become a better-rounded individual.

Appendix B Fall 2014 and Spring 2014 Survey

Fall 2014 and Spring 2014 IMPACT Student Survey Questions and Constructs

Are you still enrolled in BCM 1001 being taught in ${e://Field/Semester}?
Classroom Space / / / / Use the scale below to indicate your level of agreement with each / of the items below regarding your perceptions of the physical / classroom space in BCM 1001: / $...-The classroom physical space met my needs for learning.
Classroom Space / / / / Use the scale below to indicate your level of agreement with each / of the items below regarding your perceptions of the physical / classroom space in BCM 1001: / $...-The instructor utilized classroom technologies which further engaged my interest in the class.

About the Learning Experience
The questions below are related to your learning experience in BCM 1001 thus far. The learning experience in different...-
1. I feel that my instructor provides me choices and options.
2. The learning experience in different...-I feel understood by my instructor.
3. My instructor conveyed confidence in my ability to do well in the course.
4. My instructor encouraged me to ask questions.
5. My instructor listens to how I would like to do things.
6. My instructor tries to understand how I see things before suggesting a new way to do things.
Motivation for taking BCM 1001: The questions below are related to your feelings of why you are / taking BCM 1001
7. Because it allows me to develop skills that are important to me.
8. Because I would feel bad if I didn't.
9. Because learning all I can about academic work is really essential for me.
10. I don't know. I have the impression I'm wasting my time.
11. Because acquiring all kinds of knowledge is fundamental for me.
12. Because I feel I have to.
13. I'm not sure anymore. I think that maybe I should quit (drop the class).
14. Because I really enjoy it.
15. Because it's a sensible way to get a meaningful experience.
16. Because I would feel guilty if I didn't.
17. Because it's a practical way to acquire new knowledge.

18. Because I really like it.
19. Because experiencing new things is a part of who I am.
20. Because that's what I'm supposed to do.
21. I don't know. I wonder if I should continue.
22. Because I would feel awful about myself if I didn't.
23. Because it's really fun.
24. Because that's what I was told to do.

Your Overall Experience

The following questions concern your feelings about your / experience in BCM 1001: Please indicate how true / each of the following...-

25. I feel like I can make a lot of inputs in deciding how my coursework gets done.
26. I really like the people in this course.
27. I do not feel very competent in this course.
28. People in this course tell me I am good at what I do.
29. I feel pressured in this course.
30. I get along with people in this course.
31. I pretty much keep to myself when in this course.
32. I am free to express my ideas and opinions in this course.
33. I consider the people in this course to be my friends.
34. I have been able to learn interesting new skills in this course.
35. My feelings are taken into consideration in this course.
36. In this course I do not get much of a chance to show how capable I am.
37. People in this course care about me.
38. There are not many people in this course that I am close to.
39. I feel like I can pretty much be myself in this course.
40. The people in this course do not seem to like me much.
41. I often do not feel very capable in this course.
42. There is not much opportunity for me to decide for myself how to go about my coursework.
43. People in this course are pretty friendly towards me.

Relevance of the Learning Experience

Please consider the following questions as they relate to BCM 1001 and record the extent to which you agree using the choices...

44. I feel confident in my ability to apply the course material in other classes that I have.
45. I feel confident in my ability to apply the course material in my professional life.
46. I feel as if the material covered in this course is relevant to my future career.
47. Given the future career that I have chosen, it is important for me to learn the information covered in this class.
48. I understand how I will use the information learned in this class in my professional life.
49. Information learned in this course will inform my future learning experiences.
50. I believe that it is important for me to learn the information included in this course.

51. The information learned in this course will help me become a better-rounded individual.

Appendix C IRB Form

PURDUE
UNIVERSITY

HUMAN RESEARCH PROTECTION PROGRAM
INSTITUTIONAL REVIEW BOARDS

To:	DAPHENE KOCH KNOY
From:	JEANNIE DICLEMENTI, Chair Social Science IRB
Date:	10/24/2014
Committee Action:	**Exemption Granted**
IRB Action Date:	10/24/2014
IRB Protocol #:	1410015392
Study Title:	The comparison of cognitive, teaching and learning constructs with the introduction of an online textbook

The Institutional Review Board (IRB) has reviewed the above-referenced study application and has determined that it meets the criteria for exemption under 45 CFR 46.101(b)(2) .

If you wish to make changes to this study, please refer to our guidance **"Minor Changes Not Requiring Review"** located on our website at http://www.irb.purdue.edu/policies.php. For changes requiring IRB review, please submit an **Amendment to Approved Study** form or **Personnel Amendment to Study** form, whichever is applicable, located on the forms page of our website **www**.irb.purdue.edu/forms.php. Please contact our office if you have any questions.

Below is a list of best practices that we request you use when conducting your research. The list contains both general items as well as those specific to the different exemption categories.

General

- To recruit from Purdue University classrooms, the instructor and all others associated with conduct of the course (e.g., teaching assistants) must not be present during announcement of the research opportunity or any recruitment activity. This may be accomplished by announcing, in advance, that class will either start later than usual or end earlier than usual so this activity may occur. It should be emphasized that attendance at the announcement and recruitment are voluntary and the student's attendance and enrollment decision will not be shared with those administering the course.
- If students earn extra credit towards their course grade through participation in a research project conducted by someone other than the course instructor(s), such as in the example above, the students participation should only be shared with the course instructor(s) at the end of the semester. Additionally, instructors who allow extra credit to be earned through participation in research must also provide an opportunity for students to earn comparable extra credit through a non-research activity requiring an amount of time and effort comparable to the research option.
- When conducting human subjects research at a non-Purdue college/university, investigators are urged to contact that institution's IRB to determine requirements for conducting research at that institution.
- When human subjects research will be conducted in schools or places of business, investigators must obtain written permission from an appropriate authority within the organization. If the written permission was not