CONTEXTUAL SUPPORT, MOTIVATION, AND WELL-BEING IN THE ONLINE LEARNING ENVIRONMENT: A TEST OF SELF-DETERMINATION THEORY

by

Kuan-Chung Chen

(Under the Direction of Robert Maribe Branch)

ABSTRACT

Self-determination theory has been widely applied to general education and many other fields; however, the application of SDT to the online learning environment is still in its inception. This study comprehensively tested self-determination theory in two special education online programs in order to answer the three research questions: 1) What is the primary locus of motivation for students enrolled in an online course? 2) What is the degree to which the SDT framework can be substantiated in an online learning environment? 3) What is the relative salience of autonomy, relatedness, and competency on online learners' motivation and learning outcomes?

This study employed a cross-sectional design, and collected online students' perceptions of *contextual support*, *need satisfaction*, *motivation*, and *learning outcomes* through the pre-test (N = 263) and the post-test (N = 270) online surveys. Results substantiated much of SDT's theorizing, including the distinctiveness of the five types of motivation, the existence of self-determination continuum, and the positive effect of contextual support on learner motivation. Additionally, four out of six SDT full models yielded proper fit through structural equation modeling, and all the fitted models substantiated the mediating effect of *need satisfaction*

between *need support* and *self-determination*. Lastly, this study found that perceived autonomy, relatedness, and competency synergistically affected online students' self-determination. Taken together, it could be argued that SDT is valid and tenable, and can serve as an appropriate framework for addressing learner motivation in the online learning environment.

This study also found that *identified regulation* stood out as the primary locus of online learners' motivation, and that the relative salience of *autonomy*, *relatedness*, and *competency* varied from categories of motivation and learning outcomes. Implications for online learning practitioners were discussed, and recommendations for future studies were proposed. It is hoped that this study inspires more studies to apply self-determination theory, and to examine the interrelationships among contextual support, need satisfaction, learner motivation, and learning outcomes in the online learning environment.

INDEX WORDS: Online Learning, Motivation, Self-determination Theory, Structural Equation Modeling, Student Support, Instructional Strategies

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DEDICATION

To my parents, Yi-Chao Chen and Chin-Pi Hung, my wife Shih-Ying, my sister Kuan-Yi, and my brother Kuan-Hwa and his girlfriend Wei-Ting. Your immense love and care has been the main impetus for my doctoral study. I feel so blessed to have such a warm and supportive

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CHAPTER I

INTRODUCTION

Online learning has grown tremendously in recent years. According to the Sloan Consortium's report (Allen & Seaman, 2006), nearly 3.2 million students in higher education enrolled in online courses in the fall of 2005, which was a substantial increase over the 2.3 million the previous year. The Sloan Consortium's report also indicated that more than 96% of large educational institutions (15,000+ enrollments) in the United States offered online learning options. The growth trend for students enrolled in online courses is estimated to be around 40% per year over the next decade (Peltier, Schibrowsky, & Drago, 2007). Online learning has become an important part of the education system.

Flexibility and accessibility are two of the primary reasons for the growing popularity of online learning. Online learning allows people who are separated by distance, work schedules, or physical disabilities, to participate together (Morrison, Sweeney, & Hefferman, 2004). In a newspaper article, Carr (2000) reported that students described flexibility of time as the most significant motivating factor for participating in online learning. For example, one student said: "I really think that distance education is a great opportunity for someone who has either a tough professional schedule or a tough personal schedule to continue their education" (¶ 26). Reed (2000) claimed that online learning also expands learning opportunities, for example, course materials and conversations can become permanently accessible to others at a later time, allowing for continued discussions and deeper reflections. Flexibility and accessibility of course content emerge as two of the main advantages of online learning.

Problem Statement

The problem is that online learning has a high student attrition rate. High attrition rates seem counterintuitive for an online learning environment where access and flexibility are featured components of instruction, but research by Parker (1995), Clark (2003), and others has found that online learners have a higher attrition rate than their campus-based counterparts. When Carr (2000) interviewed online learning program administrators she was told that the dropout rate in online courses ranged from 20% to 50%, or 10% to 20% higher than their face-to-face counterparts. The attrition rate has become such a distinct issue that the Open University in the United Kingdom, which is widely recognized as being an established high quality distance education institution, launched a retention program to investigate ways to provide retention-supportive activities (Tait, 2003). While persistence at learning tasks serves as a key indicator of motivation (Pintrich & Schunk, 2002), attrition reflects the need to address motivational issues of online learning (Keller, 1999), as well as to adopt strategies that motivate and engage online learners.

Studies on barriers and challenges of online learners reveal factors that influence online students' motivation. Foremost among the barriers and challenges expressed by online learners are feelings of alienation and isolation (Abrahamson, 1998; Fraster & van Staden, 1996), which is due in part to the nature of online communication. Computer-mediated communication (CMC) has been recognized as being impersonal due to the lack of non-verbal cues such as gesture, eye contact, and facial expression. Dabbagh and Bannan-Ritland (2005) stated:

> Although several telecommunications technologies such as audio- and videoconferencing have enabled a simulated human interaction learning context, the absence of face-to-face

> interaction in classic distance education settings has been identified as one of the main causes of loss of student motivation in such learning contexts. (p. 6)

Online learning also imposes greater challenges with respect to a variety of skills, including technology, collaborative learning, and self-regulation than face-to-face classrooms (Dabbagh & Bannan-Ritland, 2005). For example, basic computer operation, software installation, and troubleshooting challenges require online learners to have greater technology skills to participate effectively in the online learning environment. Students report feeling anxious, overwhelmed, or disoriented if they do not have enough competencies for using technology, learning collaboratively, and performing self-directed learning (Hara & Kling, 2000); if these students are left unattended, they may eventually drop their online courses.

Student support has been identified as critical to promote student success and to alleviate learner attrition. Online learners need a variety of support, such as learning support, institutional support, and technical support (Mills, 2003; Tait, 1995, 2000). Many support strategies have been proposed to assist online learners. Song, Singleton, Hill and Koh (2004), for example, suggested online instructors to assist learners with time management strategies, and foster learners' sense of belongingness. McLoughlin (2002) identified categories of online scaffolding, including conceptual scaffolding, metacognitive scaffolding, and strategic scaffolding. Online instructors need to be able to meet the various needs of different students (Motteram & Forrester, 2005), which means that the "one-size-fits-all" approach is rarely, if ever, suitable for supporting online learners.

While themes surrounding student attrition and learner support have been well-addressed in online learning literature, motivation, the central factor underlying student attrition (Keller, 1999), remains unclear (Clark, 1999; Miltiadou & Savenye, 2003). Motivation has been

regarded as one of the essential factors in education (Lim, 2004; Wlodkowski, 1999) and has been found to contribute to a variety of important learning outcomes, such as *persistence* (Vallerand & Bissonnette, 1992), *retention* (Lepper & Cordova, 1992), *achievement* (Eccles et al., 1993; Rocco, 2005), and *course satisfaction* (Fujita-Starck & Thompson, 1994; Rodriguez, Ooms, Montanez, & Yan, 2005). Indeed, to resolve learning problems in the online learning environment, a thorough investigation of students' motivation is indispensable. Miltiadou and Savenye (2003), after reporting a thorough review of motivational theories, recommended that researchers test motivational theories and constructs in the online learning environment.

A theory that deserves more thorough testing in the online learning environment is Deci and Ryan's (1985) self-determination theory (SDT). Pintrich and Schunk (2002) described self-determination theory as "one of the most comprehensive and empirically supported theories of motivation available today" (p. 257). Self-determination theory has been successfully applied to a variety of settings, including *physical education* (Standage, Duda, & Ntoumanis, 2003, 2005), *politics* (Losier, Perreault, Koestner, & Vallerand, 2001), *health care* (Williams & Deci, 1996; Williams, Freedman, & Deci, 1998), and *religion* (Neyrinck, Lens, & Vansteenkiste, 2005). However, the tenability of self-determination theory has not been sufficiently established in online learning contexts. The next section presents the core tenets of Deci and Ryan's SDT, followed by a discussion about why SDT may serve as an appropriate framework for addressing motivation in the online learning environment.

Self-Determination Theory

Self-determination theory is a general theory of motivation that explicates the dynamics of human needs, motivation, and well-being within the immediate social context. The term *self-determination*, as defined by Deci and Ryan (1985), is "a quality of human functioning that

involves the experience of choice [which are] the determinants of one's actions" (p. 38). Self-determination theory assumes that humans' psychological growth and integration are facilitated through the satisfaction of three universal human needs: *autonomy* (a sense of control and agency), *competence* (a belief of proficiency in performing tasks and activities), and *relatedness* (feeling included or affiliated) (Pintrich & Schunk, 2002). Contextual support enhances individuals' motivation and well-being by fostering autonomy, competence, and relatedness, the basic needs. Social contexts undermine individuals' motivation and well-being when they fail to support the basic needs of autonomy, competence, and relatedness.

Self-determination theory posits three main types of motivation as the mediating process between need satisfaction and well-being: 1) *intrinsic motivation* (doing something because it is interesting, pleasing, or enjoyable), 2) *extrinsic motivation* (doing something because of fear, guilt, or external incentives), and 3) *amotivation* (lacking intention to act). Extrinsic motivation is further categorized into four stages/types:

1. *External regulation*, whereby individuals behave in order to obtain rewards or avoid punishment;
2. *Introjected regulation*, whereby individuals introject the tasks into internal "ought" or "should" motives and usually feel guilty or anxious;
3. *Identified regulation*, whereby individuals recognize the tasks as personally important but are still motivated externally; and,
4. *Integrated regulation*, whereby individuals integrate various sources of information into their self-schema.

Internalization serves as the key concept throughout the four stages of extrinsic motivation. Internalization is the process whereby an individual integrates extrinsic goals and

values into the self. During internalization, individuals become more self-determined, and are likely to achieve enhanced well-being. Internalization is a highly desired outcome that fosters online learning experiences, since not every online learning activity is inherently interesting or enjoyable.

Self-Determination Theory and Motivation in Online Learning

Many factors suggest that SDT is an appropriate framework for addressing motivation in the online learning environment. First, SDT may serve as a theoretical framework that integrates main issues in online learning. Self-determination theory addresses autonomy, relatedness, and competency as determinants of motivation. The three constructs correspond to features of online learning such as flexibility, interaction, and challenges for learning and technical skills. Contextual support is especially valuable, as online learners need a variety of support from instructors, peers, administrators, and technical support personnel. Past experimental research indicates that self-determination theory predicts a variety of learning outcomes, including *performance*, *persistence*, and *course satisfaction* (Deci & Ryan, 1985, for a review). Self-determination theory has the potential to explain learning problems such as student attrition in the online learning environment.

Furthermore, in contrast to other motivation theories, such as expectancy-value theory (Eccles, 1983) and social cognitive theory (Bandura, 1986) that treat motivation as a monolithic construct, SDT distinguishes six types of motivation. The six-type categorization reflects the complexity and dynamics of human motivation, and allows researchers to detect changes across motivation types. Another point is that in contrast to motivation theories that only emphasize a single factor, for example, Bandura's *self-efficacy* construct, SDT addresses three factors: *autonomy*, *relatedness*, and *competency*. Therefore, self-determination theory seems to be more

theoretically comprehensive, and better able to render explanatory potential with respect to online learning. Educational researchers can investigate the relative salience of autonomy, relatedness, and competency that influence online learners' motivation and learning outcomes through the lens of self-determination theory.

Another advantage of SDT is that it generates *prescriptions* for motivational enhancement in addition to describing individuals' motivation process (Ryan & Deci, 2004). Self-determination theory-based studies have identified strategies that foster individual self-determination and motivation. Reeve and Jang (2006), for example, validated eight types of teacher's autonomy-supportive behaviors, such as allowing choice, providing rationale, and offering informational feedback that enhanced students' perceived autonomy, engagement, and performance. The SDT-based strategies may be applicable to a variety of educational settings including the online learning environment.

Self-determination theory also addresses the importance of the social context, which aligns with the emerging trend of a *situated* view of motivation. Jarvela (2001) said, "Motivation is no longer a separate variable or a distinct factor, which can be applied in explanation of an individual's readiness to act or learn – but it is a reflective of the social and cultural environment" (p. 4). Self-determination theory purports to explicate the dynamics of human need, motivation, and well-being within the immediate social context. The SDT framework enables researchers to examine the mechanism through which contextual factors, such as instructor behaviors or social interactions, enhance or dampen motivation of online learners. The SDT framework also helps instructors and instructional designers identify better strategies of contextual support, on the basis of which vibrant, motivating online learning environments may flourish.

Research Questions

Self-determination theory has been widely applied to general education and many other fields; however, the application of SDT to the online learning environment is still in its inception. The purpose of this study is to test SDT's tenability in an online learning environment. The contention is that motivation is essential for online learning and SDT is an appropriate framework for addressing online learners' motivation. This study intends to test the main postulates of self-determination theory. This study also intends to test the full model of SDT (Figure 1) in an online learning environment.

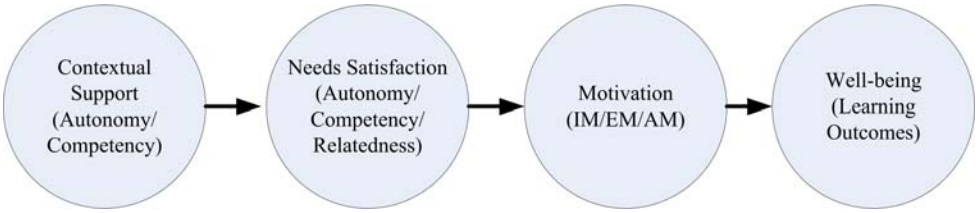

Figure 1. The full model of self-determination theory

Knowledge gained in this study should suggest improvements for motivation directly applicable to the defined online learning environments. This study also seeks to inform the design of online courses in terms of learner motivation and contextual support. Finally, this study seeks to identify basic motivational design principles that are applicable within an online learning environment. The results of this study should expand the knowledge base regarding online students' motivation structure, the dynamics between contextual support, motivation, and learning outcomes, and effective strategies for online facilitation. This study also extends the applications of self-determination theory.

This study surveys online learners' motivational profiles through the lens of SDT, in order to understand the main locus of motivation for students enrolled in an online course. This study also investigates the relative salience of autonomy, relatedness, and competency on online learners' motivation and learning outcomes. Three research questions guide this study:

1. What is the primary locus of motivation for students enrolled in an online course?
2. What is the degree to which the SDT framework can be substantiated in an online learning environment?
3. What is the relative salience of autonomy, relatedness, and competency on online learners' motivation and learning outcomes?

CHAPTER II

LITERATURE REVIEW

Overview

The purpose of this study is to test self-determination theory (SDT), a general theory of motivation in the online learning environment. Accordingly, this literature review chapter covers the following three main sections:

1. *Motivation in the Online Learning Environment*, which introduces motivation and the online learning environment in general (e.g., definitions, features, and history), then delineates main themes in online learning research that relate to online learners' motivation and learning outcomes;
2. *Self-Determination Theory*, which includes an overview of the theory, followed by a discussion of the theory's tenability in reference to its empirical evidence and theoretical soundness; and,
3. *Applying SDT to the Online Learning Environment*, which identifies gaps in online motivation research, and suggests SDT as an appropriate framework to bridge these gaps.

The primary source of literature is The University of Georgia's online database systems (GALILEO, http://www.libs.uga.edu/research/), including Academic Search Complete, EJS E-Journals, ERIC, Information Science & Technology Abstracts (ISTA), Jstor, PsycARTICLES, PsycCRITIQUES, Psychology and Behavioral Sciences Collection, PsycINFO, Dissertation Abstracts, ISI Web of Knowledge, and the GIL@UGA Catalog. Regarding SDT-based studies,

the main source is SDT's official website (http://www.psych.rochester.edu/SDT/publications/index.html), which hosts a wealth of studies published by the Rochester SDT Laboratory and other research institutions. The secondary source of literature encompasses online search engines, including Google (http://www.google.com) and Google Scholar (http://scholar.google.com). Peer-reviewed journals were given higher priority during the literature search. Social Science Citation Index (SSCI), citation check, and consultation with peers have been used as additional resources to assess the quality of articles.

In order to insure a broad and comprehensive literature review, a systematic combination of relevant keywords had been used. The keywords applied in this search have been organized into six categories: a) central construct (i.e., motivation), b) antecedents, c) outcomes, d) context, e) actions, and f) conditions. The keywords used in each category, along with the connecting Boolean logic, are illustrated in Figure 2.

Figure 2. Categories of search terms for literature review

Motivation in the Online Learning Environment

Motivation

Psychologists have been trying to define motivation for decades; however, "in just 60 years there have been major upheavals in the field, metaphors replaced, important new areas uncovered, and essential new concepts introduced" (Weiner, 1990, p. 622). Due to its constant shift of paradigms and perspectives, and perhaps also because of its intangible nature, motivation has never been defined in a way that is unanimously accepted. Nevertheless, several definitions of motivation are more frequently cited than others. Pintrich and Schunk (2002) defined motivation as "the process whereby goal-directed activity is instigated and sustained" (p. 3). Keller (1983) defined motivation as the "magnitude and direction of behavior. In other words, it refers to the choices people make as to what experiences they will approach or avoid, and the degree of effort they will exert in that respect" (p. 389). Despite motivation being defined differently from various perspectives, motivation continues to account for human behaviors in all their variety, including learning and instruction.

Since the dawn of psychology as a distinct field of study, a variety of motivational theories and constructs have been proposed. Some early motivational constructs, such as *instinct* (McDougall, 1926), *volition/will* (James, 1890), and *drive* (Woodworth, 1918) have become obsolete or been incorporated into more recent theories. There have been two main schools of motivation theories: behaviorist and cognitive theories of motivation. Behaviorists regard motivation as the change in the rate, frequency, or form of behavior in response to environmental stimuli; in other words, motivation refers to the likelihood or rate of behavior, which is external to the individuals (Pintrich & Schunk, 2002). The cognitive school of motivation, being the dominant paradigm at present, focuses on individuals' internal reasoning, and its influence on

human's intentions to act (motivation). The *expectancy-value theory* (Atkinson, 1964; Eccles & Wigfield, 1995), for example, posits that individuals' actions toward a certain behavior depend on their evaluation of the expectancy of success and the value of the task. *Attribution theory* (Weiner, 1985) postulates that motivation is influenced by people's causal judgment of their success or failure in reference to environmental and personal conditions. *Social cognitive theory* (Bandura, 1986) contends that people's self-judgments of ability determine their intentions to act. Furthermore, people's intentions, beliefs and emotions are influenced by social interactions, including observations, modeling, and social comparison.

An emerging trend in motivation studies is the *situated* perspective of motivation, for which the role of context is highlighted. Jarvela (2001) said, "Motivation is no longer a separate variable or a distinct factor, which can be applied in explanation of an individual's readiness to act or learn – but it is a reflective of the social and cultural environment" (p. 4). Turner (2001) contended that the context should not be reduced into a "background variable." The context, in fact, serves as a main constituent of motivation. Volet (2001) concluded that the situated perspective signifies six conceptual changes:

1. From a decontextualized to a situated and experiential approach;
2. From stable motivational traits to dynamic conceptualizations of motivation;
3. From a dominance on cognitive aspects to multi-dimensional aspects;
4. From a single-level to multi-level conceptualizations and analyses;
5. From uni-directional to bi- or multidirectional individual and contextual influences; and,
6. From single to integrated or multidimensional theoretical perspectives. (pp. 319-330, item numbers added)

Although motivation had long been a focus for educational research, Brown's (1988) article gave a renewed impetus for motivational research in education. In that article, Brown maintained that the field of education had been dominated by "cold cognition," where studies merely focused on learning and teaching mathematics. Because "The emotional cannot be divorced from the cognitive, nor the individual from the social" (p. 311), Brown recommended that educational researchers take seriously the motivational and emotional aspects of learning, and extend research agendas to such arenas.

Inspired by Brown (1988), more studies have since investigated motivation constructs and their influence on learning outcomes in classroom settings (Jarvela, 2001). Over the years, motivation has been found to contribute to a variety of important learning outcomes, such as *persistence* (Vallerand & Bissonnette, 1992), *retention* (Lepper & Cordova, 1992), *achievement* (Eccles et al., 1993), and *course satisfaction* (Fujita-Starck & Thompson, 1994). The above studies suggest that motivation should be taken seriously in any type of learning environment. Miltiadou and Savenye (2003) examined six motivation constructs (*self-efficacy*, *locus of control*, *attributions*, *goal orientation*, *intrinsic versus extrinsic motivation*, and *self-regulation*) which are substantiated in traditional face-to-face classrooms. The authors then discussed the constructs' implications for online learning. Miltiadou and Savenye concluded that, in order to reduce attrition rates and insure student success, more empirical studies are needed to test motivation theories and constructs in the online learning environment.

The Online Learning Environment

The online learning environment is the context for this study. An o*nline learning environment* refers to any setting that "uses the Internet to deliver some form of instruction to learners separated by time, distance, or both" (Dempsey & Van Eck, 2002, p. 283). The Sloan

Consortium (Allen & Seaman, 2006) classified four types of learning environments based on the proportion of content and activities delivered online: 1) *traditional face-to-face* courses (0%), for which no online technology is used and content is delivered orally or in writing; 2) *web facilitated* courses (1 to 29%), for which courses use web-based technology to supplement face-to-face classrooms; 3) *blended/hybrid* courses (30 to 79%), for which courses blend online and face-to-face delivery, and usually have online discussions and face-to-face meetings; and, 4) *online* courses (80+%), for which most or all of the content and activities are delivered online and typically include no face-to-face meetings. Regarding areas of application, online learning has been adapted by various settings such as K-12 education, higher education, business and military training, and home/self-study. This study focuses on web-based higher education courses with more than 80% of content and activities delivered online.

Online learning's most distinguishing feature is its ability to liberate education from the constraints of time and distance (Collins & Berge, 1995). In face-to-face classrooms, teachers and students meet in a physical location at a fixed period of time, while much of online learning happens in cyberspace, in which students can access learning materials anytime and anywhere. The second feature is that online learning relies on computer programs to *mediate* course materials and interactions, whereas people interact directly in face-to-face classroom settings. The distinctions of time, space, and ways of communication have, indeed, substantially changed the way people learn, for example, the online environment further allows for distributed forms of learning (Dede, 1996; Locatis & Weisberg, 1997). Course events that have unfolded centrally in face-to-face classrooms are now distributed across instructors and learners online. Therefore, "learning can occur at the same time in different places (e.g., through scheduled video conferencing events … or at different times in different places (e.g., using email

to communicate with the instructor and with one another)" (Dabbagh & Bannan-Ritland, 2005, p. 11). Distributed learning enables diverse ways of learning in the online environment.

Given that the online learning environment embraces features distinct from face-to-face classrooms, a question emerges regarding whether online students' motivation differs from those studying in face-to-face settings. Mullen and Tallent-Runnels (2006) found that students in online classes and in face-to-face settings perceived learning environments differently. The differences of perception, in turn, affected students' motivation, course satisfaction, and learning. Mullen and Tallent-Runnels concluded that "instructors should be careful not to assume that teaching the same in both environments will create similar results" (p. 264). In the same vein, researchers should not assume that motivation theories established in traditional face-to-face settings can be directly transplanted to the online learning environment without substantiation, because the dynamics of student motivation are different in online settings. A thorough investigation of online learners' motivation, including testing motivation theories and constructs in the online learning environment is necessary.

Themes Relating to Online Learners' Motivation and Learning Outcomes

A review of online and distance learning literature revealed that there is a lack of systematic investigation of learner motivation in the online learning environment. Nevertheless, many research areas or issues discussed in the literature have been associated with student motivation and subsequent learning outcomes. The following sections synthesize the most frequently cited issues, as thematically grouped into four factors: 1) *autonomy*, 2) *affiliation*, 3) *ability*, and 4) *assistance*.

Autonomy

Flexible learning, learner autonomy, and *learner control* share the common theme of *autonomy*. Brande (1994) defined flexible learning as "enabling learners to learn when they want (frequency, timing, duration), how they want (modes of learning), and what they want (that is learners can define what constitutes learning to them)" (p. 2). A similar definition was given to learner control: "learners make their own decisions regarding some aspect of the 'path,' 'flow,' or 'events' of instruction" (Williams, 1996, p. 957). Regarding learner autonomy, Moore (1993) defined it as "the extent to which in the teaching/learning relationship it is the learner rather than the teacher who determines the goals, the learning experiences, and the evaluation decisions of the learning programme" (p. 31).

The common ground underlying flexible learning, learner autonomy, and learner control is that learners are capable of exerting control over their own learning processes, thereby aligning learning pace with learning style. *Autonomous learners* also assume higher responsibility for their learning, which requires self-direction and self-regulation (Rovai, 2003). The interrelationships between autonomy, flexibility, and learner control are illustrated in Figure 3.

The *autonomy* category, which includes flexible learning, learner autonomy, and learner control, is closely related to online learners' motivation. The online learning environment renders flexibility of time and space, allowing for people who are distant, busy, or physically

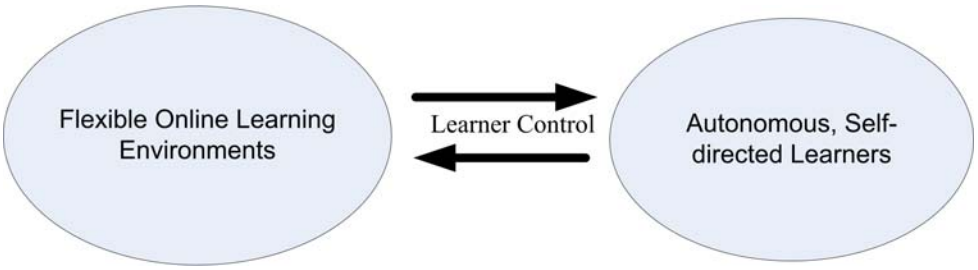

Figure 3. The interrelationships among autonomy, flexibility, and learner control

disabled to participate in class. Furthermore, online learning increases accessibility. Course materials and conversations can be accessible to students at a later time, enabling continued discussions and deeper reflections on given topics (Reed, 2000). Students can also retrieve virtually limitless resources online, access a variety of computer-based learning tools such as simulations and games, or collaborate with experts and students worldwide (Riel & Harasim, 1994). The flexible nature of online learning has frequently been reported as the most motivating factor for online students (Kim, Liu, & Bonk, 2005; Morrison et al., 2004; Peltier et al., 2007). For example, one student interviewed for a newspaper report by Carr (2000) described flexibility of time as the most significant motivating factor, "I really think that distance education is a great opportunity for someone who has either a tough professional schedule or a tough personal schedule to continue their education" (¶ 26).

Rarely does every online student perceive online learning as *flexible*. Willems (2005), in fact, raised concerns about the "inflexibility" inherent in online learning, which is likely to cause student frustration. Willems argued that online learning may impose time, place, and pace *dependence* as it becomes more tethered to equipment, places, and schedules. Some students may find difficulty accessing the Internet, downloading files, or merely finding a place to study, due to their area of residence or social economic status. Other students may feel frustrated because they cannot print out course materials and study *anywhere*, due to the format or size of learning materials. An example of the inflexibility of time is provided by Mullen and Tallent-Runnels' (2006) study. One student, during the interview, expressed resentment about synchronous discussion. The student felt frustrated because she was required to attend the chat sessions at specified times, which interfered with her schedule.

Willems' (2005) observations bring to the fore another issue: students' unrealistic expectations of online learning. Howland and Moore (2002) reported that students' initial misperceptions of time commitments for online learning resulted in difficulty balancing work, study, and family obligations. Other students mistakenly assume that flexible online learning allows them to submit their assignments only at the end of semester. Indeed, online students need assistance in settling into the learning environment. Such assistance will help online learners formulate reasonable expectations regarding the requirements and logistics of online learning, and be able to make better judgments regarding their choices. Armatas, Holt, and Rice (2003) stated:

> Unless students can see the "bigger picture," it will be difficult for many of them to make informed choices about how to engage with the available resources, which can potentially detract from the quality of their learning experience. (p. 157)

Regarding the effects of learner autonomy on student motivation and learning outcomes, past studies yield mixed results. Especially inconclusive are learner control studies in computer-based instruction (Reeves, 1993; Williams, 1996). The inconclusiveness of learner control research is due, according to Reeves, to technical and methodological flaws such as small sample sizes, large attrition rates, and insufficient treatment durations. Williams mentioned that learners may not have sufficient capacity to make rational choices, which may have confounded the treatment effects. Providing details for learner control research is beyond the scope of this review, as the majority of studies addressed interactive multimedia rather than online learning.

The following are studies of learner autonomy conducted in the online learning environment. Drawing on Davis, Bagozzi, and Warshaw's (1989) Technology Acceptance Model (TAM), Drennan, Kennedy, and Pisarki (2005) explored the relationships between

students' locus of control, perceived usefulness/ease of use of flexible learning, and course satisfaction. Using structural equation modeling, Drennan et al. found a positive and direct relationship between students' locus of control and course satisfaction, meaning that those students who believe they have control over their learning enjoy higher levels of course satisfaction than those who do not. A positive and direct path was also found between locus of control and perceived usefulness of flexible learning.

Similar results were found in Chou and Liu's (2005) 14-week field experiment. In Chou and Liu's study, a technology-mediated virtual learning environment (TVLE) was developed with a focus on enhanced learner control. Chou and Liu found that students in the TVLE group achieved better, attained higher computer self-efficacy, were more satisfied, and experienced a better learning climate than those in the face-to-face classroom group. Xie, Debacker, and Ferguson (2006), in their study of online discussions, found a negative effect of *instructor control*. Students' motivation decreased due to mandatory participation in online discussions.

This study regards autonomy and flexibility as defining characteristics, and thus, primary design components for effective online learning environments. Yet, further investigation reveals several problems that challenge such notions. The effects of learner autonomy, flexible learning, and learner control remain inconclusive. One well-established principle, however, is that support is crucial to help online learners formulate reasonable expectations, make informed choices, and self-direct their learning progress.

Affiliation

Although online learners have often been labeled as *autonomous* or *independent* learners, this is not to say that online learners do not need to affiliate with others. Quite the opposite: online learners' affiliation has long been acknowledged as a critical factor influencing their

learning success (Dennen, Darabi, & Smith, 2007; Hara, & Kling, 2000; Wegerif, 1998). On the cognitive side, affiliation/social interaction may expand learners' perspectives, deepen their thoughts, and resolve learning problems beyond an individual's capacity. On the affective side, affiliation promotes learners' feelings of belongingness, and increases their motivation to learn. In the online learning literature, issues revolving around student affiliations include *social interaction*, *social presence in computer-mediated communication* (CMC), *student isolation*, and students' *sense of community*. This section synthesizes these issues, with a focus on students' motivation.

Face-to-face interactions, an essential and inseparable element in traditional classrooms, are substituted by computer-mediated communications in the online learning environment, as mentioned earlier. Given this fact, online learning has been charged with being cold, impersonal, and demotivating (Galusha, 1997). Dabbagh and Bannan-Ritland (2005) stated:

> Although several telecommunications technologies such as audio- and videoconferencing have enabled a simulated human interaction learning context, the absence of face-to-face interaction in classic distance education settings has been identified as one of the main causes of loss of student motivation. (p. 6)

Social presence theory (Short, Williams, & Christie, 1976) has been applied to explain the above-mentioned phenomenon (Gunawardena, 1995; Walther, 1992). Short et al. defined *social presence* as the "degree of salience of the other person in the interaction and the consequent salience of the interpersonal relationships" (p. 65). Social presence is perceived through verbal and nonverbal cues. The former includes speech and text**,** whereas the latter refers to facial expression, direction of gaze, posture, dress, and physical presence (Gunawardena, 1995; Walther, 1992). Non-verbal cues are lacking due to the absence of direct human interaction in

the online learning environment. Furthermore, the majority of online communications are text-based (Lapadat, 2002; Tu, 2002). When the primary communication medium is written text, resolving ambiguities in communications becomes more difficult than in face-to-face encounters (Hara & Kling, 2000). The lack of social presence and miscommunications has been reported to result in student frustration and isolation, which may eventually lead to student dropout (Gunawardena, 1995).

Because of the limitations of computer-mediated communication, enhancing social interaction becomes an even more important issue in the online learning environment. Kreijns, Kirschner, and Jochems (2003), however, identified two pitfalls commonly found in computer-mediated learning environments: 1) educators taking for granted that social interactions automatically happen; 2) educators focusing on the cognitive effects of social interactions while ignoring socio-emotional processes. Kreijns et al. suggested four ways to promote social interactions: 1) using collaborative learning methods; 2) building interactivity into computer-supported learning environments; 3) adapting student-centered pedagogies; and, 4) increasing students' feeling of social presence. Notably, the authors emphasized the importance of non-task activities (e.g., informal and casual conversations), as these activities better contribute to impression formation, cultivation of social relationships, and nurturing a sense of community than task-based activities. Howland and Moore (2002) suggested that instructors provide timely and adaptive feedback based on task difficulty and individual student's needs, maintain periodic correspondence to keep students connected and engaged, and arrange optional face-to-face activities if possible.

Empirical studies have shown that social interaction/student affiliation significantly impacts student motivation and learning outcomes. Wegerif (1998), for example, found that

students who felt themselves *insiders* of the learning community evaluate themselves as being successful and benefited most from class. Conversely, those *outsiders* tend to feel anxious, defensive, and unwilling to take risks involved in learning. An online instructor interviewed for Carr's (2000) article in the *Chronicle of Higher Education* reported that his course-completion rates jumped from 62 percent to 90 percent when he switched to a more interactive online system and started to efficiently manage student correspondence.

Gao and Lehman (2003) conducted a field experiment to investigate *levels* of social interaction and college students' motivation and achievement. Two experimental groups were assigned. Students in the *reactive interaction* group received elaborated immediate feedback, while those in the *proactive interaction* group were required to participate in generative activities. The control group only received static hyperlinks of the course content. Results showed that students in both the reactive and proactive interaction groups achieved better than those in the control group. Moreover, students in the reactive interaction group revealed higher motivation to learn than the control group. Marks, Sibley, and Arbaugh (2005) studied different *types* of interactions. Drawing on Moore's (1989) typology of interaction, Marks et al. examined interaction-related constructs and their effects on students' perceived learning. Using structural equation modeling, Marks et al. found that instructor-student interactions and student-student interactions stood out as the most significant predictors of perceived learning, while most content-related constructs were non-significant. Notably, instructor-student interactions were much more salient than student-student interactions in predicting perceived learning, with the path coefficient twice as much as student-student interactions. Gao and Lehman's, and Marks et al's studies suggest that social interactions are essential to online learners' motivation and learning outcomes. Instructors should first emphasize their interactions with students, and then

adopt strategies such as encouraging discussion and providing feedback in their online instruction.

This study adopts the perspective that online learners' affiliation with others plays an extremely important role in their motivation and learning outcomes. Social interactions, including teacher-student interactions and student-student interactions, are essential for students to overcome barriers of communications and feelings of isolation. Online instructors should adopt strategies, such as timely feedback, periodic correspondence, and community building initiatives to keep students connected and engaged, making their online learning motivating and enjoyable.

Ability

Ability is the third theme relating to online learners' motivation. Online learning imposes greater requirements for a variety of skills, regarding technology, collaborative learning, and self-regulation (Dabbagh & Bannan-Ritland, 2005). With regards to technological skills, computer operation, software installation, and troubleshooting often accompany online course activities. Web browsing, data searching, and file management are also integral to online learning. Some course activities require greater technical skill, as applied to using software for design work, for example.

Furthermore, for synchronous and asynchronous communications, collaborative learning skills are indispensable. Dabbagh and Bannan-Ritland (2005) listed four categories of collaborative learning skills: 1) social learning skills, 2) discursive, or dialogic, skills, 3) self- and group evaluation skills, and 4) reflection skills. Joined with autonomy in online learning is self-directed learning. This requires developing a variety of cognitive and metacognitve strategies, such as organizational strategies, self-awareness, and self-regulation (Howland, &

Moore, 2002; Olgren, 1998). Lastly, as mentioned earlier, a majority of online communication is presented in written format (Lapadat, 2002; Tu, 2002). The text-based property of online communication challenges online learners' communication and writing skills (Yang, Tsai, Kim, Cho, & Laffey, 2006). In view of a variety of skills required for online learning, Vonderwell and Zachariah (2005) suggested that "students need to be prepared for technology, learning management, pedagogical practice, and the social roles" (p. 225).

Many frustrations of online learners are competency-related, among which technical issues and information overload are most frequently reported. Song et al. (2004) found technical problems to be the biggest barrier for online learners, as was expressed by 58% of their participants. Howland and Moore (2002) found that online learning technologies, such as the discussion board, were challenging for novice students. When students feel incompetent using technologies, or when they encounter technical problems without timely help, they feel anxious, awkward, and distressed (Motteram & Forrester, 2005; Xie et al., 2006). Tait (2003) stated that the technical issue is one of the main reasons students drop their online courses.

Another frequently cited problem is information overload, which refers to the situation in which a person's intended cognitive processing exceeds his/her available cognitive capacity (Mayer & Moreno, 2003). Armatas et al. (2003) reported that many online students were overwhelmed by the variety of resources and were confused about what they should prioritize. Online discussions and email messages also overwhelm students, as illustrated by an online student's report: *"I don't really like turning on the computer and finding that I have eleven messages on my e-mail. It's a pain … that is just time-consuming, but it is a part of at a distance"* (Hara & Kling, 2000, ¶ 57). Clearly, students need guidance to prioritize relevant resources, as well as to develop strategies to manage information.

Prior studies have shown that online students' perceived ability is a strong predictor of motivation and learning outcomes. In an effort to build a model of online learning satisfaction, Lim (2001) surveyed 235 online learners across five universities. Multiple regression analysis revealed that computer self-efficacy was a strong predictor of learning satisfaction, as well as participants' motivation to take future web-based courses. Thompson, Meriac, and Cope (2002) also found a positive correlation between online students' self-efficacy and their performance on online data search.

Prior experience, a factor closely related to ability, has been related to online learners' motivation. Conrad (2002) found that students with more online learning experience were less anxious about online learning. Armatas et al. (2003) reported students' attitudes change with experience. Students were confused and disgruntled at the beginning of the semester; however, once students became familiar with the learning environment they began to enjoy their online learning. The results of Conrad and Armatas et al.'s studies suggest that supporting online learners' self-efficacy and experiences provide a pathway to student success.

This study contends that students need to be equipped with a variety of skills to be successful in their online learning, and many students' distress and frustrations originate from competency-related issues such as technical problems and information overload. Studies such as Lim (2001) and Thompson et al. (2002) show that the greater the students' perceived ability, the better their motivation and learning outcomes. Learner support is necessary to help students strengthen abilities for online learning and move beyond their original capacity.

Assistance

Assistance, or *online learner support*, is the fourth theme relating to student motivation. Earlier sections discussed *autonomy*, *affiliation*, and *ability*, themes corresponding

to online students' motivation and learning outcomes. The above themes reflect the multiple complex influences on online students' motivation. Additionally, studies addressing these themes consistently acknowledge the critical importance of learner support, especially the instructor's role in online facilitation. This section discusses online learner support in more detail, focusing on strategies for online instruction.

The issue of learner support has been widely discussed in online and distance learning literature (Krauth, 1999; McLoughlin, 2002; Mills, 2003; Morgan & McKenzie, 2003; Simpson, 2002; Tait, 1995, 2000, 2003; Thorpe, 2002). Tait (2003) discussed, from a socially transformative perspective, a range of issues that urged practitioners to rethink the role of learner support, such as the increase of student attrition rate, the decrease of time available for study due to rapid shifts of occupational environments, and the impact of lifelong learning as a government agenda. The reasoning is that learner support promotes student recruitment, reduces student attrition, and widens student participation. McLoughlin (2002) maintained that peer, task, and social supports should be well-integrated into the design of distance programs. McLoughlin proposed ten dimensions for effective support design, such as *goal orientation*, *adaptability*, *accessibility*, *collaboration*, and *multiplicity*.

The importance of aligning contextual support with learners' needs have also been emphasized. Online students come with different learning styles, knowledge levels, and technical skills; they also encounter different barriers and challenges. Therefore, learner support should be flexible and adaptive to various student conditions. Willems (2005) said, "no [learner support] option will suit all flexible learners in a single system, [and] a variety of options would assist in making the educational opportunity a more inclusive entity" (p. 434). An example of multiple options would be the presentation of reading materials. While some online students

prefer on-screen reading, others favor reading printouts (Armatas et al., 2003). Providing *both* print and on-screen options supports students to read in their own way, which further realizes the notion of flexible learning. Aside from providing flexible options, Mills (2003) maintained that special attention should be given to those who are inexperienced, poor, unsure, and lonely.

Various learner support strategies have been proposed to help learners overcome barriers and challenges, and become more cognitively and affectively engaged. Most of the strategies are provided for online instructors. A discussion of these support strategies, thematically organized into *autonomy*, *affiliation*, and *ability* categories follows.

Assisting learner autonomy. One way to promote learner autonomy is to offer online learners more control over their learning process, such as involving learners in deciding what, when, and how to learn (Taylor, 1995). Once learners gain more control, they are likely to become more cognitively engaged, thus more willing to take responsibility for their learning (Williams, 1996). Nevertheless, Xie et al. (2006) advised that designers and instructors find a balance between task-oriented (which is assumed to be more controlling) and self-directed approaches, because both approaches bring intrinsic and extrinsic values to online learners. Another way of supporting learner autonomy is to provide flexible options, such as multiple ways of presenting reading materials, as discussed earlier. Perreault, Waldman, and Alexander (2002) further recommended that instructors use alternative assessment strategies such as e-portfolios, to render flexibility in measuring student achievement.

Strategies have also been proposed to resolve problems of students' misconceptions and unrealistic expectations. Marks et al. (2005) suggested that instructors clarify the requirements and logistics of the course from the outset, including a section of "frequently asked questions." Similar suggestions were given by Hara and Kling (2000), Kuboni and Martin (2004), Perreault

et al., and Song et al. (2004), among which Song et al. recommended that instructors remind students of possible pitfalls so that students would be better prepared.

Assisting learner affiliation. Increasing social presence, promoting social interactions, providing instant feedback, and cultivating senses of community are suggested for promoting learner affiliation. Berger (1999) advised that instructors build effective communication frameworks at the outset of the course. Instructors can build such frameworks using a variety of technology tools, such as e-mail, discussion board, virtual conference room, and instant messaging (Howland & Moore, 2002; Kim et al., 2005; Perreault et al., 2002). The application of technology tools will serve to promote social presence and students' feelings of community. Song et al. (2004) suggested that instructors embed community building strategies, such as encouraging collective reflection and devising small group case studies into their course design. Optional face-to-face activities were suggested by Howland and Moore (2002) to compensate for the lack of social presence and to promote a higher level of social engagement. Regarding student-student interactions, Kreijns et al. (2003) and Perreault et al. (2002) recommended that instructors adopt a collaborative learning pedagogy and design course activities (e.g., authentic group project) that foster student collaborations.

Instructors' feedback is crucial, not only because it provides students with information, reinforces students' learning, and clarifies mistakes (Gao & Lehman, 2003), but it also affects students' feelings of affiliation. Hara and Kling (2000) suggested prompt and clear feedback from instructors in view of the fact that delayed and unclear feedback contributed to student isolation and frustration. Ng and Nicholas (2007) called on instructors to negotiate with students about the frequencies and styles of feedback. Based on research findings, Dennen et al. (2007) pointed out that timeliness is more important than thoroughness in providing feedback for online

students. Given that the level of social presence is limited by the lack of face-to-face interactions in the online learning environment, online instructors should lay more emphasis on providing quality feedback. *Timeliness*, *frequency*, *clarity*, and *thoroughness* are significant factors for online instructors to consider when devising feedback for their online students.

Assisting learner ability. Support strategies pertaining to learner ability inform student orientation, scaffold requisite skills and provide technical support. Motteram and Forrester (2005) highlighted the importance of student orientation. Motteram and Forrester argued that student orientation should be well-designed to help online learners familiarize themselves with the learning environment; especially, technical requirements, prerequisite skills, and any special requirements for participation should be clearly conveyed to students along with relevant support information. Another path to student support is the scaffolding of online learning skills. Perreault et al. (2002) recommended training in computer literacy and distance learning strategies. Step-by-step guidelines and tutorials are suggested to help online learner access course units and other online resources (Motteram & Forrester, 2005). To advance online communication and interactions, acquainting students with communication tools and training in virtual teaming skills are suggested (Kim et al., 2005). Lastly, in view of the importance of self-regulation in online learning, scholars suggested that instructors provide students guidance for learning strategies, such as time management and the development of productive study routines (Motteram & Forrester, 2005; Song et al., 2004).

Technical problems have been reported as the biggest barrier to the online learner (Song et al., 2004). Expert technical help should be in place to provide troubleshooting, hardware and software advice, and assistance with class routines (Beffa-Negrini, Cohen, & Miller, 2002; Kuboni & Martin, 2004; Zirkle, 2001). Irani (2001), Marks et al. (2005), and Telg et al. (2005)

suggested that aside from exterior technical support, instructors need to receive technical training to render timely and proximal help to their online students.

Empirical studies on learner support. Learner support has been acknowledged as critical to students' learning, and many strategies have been proposed to assist online learners. Yet, empirical studies, especially experiments testing the effects of support strategies, are scant. Mills (2003) explained that,

> One of the major difficulties facing researchers into [online] learner support is the lack of opportunity to plan experimental work with single variable and controls. Moral considerations prevent the notion of providing one kind of service to one cohort of students, and another, perhaps less expensive, service to another group for the purpose of research. (p. 111)

Whereas experimental studies testing specific support strategies are scant, research on students' general perceptions of support revealed positive correlations between students' perceived support and their motivation and learning outcomes. Mullen and Tallent-Runnels (2006), for example, examined the effects of *academic support* (providing clear instructional strategies, corrective feedback, and stressing student learning) and *affective support* (promoting students' self-image) on online graduate students' motivation, course satisfaction, and perceived learning. Results showed that both academic and affective support positively correlated with all outcome variables. Moreover, the correlation coefficients were similar between *academic support* and *affective support*, indicating that these types of support are commensurately important. Therefore, instructors should tactically employ both types of support in their online facilitation.

Students need a variety of support strategies to survive their online learning. In the online and distance learning literature, many support strategies have been proposed to facilitate autonomy, affiliation, and ability. Nevertheless, empirical studies, especially field experiments, are still lacking. More research, as suggested by Tait (2003), is needed to verify the actual effects of learner support in all its variety. Table 1 summarizes the themes, problems, and support strategies discussed in the *Autonomy*, *Affiliation*, *Ability*, and *Assistance* sections.

Although themes (i.e., *autonomy*, *affiliation*, *ability*, and *assistance*) relating to online learners' motivation and learning outcomes have been extensively discussed in the online and distance learning literature, motivation, the central construct, remains unclear (Clark, 1999; Miltiadou & Savenye, 2003). One way to bridge this gap is to test motivation theories and models in the online learning environment. Gabrielle (2003), for example, applied Keller's (1987) ARCS (*attention*, *relevance*, *confidence*, and *satisfaction*) model to design technology-based instructional strategies for online students. Results showed that the ARCS-based learning support was effective in promoting students' motivation, achievement, and self-directed learning. Lee (2002) investigated constructs of *self-efficacy* (Bandura, 1986) and *task value* (Eccles, 1983) and found that the two constructs were significant predictors of online students' satisfaction and performance. Gabrielle's and Lee's theory-based studies have provided valuable insights for instructional design and facilitation. Therefore, evidence has emerged that warrants investigation into the ways a student determines the role of motivation for himself or herself in the online learning environment.

Table 1
Summary of Studies on Autonomy, Affiliation, Ability, and Assistance

Theme	Issue	Problem	Support Strategy
AUTONOMY	Flexible learning Learner autonomy Learner control	Inflexibility in online learning Students' unrealistic expectations	1. Allow learners to pursue their own interests (Rovai, 2003). 2. Involve learners in deciding what, when, and how to learn (Taylor, 1995). 3. Balance between task-oriented and self-directed approaches (Xie et al., 2006). 4. Provide flexible learning options that meet student needs, including assessment (Armatas et al., 2003; Perreault et al., 2002; Willems, 2005). 5. Clarify the requirements and logistics of the course from the outset (Hara & Kling, 2000; Kuboni, 2004; Marks et al., 2005). 6. Remind students of possible pitfalls at the beginning of class (Song et al., 2004).
AFFILIATION	Social presence in CMC Instructor-student interaction Student-student interaction Sense of community	Student isolation Miscommunication	1. Build effective communication frameworks using technologies (Berger, 1999; Howland & Moore, 2002; Kim et al., 2005). 2. Apply community building strategies to course design (Song et al., 2004). 3. Arrange optional face-to-face activities if possible (Howland & Moore, 2002). 4. Design collaborative learning activities to foster peer interactions (Kreijns et al., 2003; Perreault et al., 2002). 5. Provide students with clear and timely feedback (Dennen et al., 2007; Hara & Kling, 2000).
ABILITY	Requisite skills for online learning Student orientation	Learning difficulties caused by insufficient skills in technology, collaborative learning, communication, and self-regulation.	1. Provide well-designed student orientations (Motteram & Forrester, 2005). 2. Provide training/tutorials regarding technology, online communication, and teamwork skills (Kim et al., 2005; Motteram & Forrester, 2005; Perreault et al., 2002). 3. Assist students with self-regulation and learning strategies (Motteram & Forrester, 2005; Song et al., 2004). 4. Ensure that expert technical help is available to students (Beffa-Negrini et. al., 2002; Kuboni, 2004; Zirkle, 2001).

A motivation theory that deserves fully testing in the online learning environment is Deci and Ryan's (1985) self-determination theory (SDT). Pintrich and Schunk (2002) described self-determination theory as "one of the most comprehensive and empirically supported theories of motivation available today" (p. 257). Self-determination theory has been successfully applied to a variety of settings, including *physical education* (Standage et al., 2003, 2005), *politics* (Losier et al. 2001), *health care* (Williams & Deci, 1996; Williams, Freedman, & Deci, 1998), and *religion* (Neyrinck et al., 2005). However, the tenability of self-determination theory in the online learning environment remains unsubstantiated. The rest of this chapter presents a thorough discussion of self-determination theory, and how SDT may address gaps in online motivation research.

Self-Determination Theory

Overview

Self-determination theory (Deci & Ryan, 1985, 2002) is a general theory of motivation that purports to systematically explicate the dynamics of human needs, motivation, and well-being within the immediate social context. The term *self-determination*, as defined by Deci and Ryan (1985), is "a quality of human functioning that involves the experience of choice. [It is] the capacity to choose and have those choices … be the determinants of one's actions" (p. 38). Self-determination theory begins with an assumption that humans are active and growth-oriented organisms seeking a sense of wholeness, vitality, and integrity (Ryan & Deci, 2000a). Psychological growth and integration are facilitated through the satisfaction of three universal human needs: the need for *autonomy* (a sense of control and agency), the need for *competency* (feeling competent with tasks and activities), and the need for *relatedness* (feeling included or affiliated) (Pintrich & Schunk, 2002). Individuals experience an elaborated and

unified sense of self, embrace self-oriented motivation, and achieve a better sense of well-being through the satisfaction of autonomy, competency, and relatedness (Ryan & Deci, 2002). Conversely, the deprivation of the three basic needs produces highly fragmented, reactive, or alienated selves.

Self-determination theory posits three main types of motivation as the mediating process between need satisfaction and well-being: *intrinsic motivation*, *extrinsic motivation*, and *amotivation*. Intrinsic motivation refers to doing something because it is enjoyable, optimally challenging, or aesthetically pleasing (Ryan & Deci, 2000a; Ryan & Deci, 2002). Extrinsic motivation occurs when people are "doing something because it leads to a separable outcome" (Deci & Ryan, 1985, p. 55). With extrinsic motivation, people act because of fear, guilt, external incentives, or in recognition of personal importance. Amotivation refers to "the state of lacking intention to act" (Ryan & Deci, 2002, p. 17). Usually, amotivation results from a lack of contingency, feeling of competency, or perceived value of the tasks (Ryan & Deci, 2002). Self-determination theory theorizes that the three main types of motivation lie on a continuum according to the degree of self-determination, with amotivation representing the least self-determined motivation and intrinsic representing the most self-determined motivation.

Contrasting the traditional intrinsic/extrinsic dichotomy (deCharms, 1968) that regards extrinsic motivation as negative to learning and performance, SDT recognizes the commensurate importance of extrinsic motivation in relation to intrinsic motivation. Self-determination theory conceptualizes extrinsic motivation into four stages/types which are based on levels of self-determined behavioral regulation:

1. *External regulation*, whereby individuals behave in order to obtain rewards or avoid punishment, is the least self-determined type of extrinsic motivation;

2. *Introjected regulation*, whereby individuals introject the tasks into internal "ought" or "should" motives and usually feel guilty or anxious when they function within this category;
3. *Identified regulation*, whereby individuals recognize the tasks as personally important but are still motivated externally; and,
4. *Integrated regulation*, whereby individuals integrate various sources of information into their self-schema. Individuals engage in a behavior because of its importance to their sense of self. Integrated regulation represents the most self-determined type of extrinsic motivation (Pintrich & Schunk, 2002; Ryan & Deci, 2002).

Throughout the stages, *internalization* serves as the key concept. Internalization is the process whereby an individual integrates extrinsic goals and values into the self. During internalization, individuals become more self-determined, and are more likely to move to higher levels of extrinsic regulation or even intrinsic motivation. Figure 4 illustrates the self-determination continuum showing the six types of motivation with their regulatory styles and corresponding processes.

Contextual support plays a crucial role in promoting intrinsic motivation and facilitating internalization. Individuals absorb "nutrients" from social interactions that provide support for autonomy, competence, and relatedness, the three basic needs. Conversely, individuals feel discontent when these needs go unmet. The dynamic processes of contextual support are delineated in two sub-theories of SDT called *cognitive evaluation theory* (CET) and *organismic integration theory* (OIT).

Cognitive evaluation theory focuses on humans' intrinsic motivation. Cognitive evaluation theory argues that socio-contextual events promote individuals' perceived

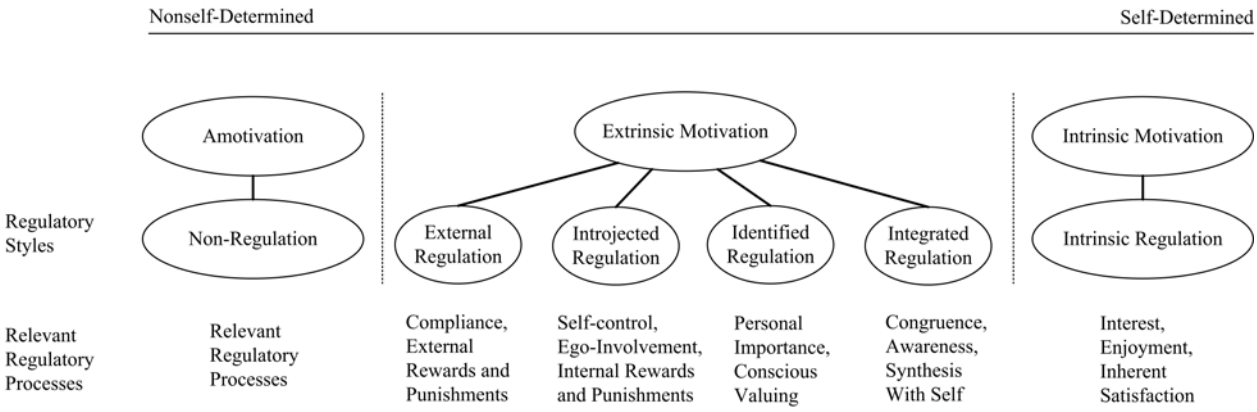

Figure 4. The self-determination continuum showing types of motivation with their regulatory styles and corresponding processes[1].

competence. However, to maintain intrinsic motivation, feelings of competence must be accompanied by a sense of autonomy (Ryan & Deci, 2002). Aside from competence and autonomy, Ryan and Deci (2002) argued that relatedness has a distal influence on intrinsic motivation.

Organismic integration theory details the aforementioned motivational continuum and the four types of extrinsic motivation. Also, OIT delineates the conditions in which internalization may be facilitated. Significant others are very important for individuals to initiate an extrinsically motivated behavior. However, "if people do not feel competent … they are unlikely to internalize regulation of the behavior; in fact, they will likely find a excuse not to do the behavior at all, even in the presence of the significant other" (Ryan & Deci, 2002, p. 19). Ryan and Deci (2002) pointed out the key role autonomy plays for internalization. Lacking perceived autonomy, individuals may stay at controlled (i.e., external or introjected) regulations without moving forward to self-determined (identified or integrated) stages.

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[1] From "Self-determination theory and the facilitation of intrinsic motivation, social development, and well-being," by R. M. Ryan, and E. L. Deci, 2000b, *American Psychologist*, 55, p. 72.

A summary of self-determination theory is presented in the following three points:

1. Humans have three universal and basic needs: *autonomy*, *competence*, and *relatedness*. Satisfaction of the three basic needs promotes intrinsic motivation and internalization, which in turn enhances well-being;
2. Amotivation, extrinsic motivation, and intrinsic motivation lie on a continuum of self-determination. Extrinsic motivation is presented in four stages: extrinsic, introjected, identified, and integrated regulations. When individuals internalize extrinsic goals and values, they become more self-determined. Individuals then move forward to a higher stage of extrinsic motivation, or even intrinsic motivation; and,
3. Social context enhances individuals' intrinsic motivation and facilitates internalization by supporting autonomy, competence, and relatedness. Social context undermines individuals' motivation when it fails to support the three basic needs.

Empirical Evidence that Supports Self-Determination Theory

Self-determination theory is a broad theory that includes sub-theories and a long causal chain (contextual support →need satisfaction→motivation→ well-being). Accordingly, this literature review focuses on empirical studies that support central tenets of SDT, as organized into four postulates inherent in self-determination theory.

Postulate 1. Intrinsic motivation (IM), extrinsic motivation (EM, including external, introjected, identified, and integrated regulations), and amotivation (AM) are distinct constructs which can be used to interpret important consequences. An important distinction between self-determination theory and other motivation theories is that SDT delineates six types of motivation. One way to validate this six-type categorization is to examine whether the six types of motivation are distinctive constructs, and whether these constructs explain a range of

important behavioral and psychological outcomes. Studies on SDT-based motivation scales provide supporting evidence for the six-type categorization. Losier et al. (2001) examined the factor structure of the *Self-Determination Scale of Political Motivation* (SDSPM), which measures *intrinsic*, *identified*, *introjected*, and *amotivated* reasons for following politics. Results from a confirmatory factor analysis supported the four-factor structure of the scale. Another study (Vallerand et al., 1992) tested the factor structure of the *Academic Motivation Scale* (AMS, which measures *intrinsic*, *external*, *identified*, *introjected*, and *amotivated* reasons) and obtained consistent results.

Regarding whether the different types of motivation can be used to interpret important outcomes, a prospective field study (Vallerand & Bissonnette, 1992) showed that different types of motivation did influence students' academic persistence. Using a factorial design, Vallerand and Bissonnette (1992) found that students who remained persistent in a French course were more intrinsically motivated, integrated, identified, and less amotivated than those who dropped the course. Moreover, persistent students were more self-determined (using the *Relative Autonomy Index*, Grolnick & Ryan, 1987) than drop-out students. The results of Vallerand and Bissonnette's study are consistent with Deci and Ryan's (1985) laboratory experiment. Importantly, Vallerand and Bissonnette's study showed that not only intrinsic motivation, but also self-determined forms of extrinsic motivation (integrated and identified regulations) influence important outcomes in field settings.

Postulate 2. Intrinsic motivation, extrinsic motivation, and amotivation lie on a continuum of self-determination. Self-determination theory theorizes that intrinsic motivation (IM), extrinsic motivation (EM), and amotivation (AM) lie on a continuum of self-determination, in which IM signifies the most self-determined motivation and AM represents the least self-

determined motivation. To verify, the six types of motivation must conform to a simplex or ordered correlation structure (Guttman, 1954). This means that variables that are deemed more similar (e.g., two adjacent phases of motivation) should correlate more highly than those that are hypothetically more discrepant (e.g., two remote phases of motivation). Based on Guttman's (1954) reasoning, Ryan and Connell (1989) tested the motivation continuum in achievement and prosocial domains. Intrinsic, extrinsic and amotivation were measured based on types of reasons that participants identified while performing certain tasks. The results showed that in both achievement and prosocial domains the motivational phases conformed to a simplex structure, supporting SDT. Nevertheless, *integrated regulation* was missing in the Ryan and Connell study. The gap of missing one or more types of motivation was filled by Vallerand and Bissonnette's (1992) study, which used the experimental version of the *Academic Motivation Scale* (AMS) to measure all six types of motivation. Correlation analysis revealed a simplex structure among the six types of motivation, lending full support to the motivation continuum.

Postulate 3. Contextual supports of autonomy, competency, and relatedness enhance intrinsic motivation and internalization, and vice versa. A huge repertoire of SDT studies revolve around the antecedents of motivation. Early studies focused on the effect of autonomy-supportive vs. controlling behaviors on intrinsic motivation. Generally, these studies provide support for SDT's postulate 3, for example, experimental studies found that autonomy-supportive behaviors, such as choice, flexibility of time, and opportunities for self-regulation were found to promote intrinsic motivation (Deci & Ryan, 1985, for a review). Conversely, studies found that controlling behaviors, such as *threats of punishment* (Deci & Cascio, 1972), *deadlines* (Amabile, DeJong, & Lepper, 1976), *imposed goals* (Mossholder,

1980), *surveillance* (Lepper & Greene, 1975), *competition* (Deci, Betley, Kahle, Abrams, & Porak, 1981), and *evaluation* (Ryan, 1982) all decreased intrinsic motivation.

There are other studies that substantiate positive effects of competency support. Vallerand and Reid (1984), for example, tested how teachers' feedback influences students' intrinsic motivation. Results showed that teachers' positive feedback increased students' intrinsic motivation while negative feedback decreased it. Using path analysis, Vallerand and Reid substantiated the mediating effects of perceived competency between teachers' feedback and students' intrinsic motivation.

Compared to autonomy and competency, the effects of relatedness on motivation remain relatively unexplored in SDT studies (Ryan, Stiller, & Lynch, 1994). Among a few available studies, Ryan et al. (1994) conducted a correlational field study to investigate students' relationships with others, academic motivation (including intrinsic motivation and external, introjected, and identified regulations) and school outcomes. Ryan et al. found that in general, students' relationships with parents and teachers positively predicted students' intrinsic motivation, coping strategies, academic engagement, and self-esteem. However, students' relationships with friends did not show much positive effects except for self-esteem. A recent study from Furrer and Skinner (2003) demonstrated similar results. Notably, in Furrer and Skinner's study, students' relatedness (i.e., relationships) with teachers had particularly salient effects on academic engagement. Ryan et al.'s, and Furrer and Skinner's studies suggest that the effects of relatedness are role-specific and context-dependent.

Another line of research tests the effect of contextual support on internalization. Deci, Eghrari, Patrick, and Leone (1994), in a classic laboratory experiment, tested the hypothesis that the provision of facilitating factors – presenting meaningful rationales, acknowledging

participant's feelings, and conveying choice – results in integrated regulation, whereas the lack of support may result in introjected regulation. Initially, no single facilitating factor was found to be strong enough to affect outcome variables. However, after collapsing experiment cells and reconstructing four groups each comprised zero, one, two, and three facilitating factors, significant results appeared. Given two or three supporting factors, participants' internalization was integrated. Given zero or one supporting factor, participants' internalization was introjected. The Deci et al. study provided strong support for internalization, showing that different sources of contextual supports have synergistic effects on internalization. The increase of supportive factors tends to help individuals achieve self-determined types of motivation. Importantly, the causal relationship between contextual support (manipulation of three facilitating factors) and internalization (as measured by engagement time) was confirmed in Deci et al's experiment.

Postulate 4. Self-determined motivation (intrinsic motivation, integrated and identified regulations) leads to positive outcomes while non-self-determined motivation (amotivation, external, and introjected regulations) results in negative outcomes. Many experiments and correlational studies supported this postulate. Regarding intrinsic motivation, it was found that students who were intrinsically motivated were more creative (Ryan, Mims, & Koestner, 1983) and cognitively flexible (McGraw & McCullers, 1979). Students also exhibited better learning (Grolnick & Ryan, 1987), improved retention (Lepper & Cordova, 1992), and enhanced achievement (Rocco, 2005). Conversely, amotivation was found to be associated with impaired performance, negative affect, and lower academic persistence (Peterson & Seligman, 1984, for a review).

The effects of different types of extrinsic motivation have also been explored. Identified and integrated regulations, which reflect internally autonomous conditions, were found to be associated with positive outcomes such as school enjoyment, proactive coping, and conceptual understanding (Grolnick & Ryan, 1987; Ryan & Connell, 1989). Introjected motivation, which represents an internally controlling status, was found to relate to negative outcomes such as academic anxiety and maladaptive coping (Ryan & Connell, 1989). Vallerand and Bissonnette (1992), in an aforementioned comprehensive study, substantiated that self-determined motivation (intrinsic motivation, integrated and identified regulations) was positively associated with students' academic persistence. In contrast, amotivation predicted students' dropout rate. Vallerand and Bissonnette also found that on-task students were more self-determined than dropout students. The above studies (Grolnick & Ryan, 1987; Ryan & Connell, 1989; Vallerand & Bissonnette, 1992) not only support the current postulate, but also provide support for the first postulate that the IM/EM/AM typology can be used to interpret a variety of important outcomes.

Studies that test the full model of SDT. Most of the SDT studies only investigated part of the SDT model. Studies aiming at testing the "full SDT model" (contextual support →need satisfaction →motivation→ well-being) are much fewer in number. One such study was conducted by Vallerand, Fortier, and Guay (1997), which examined motivational antecedents and academic persistence of high school students. Using a prospective design and structural equation modeling, Vallerand et al. obtained an appropriate model fit. Teachers, parents, and school administrators' supports were positively related to students' perceptions of competence and autonomy. Perceptions of competence and autonomy, in turn, led to higher levels of self-determined motivation. Finally, self-determined motivation negatively predicted student dropout. Another study was conducted by Standage et al. (2005), which aimed to test self-

determination theory in physical education. Using structural equation modeling, Standage et al. tested a model comprising need support, need satisfaction, motivation, and psychological outcomes. The results showed that students who perceived a need-supporting environment experienced greater levels of need satisfaction. Need satisfaction predicted intrinsic motivation, and in turn, intrinsic motivation predicted adaptive outcomes (including concentration, positive affect, task challenge, and happiness). Apparently, the results rendered support for self-determination theory. Table 2 summarizes empirical studies that supported self-determination theory, as discussed in this section.

Tenability of SDT

Overall, SDT has received a wide range of support from empirical studies. Experimental and correlational studies indicated that promoting autonomy, relatedness, and competency lead to enhanced intrinsic motivation and better internalization, in turn resulted in a variety of positive outcomes. Additionally, the IM/EM/AM typology and the self-determination continuum have been substantiated. Although not all causal relationships in SDT have been confirmed by true experiments, evidence from prospective and longitudinal studies, as well as studies that yielded satisfactory fits of SDT-based models, have cumulatively provided substantial support for the tenability of SDT.

Nevertheless, there are psychometric concerns in SDT studies. Researchers used different scales to measure the same motivational constructs. These scales vary in conceptual basis, theoretical alignment, and instrumental quality. Grolnick and Ryan (1987), for example, used Harter's (1981) *Intrinsic Versus Extrinsic Motivation Scale* in their study. The scale is based on deCharms'(1968) intrinsic/extrinsic motivation dichotomy and does not allow independent assessments of motivation constructs (Vallerand & Bissonnette, 1992). Also, the scale does not

Table 2
Summary of the Empirical Evidence that Supports Self-Determination Theory

Postulate	Empirical Evidence
Postulate 1. Intrinsic motivation (IM), extrinsic motivation (EM, including external, introjected, identified, and integrated regulations), and amotivation (AM) are distinct constructs which can be used to interpret important consequences.	a. The factor structures of SDT-based motivation scales conformed to SDT's theorizing (Losier et al.,2001; Vallerand et al., 1992). b. Different types of motivation bring significant and differentiated effects on students' academic persistence (Deci & Ryan, 1985; Vallerand & Bissonnette, 1992).
Postulate 2. Intrinsic motivation, extrinsic motivation, and amotivation lie on a continuum of self-determination.	Correlation analysis revealed a simplex structure among the six types of motivation (Ryan & Connell,1989; Vallerand & Bissonnette; 1992).
Postulate 3. Contextual supports of autonomy, competency, and relatedness enhance intrinsic motivation and internalization, and vice versa.	a. Instructors' controlling behaviors (e.g., deadlines, imposed goals, and surveillance) decreased students' intrinsic motivation (Amabile et, al., 1976; Lepper & Greene, 1975; Mossholder, 1980). b. Instructors' autonomy-supportive behaviors (e.g., choice, flexibility of time, and opportunities for self-regulation) enhanced students' intrinsic motivation (Deci & Ryan, 1985). c. Teachers' positive feedback increased students' intrinsic motivation while negative feedback decreased it (Vallerand & Reid, 1984). d. Students' relationships with parents and teachers positively predicted students' intrinsic motivation, coping strategies, academic engagement, and self-esteem. (Furrer & Skinner, 2003; Ryan et al., 1994). e. Presenting meaningful rationales, acknowledging students' feelings, and conveying choice synergistically affected students' levels of internalization. With the increase of supportive factors students achieved more self-determined types of motivation (Deci et al., 1994).

Table 2 (continued)
Summary of the Empirical Evidence that Supports Self-Determination Theory

Postulate	Empirical Evidence
Postulate 4. Self-determined motivation (intrinsic motivation, integrated, and identified regulations) leads to positive outcomes while non-self-determined motivation (amotivation, external and introjected regulations) results in negative outcomes.	a. Students with intrinsic motivation exhibited better learning (Grolnick & Ryan, 1987), improved retention (Lepper & Cordova, 1992), and enhanced achievement (Rocco, 2005). b. Identified and integrated regulations were associated with school enjoyment, proactive coping, conceptual understanding, and persistence (Grolnick & Ryan, 1987; Ryan & Connell, 1989; Vallerand & Bissonnette,1992). c. Introjected motivation was related to academic anxiety and maladaptive coping (Ryan & Connell, 1989). d. Amotivation was associated with impaired performance, negative affect, and lower academic persistence (Peterson & Seligman, 1984; Ryan & Connell, 1989).
SDT full model Test Contextual Support →Need Satisfaction (perceived autonomy, competency, relatedness)→Motivation→ Well-being	a. Teachers, parents, and school administrator's support positively predicted students' perceptions of autonomy and competency, which were linked to higher levels of self-determined motivation. Higher levels of self-determined motivation, in turn, were linked to reduced dropout (Vallerand et al., 1997). b. Students who perceived a need-supporting environment experienced greater levels of need satisfaction. Need satisfaction predicted intrinsic motivation and in turn, intrinsic motivation predicted adaptive outcomes (Standage et al., 2005). c. The above two studies used structural equation modeling and both yielded appropriate model fits.

include amotivation. Other studies used the *Academic Motivation Scale* developed by Vallerand et al. (1992), which assesses amotivation, external, introjected, identified regulations, and intrinsic motivation. However, integrated regulation was still missing. Still other studies (e.g., Eisenberger, Rhoades, & Cameron, 1999; Reeve & Deci, 1996) relied on a single item or a pair of items to measure certain constructs within SDT. The validity, internal consistency and conceptual clarity are questionable for these single-item or paired-items measures (Reeve, Nix, & Hamm, 2003). The incongruity of measurements makes it challenging to validate or compare studies. More well-established questionnaires that measure all six types of motivation are warranted in future studies.

Another psychometric concern regards free-time observation. The free-time observation technique has been widely used in SDT experiments to measure intrinsic motivation. However, Ryan, Koestner, and Deci (1991) found free-time measure problematic because extrinsic motivation was also measured. Cameron, Pierce, Banko, and Gear (2005) argued that to validate free-time observation as an effective measure in a study, the free-time observation results should correlate highly with self-reports of interest and enjoyment. To this end, it is suggested that researchers include both free time observation and self reports of intrinsic motivation within a study to cross-validate research findings[2].

Regarding SDT's theoretical soundness, one way of evaluation is to compare SDT with other established motivational theories. Bandura's (1986) social cognitive theory provides an apt counter example to self-determination theory. Self-determination theory and Bandura's social cognitive theory share two common features. First, both theories stress the importance of

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[2] Free-time observation was not used in this study mainly because participants are geographically dispersed. A self-report measure was applied in this study to assess online learners' intrinsic motivation.

perceived competence on motivation. Similar to SDT's *perceived competency*, Bandura proposed the concept of self-efficacy. Self-efficacy and expected outcomes together determine individuals' motivation and engagement (Bandura, 1982). The second similarity is that both theories emphasize the importance of social context. SDT argues that social context influences individuals' need satisfaction, motivation, and well-being. Social cognitive theory maintains that social context may influence motivation and learning through reciprocal interactions, such as observations and modeling (Pintrich & Schunk, 2002).

Bandura's theory differs from SDT in two main aspects. First, Bandura's (1986) theory regards motivation as a monolithic construct that does not distinguish different types of motivation. Second, Bandura' theory focuses more on the cognitive processes that happen during social interactions. Bandura's theory explains how observational learning and reciprocal teaching may help a person gain self-efficacy. Additionally, self-observation and self-reflection are deemed important for self-regulation in Bandura's theory. The above-mentioned cognitive processes are not heavily addressed in self-determination theory.

Although SDT is relatively weak in addressing cognitive processes *within* an individual, it is still more comprehensive than Bandura's (1986) theory. Self-determination theory differentiates six types of motivation and their mechanisms. Additionally, while addressing competency, it specifies the effects of self-determination (autonomy) and of relatedness on motivation. Overall, SDT should render more explanatory potential than Bandura's social cognitive theory. However, as just mentioned, SDT is less effective in delineating cognitive processes, such as self-reflection and goal setting (Locke & Latham, 1990). Neither does SDT delineate the role of *reciprocal interaction*. These theoretical issues suggest the need to further

refine self-determination theory. At this point, it is suggested that researchers use Bandura's theory and other social cognitive theories to supplement self-determination theory.

Indeed, there is room for refinement of SDT (e.g., the cognitive process issue). Also, psychometric measures should be improved within SDT studies. Nevertheless, SDT can still be regarded as valid and tenable because SDT has received a wealth of empirical support for its fundamental tenets, as discussed in the previous section. Studies further demonstrated that SDT has been successfully applied to a variety of domains. Yet, SDT has not been fully tested in the online learning environment. The following section discusses research gaps in online motivation research and how SDT may serve as an appropriate framework to bridge these gaps, reflecting that SDT deserves a fully test in the online learning environment.

Applying Self-Determination Theory to the Online Learning Environment

Gaps in Online Motivation Research

Early in this chapter, four themes, namely *autonomy*, *affiliation*, *ability*, and *assistance* were discussed. The themes revealed that feelings of self-agency, connections with others, and self-competency are critical factors influencing online learners' motivation. Moreover, supporting online learners' autonomy, affiliation, and ability is essential to promote learner motivation and learning outcomes. Studies in these themes broaden our understanding about factors influencing online learners' motivation, and enlighten ways to improve online instruction.

At a glance, it seems that the issue of learner motivation has been fully addressed in online and distance learning literature. However, a closer look reveals three closely related research gaps:

Research gap 1: The dynamics and interrelationships among the four themes remain unclear. Most studies in the online and distance learning literature *individually* discussed the

effect of a certain theme, such as learner autonomy, on students' motivation and learning outcomes. However, still there is a lack of a "big picture" illustrating how the themes (*autonomy*, *affiliation*, *ability*, and *assistance*) relate to each other, and how these themes together influence online learners' motivation and learning outcomes. Because "the whole is more than the sum of its parts" (Bertalanffy, 1972), studies examining the dynamics and interrelationships among these themes are warranted.

Research gap 2: Theoretical frameworks that undergird issues relating to online learners' motivation are lacking. "There is a growing call by educational researchers for the development and testing of comprehensive frameworks for enhancing our understanding of how to best design, implement, and manage online programs" (Peltier et al., 2007, p. 141). Unfortunately, "because online instruction and learning still constitute a relatively new frontier in education, informative theoretical frameworks and empirical evidence addressing some research questions are scarce" (Tallent-Runnels et al., 2006, p.117). Studies reviewed so far draw on different theoretical assumptions, and some do not even have any theoretical underpinning. Furthermore, as observed by Peltier et al. (2007), "much of what has been written about online education has focused on 'how to' articles and those using case studies or anecdotal evidence" (p. 141). Such problems should be supplemented by theory-based empirical studies. Indeed, comprehensive theoretical frameworks are necessary for online motivation research. Such frameworks not only integrate past studies, but they also guide future empirical research.

Research gap 3: The relative importance of autonomy, affiliation, and ability on online learners' motivation and learning outcomes remains unknown. Previous studies show that supporting autonomy, affiliation, and ability are important for enhancing online learners'

motivation and learning outcomes. However, the relative importance of autonomy, affiliation, and ability remains unknown. Examining the relative salience of the three factors can better our understanding about the dynamics of online learner's motivation and learning outcomes. Results from this line of research also help online educators prioritize resources for online learner support.

SDT as an Appropriate Framework for Addressing Motivation in Online Learning

Based on the preceding discussions, self-determination theory stands out as an appropriate framework for addressing motivation in online learning. First, SDT aligns with main themes relating to online learners' motivation. Self-determination theory posits *autonomy*, *relatedness*, and *competency* as determinants of human motivation. The three constructs correspond to main themes relating to online learner motivation including *autonomy*, *affiliation*, and *ability*. *Contextual support* also corresponds to *Assistance*, the theme of online learner support. Established from past experiments, self-determination theory predicts a variety of learning and psychological outcomes, including *performance*, *persistence*, and *learning satisfaction* (Deci & Ryan, 1985). Self-determination theory has the potential to address learning problems such as student attrition in the online learning environment.

Secondly, SDT can bridge the aforementioned gaps in online motivation research. Self-determination theory may serve as a comprehensive framework that integrates themes in online motivation research, and directs future empirical studies. Under the SDT framework, researchers can investigate the dynamics and interrelationships among *autonomy*, *affiliation*, *ability*, and *assistance*. Researchers can also investigate the relative salience of factors that influence online learners' motivation and learning outcomes through the lens of self-determination theory.

Third, self-determination theory generates *prescriptions* for motivational enhancement in addition to describing individuals' motivation process (Ryan & Deci, 2004). Self-determination theory-based studies have identified strategies that foster individuals' self-determination and motivation. Reeve and Jang (2006), for example, validated eight types of teacher's autonomy-supportive behaviors, such as allowing choice, providing rationale, and offering informational feedback that enhanced students' perceived autonomy, engagement, and performance. If SDT is fully substantiated in the online learning environment, the SDT-based strategies are readily applicable to support online learners.

Last, self-determination theory distinguishes six types of motivation. The six-type categorization provides a detailed profile of online learners' motivation, and allows researchers to detect changes across motivation types. For example, researchers can apply learner support strategies, and examine the extent to which these strategies help online learners *internalize* goals and values of online learning, thus shifting to more self-determined types of motivation.

Select Study that Applies Self-Determination Theory in an Online Learning Environment

Self-determination theory has been largely overlooked in online learning research. Particularly, studies aiming to validate SDT in online learning contexts are barely found. One that can be retrieved is a recent study conducted by Xie et al. (2006). Xie et al. applied SDT to examine student motivation in an online discussion board. Using a mixed-methods design, Xie et al. investigated students' *perceived interest* (intrinsic motivation), *value* (extrinsic motivation), *choice* (self-determination), *course engagemen*t (as measured by the numbers of login and discussion board postings), and *attitudes* toward the class. Correlation analyses revealed that the three SDT-based indicators (perceived interest, value, and choice) positively correlated with online students' course attitude and engagement. Additionally, results

from interviews and open-ended questions indicated that instructor participation, guidance, and feedback were critical to online students' motivation. Having a clear rationale was also found to help online students perceive the value of discussion activities, supporting self-determination theory. However, the Xie et al. study revealed that perceived competency did not have significant correlations with engagement and course attitude, which was at odds with SDT.

The Xie et al. (2006) study represented preliminary success in applying SDT to the online learning environment. However, the Xie et al. study exposed several apparent limitations: foremost among these is that the *Intrinsic Motivation Inventory* (IMI) was adopted. The *Intrinsic Motivation Inventory* measures intrinsic motivation and extrinsic motivation in general, but it does not include amotivation and the four subtypes of extrinsic motivation. Therefore, changes in extrinsic motivation (i.e., internalization) can not be detected by the *Intrinsic Motivation Inventory*. Secondly, according to SDT, the relationship between perceived competency and learning outcomes is mediated by motivation. However, the Xie et al. study did not test this path. Neither did the study test the effects of perceived relatedness. Third, although the authors concluded that perceived competency failed to interpret learning outcomes, the "competency" defined in their study seems incomplete. The authors merely used computer/Internet skills as the competency measure; however, for online discussion, competency may also include other aspects such as communication and metacognitive skills, as mentioned earlier. Excluding these dimensions may yield skewed results. Given these limitations, the results of the Xie et al. study are insufficient to draw conclusions about SDT's tenability. More studies are warranted to thoroughly test SDT in the online learning environment.

Accepting that self-determination theory assumed to be appropriate, still SDT has to be fully substantiated in the online learning environment. This study will fill this need by:

1. Testing the four tenets of SDT in the online learning environment; and,
2. Testing the full model of SDT in the online learning environment.

CHAPTER III

METHODOLOGY

The preceding chapters indicated that self-determination theory may serve as an appropriate framework for addressing online learners' motivation, but its tenability has not yet been established in online learning contexts. Accordingly, the purpose of this study is to test SDT's tenability in an online learning environment. This study also intends to examine online learners' motivation profiles, and the relative salience of autonomy, relatedness, and competency on online learners' motivation and learning outcomes. Three research questions guide this study:

1. What is the primary locus of motivation for students enrolled in an online course?
2. What is the degree to which the SDT framework can be substantiated in an online learning environment?
3. What is the relative salience of autonomy, relatedness, and competency on online learners' motivation and learning outcomes?

Research Design

This study employs a cross-sectional (pre-test/post-test) design. The cross-sectional design enables the researcher to compare participants' motivation profiles at the two data points, and to examine participants' motivational changes. An overview of the research design is illustrated in Figure 5. Details of the research design (revised based on the pilot study) will be provided in the following sections.

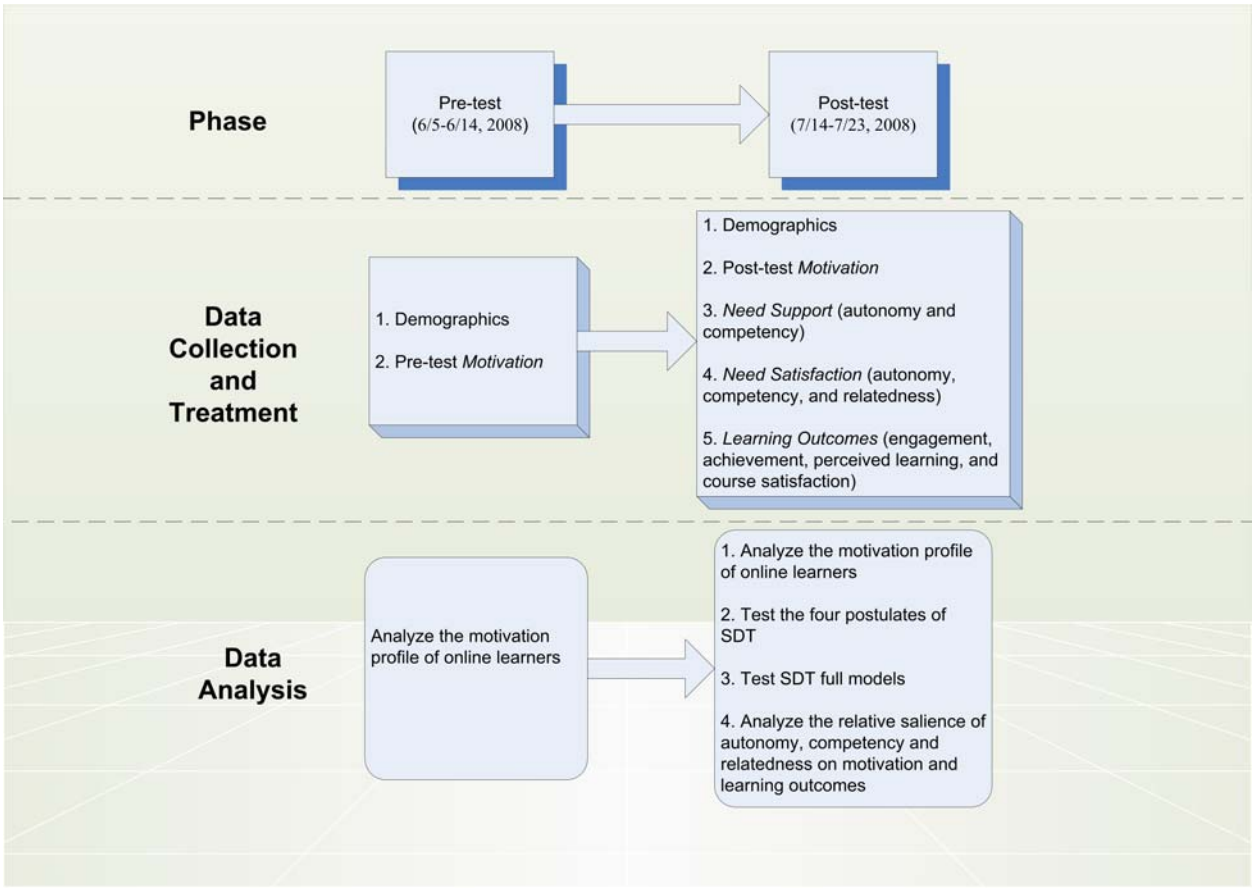

Figure 5. Research design for this study

Research Context

Special Education Training on the Web (SETWEB) and Special Education Training and Mentoring on the Web (SPECTRUM) are two online certificate programs designed for individuals who do not hold a renewable teaching certificate to become a Special Education General Curriculum Consultative P-12 teacher. Generally, it takes seven consecutive semesters to complete the programs. Students must attend the on-campus program-advising and technology orientation, and finish required web-based courses. The two online programs share similar course work. The online courses are hosted on the WebCT course management system at a large research university in the southeastern United States, and utilize a live chat system

(Wimba) and a variety of software, such as Adobe Reader and Real Player, to facilitate teaching and learning.

The main reason for selecting SETWEB and SPECTRUM as the research context is that the researcher has been working closely with the online programs for three and a half years. His responsibility has been to prepare and maintain online courses using the WebCT course management system and to provide technical support for students and instructors. It is his passion to conduct studies that may be beneficial to the online programs. In pragmatic terms, employing SETWEB/SPECTRUM helps him gather research data. The researcher is well-positioned to gain support from administrators and instructors to encourage participation.

Participants

The participants were recruited from the summer 2008 cohort of SETWEB and SPECTRUM. Five courses were offered in summer 2008, including SPED2000, SPED3030, SPED3050, SPED7110, and SPED7120. Each course had several instructors teaching a specific section. Because this study aimed to test self-determination theory, a general theory of motivation in an online learning environment, no preset exclusion criterion was applied to recruiting participants. Instead, this study intended to include all students in the summer 2008 cohort.

Two hundred and eighty (280) students participated in the pre-test, and 267 participated in the post-test. After removing outliers, 270 cases for the pre-test, and 262 cases for the post-test were included in the datasets. The majority of participants were female (77.7% for the pre-test and 78.1% for the post-test), making the male/female ratio approximately 1: 3.5. Participants' age ranged from 19 to 65, with the average of 37.39 (SD = 9.94) for the pre-test and 37.80 for the post-test (SD = 10.23). Notably, "30-39 years old" stood out as the biggest age group that

included more than one third (34.6% for the pre-test and 33.6% for the post-test) of the total participants. Approximately 82% of participants were working full-time while they were enrolled in SETWEB and SPECTRUM. Regarding participants' prior experience with online courses, around 60% of the participants had not taken any online courses before entering SETWEB and SPECTRUM. Additionally, around 50% of participants did not take any SETWEB and SPECTRUM courses before summer 2008. Table 3 presents participants' demographic characteristics in more detail.

Table 3
Demographic Characteristics of Participants

Variable	Subcategory	Pre-test (n = 270)		Post-test (n = 262)	
		Valid n	Valid %	Valid n	Valid %
Gender	Male	60	22.3	57	21.9
	Female	209	77.7	203	78.1
Age	29 and below	70	26.0	68	26.3
	30-39	93	34.6	86	33.2
	40-49	71	26.4	68	26.3
	50-59	29	10.8	31	12.0
	60 and above	6	2.2	6	2.3
Employment Status	Full-time	223	82.6	216	82.4
	Part-time	26	9.6	22	8.4
	No job	20	7.4	19	7.3
	Other	1	0.4	5	1.9
Number of online courses taken *before* entering SETWEB/ SPECTRUM	None	167	61.9	159	60.7
	1-2	38	14.1	39	14.9
	More than 3	65	24.1	64	24.4
Number of online courses taken *after* entering SETWEB/ SPECTRUM	None	135	50.6	126	48.1
	1-2	50	18.7	51	19.5
	More than 3	82	30.7	85	32.4

It is noteworthy that the online survey did not collect participants' personal information in order to maintain optimal participation rate and to insure candid responses. Participants' pre-test and post-test answers have been matched by comparing/filtering across pre-test and post-test demographic responses, including *gender*, *age*, *employment status*, *prior online learning*

experience, *courses currently taking*, and *the target course to complete the online survey*. Two hundred and one cases (72% of the pre-test participants) have been matched to include both pre-test and post-test data. Furthermore, through the assistance of the program secretary, objective measures, including participants' *final grade* (on a 0-100 scale) and the *number of hits* on WebCT, have been matched with the post-test dataset. One hundred and sixty cases (60% of the post-test participants) have been matched to include both objective (number of hits and final grade) and self-report (the online survey) data.

Instrumentation

The instruments used in this study are sorted into four categories: 1) *need support*, 2) *need satisfaction*, 3) *motivation*, and 4) *well-being/learning outcomes*. All scales and questionnaires, for consistency, were made on a 7-point Likert scale anchored by 1 (not at all true) to 7 (very true).

Need Support

Two scales were used to assess the degree to which online students perceive support from their learning context. To measure instructors' *autonomy support*, nine items were selected from the *Learning Climate Questionnaire* (Williams & Deci, 1996). A sample question is "I feel that my instructor provides me with useful choices and options." A reliability test on the nine-item *Autonomy Support Scale* revealed a satisfactory internal consistency ($\alpha = .95$). The entire nine items are presented in Appendix A.

Regarding *competency support*, in view of the lack of questionnaires available for online learning contexts, the researcher created a *Competency Support Scale* that was meant to be context-specific and quality-insured. The scale creation process started with two open-ended questions asking students' needs for competency support:

1. Based on your experience with the online program, what kinds of competence/ability do you think is necessary to accomplish your study?
2. Based on the above question, what kinds of support (from instructors, administrators, and technical support personnel) are necessary to help strengthen students' competence/ability?

Responses from 32 students were coded and then developed into fifteen items. Item analysis based on the pilot study data eliminated one question that failed to differentiate low and high scores. Beyond the information gathered from open-ended questions, one item was adapted from the *Mutual Support/Mutual Interdependence* subscale of the *Sense of Community Instrument* developed by South (2006). The (revised) item was "I feel that my classmates help me learn." The final item count was fifteen. A reliability test on the fifteen-item *Competency Support Scale* revealed a satisfactory internal consistency ($\alpha = .93$). The entire fifteen items are presented in Appendix A.

Noteworthily, *relatedness support* was not measured in this study, because autonomy and competency supports are more directly addressed by self-determination theory (Ryan & Deci, 2002). With a few exceptions, SDT-based studies measure *perceived relatedness* rather than relatedness support. Accordingly, this study measured online students' *perceived relatedness*, as will be described in the *Need Satisfaction* section.

Need Satisfaction

Three previously validated questionnaires were used to assess the degree to which online students experience the satisfaction of the three psychological needs: *autonomy*, *competency*, and *relatedness*. The *Perceived Autonomy Scale* was adapted from the Standage et al. (2005) study. The scale contains six items. Each item has been modified to fit the SETWEB/

SPECTRUM context. A sample item is "In this course I can decide which activities I want to participate." A reliability test on the six-item *Perceived Autonomy Scale* revealed an acceptable internal consistency (α = .69). The entire six items are presented in Appendix A.

Perceived competency was measured by the *perceived competence* (sub)scale of the *Intrinsic Motivation Inventory* (IMI), which was retrieved from the official SDT website (http://www.psych.rochester.edu/SDT/measures/index.html). The *Perceived Competency Scale* contains six items. The stems have been slightly modified to fit the SETWEB/SPECTRUM context. A sample item is "I am satisfied with my performance in this online course." A reliability test on the six-item *Perceived Competency Scale* revealed a satisfactory internal consistency (α = .86). The entire six items are presented in Appendix A.

To assess participants' *perceived relatedness*, South's (2006) *Sense of Community Instrument* was adopted. The instrument was designed for an online continuing education program, similar to the context of this study. After reviewing each subscale of the inventory, the researcher determined that *trust*, *interactivity*, and *shared values* were more relevant to the relatedness construct of SDT. A total of nine items were extracted from the subscales, of which a sample item is "I feel that my classmates care about each other." A reliability test on the nine-item *Perceived Relatedness Scale* revealed a satisfactory internal consistency (α = .86). The entire nine items are presented in Appendix A.

Motivation

Amotivation, intrinsic motivation, and different types of extrinsic motivation were assessed using Vallerand et al's. (1992) *Academic Motivation Scale* (AMS). Participants were asked to respond to twenty-eight items using the stem, "I enrolled in 'this' online course..." when they complete the online survey. The AMS is made up of seven subscales each contains 4 items,

for which intrinsic motivation has been further categorized into *intrinsic motivation to know*, *to accomplish*, and *to experience stimulation*, totaling three subscales with twelve items. For the purpose of this study, the categorization of intrinsic motivation was *not* adopted. The twelve items were treated as presenting a single construct: *intrinsic motivation*.

Amotivation and three types of extrinsic motivation – *external*, *introjected*, and *identified regulations* – were also measured by the *Academic Motivation Scale*. However, *integrated regulation* was not included in the latest version of AMS. As mentioned in the *Literature Review* chapter, scales that measure all six types of motivation are lacking. The only available scale that measures all six types of motivation is the *Academic Self-Regulation Questionnaire* (SRQ-A, available on the SDT website). However, the SRQ-A is used for schoolchildren and thus unsuitable for this study. The *Academic Motivation Scale* seems to be the best measure available for this study, because it was designed based on self-determination theory, and was developed to measure college and adult students' motivation to learn in various school contexts. A reliability test based on the formal data of this study indicated that AMS has satisfactory internal consistency across subscales, ranging from .77 to .96 (Vallerand et al., 1992). Vallerand et al. (1992) further demonstrated that the AMS has an appropriate test-retest reliability over a month period (r = .79). Sample items for each type of motivation are presented in Table 4. The entire twenty-eight items are presented in Appendix A.

Well-being (Leaning Outcomes)

To assess online learners' well-being, four categories of learning outcomes were gathered, including 1) *engagement*, 2) *achievement*, 3) *perceived learning*, and 4) *course satisfaction*. *Student engagement* was assessed using both self-report and objective measures. The self-report measure refers to a questionnaire item asking "How many hours per

week did you devote to this course?" The objective measure includes online students' *number of hits*, referring to the number of times that students accessed WebCT content pages. The *number of hits* data was gathered through the "track student" function of WebCT.

Student achievement was assessed using both self-report and objective measures. The self-report measure is presented by students' *expected grade*, gathered from a questionnaire item asking "What grade do you expect to get for this course?" Possible responses for the *expected grade* item include A, B, C, D, F, and Incomplete. The objective measure includes online students' *final grade*, which was loaded on a 0-100 scale. As mentioned earlier in the *Participants* section, objective measures, including participants' *number of hits* and *final grade*, have been matched with the post-test dataset through the assistance of the program secretary.

Participants' *perceived learning* was measured using Alavi's (1994) six-item *Perceived Learning Scale*. This scale has been adopted by many studies to measure students' self-perception of knowledge and skills gained from a course, either in face-to-face or online contexts (Arbaugh, 2002; Eom, Wen, & Ashill, 2006; Gomez Alvarez, 2005; Marks et al., 2005). A sample item is "I learned to inter-relate the important issues in the course material." The *Perceived Learning Scale* has been reported to yield a high internal consistency, ranging from .92 to .95 (Gomez Alvarez, 2005). A reliability test based on the formal data of this study also yielded a high internal consistency ($\alpha = .95$). The entire six items are presented in Appendix A.

As with *course satisfaction*, this study adopted Hao's (2004) *Online Course Satisfaction Survey*, which evaluates "the general course satisfaction of the online students" (Hao, 2004, p. 47). The survey has ten items, of which a sample is: "Overall, I am satisfied with this course." The items have been modified to fit the SETWEB/SPECTRUM context. A reliability test on the

ten-item *Course Satisfaction Survey* revealed a satisfactory internal consistency ($\alpha = .93$). The entire ten items are presented in Appendix A. Table 4 displays the summary and sample questions of the survey instruments used in this study. Table 5 presents reliability information of the survey instruments based on past studies and this study. A full list of questionnaire items can be found in Appendix A.

Data Collection Procedures

This study employs a cross-sectional design and includes two phases of data collection: pre-test and post-test. Before administering the pre-test, the researcher communicated with the SETWEB and SPECTRUM administrators and course instructors to make sure that they fully understood the purpose and logistics of this study. The researcher also sought and obtained support from the administrators' and instructors to encourage student participation. Because students are geographically dispersed, the pre-test and post-test surveys (along with the consent form) were delivered online through SurveyMonkey (http://www.surveymonkey.com), a commercial website for surveys. Links to the surveys were provided on the WebCT course menu for students' easy access.

The pre-test (also called the Part A survey) proceeded at the beginning of the summer term and lasted for ten days. The Part A survey gathered data concerning students' demographic information, as well as their five types of motivation (as measured by students' reasons for enrolling in a particular online course). A month after the closure of the pre-test, the post-test (also called the Part B survey) was administered. The Part B survey includes all the variables to the interest of this study, including *demographics*, *motivation*, *need support*, *need satisfaction*, and *learning outcomes*. Concerning that students may have enrolled in more than one online courses in summer 2008, participants were asked to target one course and use it to answer

Table 4
Summary of Survey Instruments for this Study

Questionnaire	Construct Measured	# of Items	Sample Item
Learning Climate Questionnaire (LCQ, on the SDT official website)	*Autonomy Support* (from instructors)	9	I feel that my instructor provides me with useful choices and options.
Self-developed *Competency Support Scale*	*Competency Support* (from instructors, peer students, and technical support personnel)	15	I always get timely help when I encounter technical problems.
Perceived Autonomy Scale	*Perceived Autonomy*	6	In this course I can decide in which activities I want to participate.
Perceived Competency Scale	*Perceived Competency*	6	I am satisfied with my performance in this online course.
Trust, interactivity, and shared values and beliefs (Subscales of the *Sense of Community Instrument*, South, 2006)	*Perceived Relatedness*	9	I feel that my classmates care about each other.
Academic Motivation Scale (Vallerand et al, 1992)	*Amotivation*	4	Honestly, I don't know; I really feel that I am wasting my time in this class.
	External Regulation	4	In order to obtain a more prestigious job later on.
	Introjected Regulation	4	To prove to myself that I am capable of completing this online course.
	Identified Regulation	4	Because eventually, it will enable me to enter the job market in a field I like.
	Intrinsic Motivation	12	Because I experience pleasure and satisfaction while learning new things.
Perceived Learning Scale (Alavi, 1994)	*Perceived Learning*	6	I learned to inter-relate the important issues in the course material.
Learning Satisfaction Scale (Hao, 2004)	*Course Satisfaction*	12	Overall, I am satisfied with this course.

Table 5
Internal Consistency of Survey Instruments for this Study

Category	Subscale	α (past studies)	α (this study)
Need support	Autonomy support	.85	.95
	Competency support	.89	.93
Need satisfaction	Perceived autonomy	.67	.69
	Perceived competency	.85	.86
	Perceived relatedness	.66	.90
Motivation	Amotivation	.91	.83
	External regulation	.82	.81
	Introjected regulation	.86	.90
	Identified regulation	.80	.77
	Intrinsic motivation	.95	.96
Well-being	Perceived learning	.93	.95
	Course satisfaction	.92	.93

throughout Part A and Part B surveys. Students' final grades and the numbers of hits data were gathered separately through the assistance of the program secretary.

Data Analysis Procedures

Data collected in this study were used to portray participants' locus of motivation, to test the tenability of the self-determination theory, and to examine the relative salience of autonomy, relatedness, and competency on participants' motivation and learning outcomes. Before proceeding with the formal data analysis, *missing values*, *outliers*, and *normality* were examined and modified (see the *Results* chapter for details). Table 6 provides an overview of research questions, related themes/postulates, and statistical methods applied in this study. Detailed data analysis procedures are presented below.

Table 6

Research Questions, Related Themes, and Data Analysis Methods

Research Question	Related Theme/Postulate	Data Analysis Method
1. What is the primary locus of motivation for students enrolled in an online course?	a. Online students' motivation profile	1. Descriptive analysis 2. Paired-sample t-test
	b. Changes in online students' motivation.	Paired-sample t-test
	c. Demographics and students' motivation.	One-way ANOVA
2. What is the degree to which the SDT framework can be substantiated in an online learning environment?	Postulate 1. Intrinsic motivation (IM), extrinsic motivation (EM, including external, introjected, identified, and integrated regulations), and amotivation (AM) are distinct constructs which can be used to interpret important consequences.	1. Exploratory factor analysis 2. Stepwise multiple regression analysis
	Postulate 2. Intrinsic motivation, extrinsic motivation, and amotivation lie on a continuum of self-determination.	Correlation analysis
	Postulate 3. Contextual supports of autonomy, competency, and relatedness enhance intrinsic motivation and internalization, and vice versa.	One-way ANOVA
	Postulate 4. Self-determined motivation (intrinsic motivation, integrated and identified regulations) leads to positive outcomes while nonself-determined motivation (amotivation, external and introjected regulations) results in negative outcomes.	1. Correlation analysis 2. One-way ANOVA
	SDT full model test	Structural equation modeling
3. What is the relative salience of autonomy, relatedness, and competency and learning outcomes?	a. The relative salience of autonomy, relatedness, and competency on online learners' motivation b. The relative salience of autonomy, relatedness, and competency on online learners' learning outcomes	Simultaneous multiple regression analysis

A descriptive analysis (using SPSS 15.0) and subsequent paired-sample t-tests were used to demonstrate participants' scores on the five types of motivation (*amotivation*, *external*, *introjected*, and *identified regulations*, and *intrinsic motivation*), informing the answer to Research Question One: What is the primary locus of motivation for students enrolled in an online course? Two additional analyses were performed to portray online learners' motivation in more detail. First, participants' *changes* in motivation (from the pre-test to the post-test) were examined through paired-sample t-tests. Secondly, the effect of demographic variables (i.e., *gender*, *age*, *employment status*, and *prior online learning experience*) on participants' motivation was evaluated using one-way analysis of variance (ANOVA).

The four postulates and the full model of SDT were tested to answer Research Question Two: What is the degree to which the SDT framework can be substantiated in an online learning environment? *Postulate One*, the distinctiveness and practical importance of the five motivation types, were tested through an exploratory factor analysis and multiple regression. The exploratory factor analysis evaluated the factor structure of the *Academic Motivation Scale*, for which the item grouping (items within each factor) was compared with the original subscale items. Stepwise multiple regression analyses were used to examine whether the five types of motivation could significantly account for online students' *engagement*, *achievement*, *perceived learning*, and *course satisfaction*.

Postulate Two, the hypothesized self-determination continuum, was tested by examining whether the six types of motivation conformed to a simplex or ordered correlation structure. A simplex structure, as mentioned earlier in the *Literature Review* chapter, means that variables that are deemed more similar (e.g., two adjacent phases of motivation) should correlate more highly than those that are hypothetically more discrepant (e.g., two remote phases of motivation). *Postulate Three*, the positive effect of contextual support on intrinsic motivation and

internalization, was tested through one-way analysis of variance. Participants were divided into three groups according to their percentile ranks on the *autonomy support* and *competency support* scores. Dependent variables included the changes of the five types of motivations, as well as the *internalization* of online learners (the calculation of the *index of internalization* will be detailed in the *Results* chapter).

Postulate Four, the positive effect of self-determined motivation and the negative effect of nonself-determined motivation on individuals' well-being, was examined by two closely related analysis methods: correlation analysis and one-way ANOVA (with the six learning outcomes as dependent variables). The results of both analyses were then compared and cross-validated.

The full model of SDT was evaluated based on empirical data gathered in an online learning environment. The "full model," as shown in Figure 6, depicts the interrelationships among *need support*, *need satisfaction*, *motivation/self-determination*, and *learning outcomes*. *Need support*, a latent variable measured by *autonomy support* and c*ompetency support*, leads to enhanced *need satisfaction* (as measured by *perceived autonomy*, *perceived relatedness*, and *perceived competency*). *Need satisfaction* then results in higher *self-determination*, a composite score of *intrinsic motivation* and *external*, *introjected*, and *identified regulations*. *Self-determination*, in turn, promotes various learning outcomes, including *engagement* (*hours per week studying* and *number of hits*), *achievement* (*expected grade* and *final grade*), *perceived learning*, and *course satisfaction*.

Furthermore, paths from *need support* to *learning outcome* and from *need satisfaction* to *learning outcome* were drawn in the model to assess the direct impacts of *need support* and *need satisfaction* on learning outcomes in addition to the above-mentioned causal chain: *need support* →*need satisfaction* →*motivation*/*self-determination*→ *learning outcome*. The positive effect of one variable on another is illustrated by a plus sign in Figure 6. In the formal data analysis, one

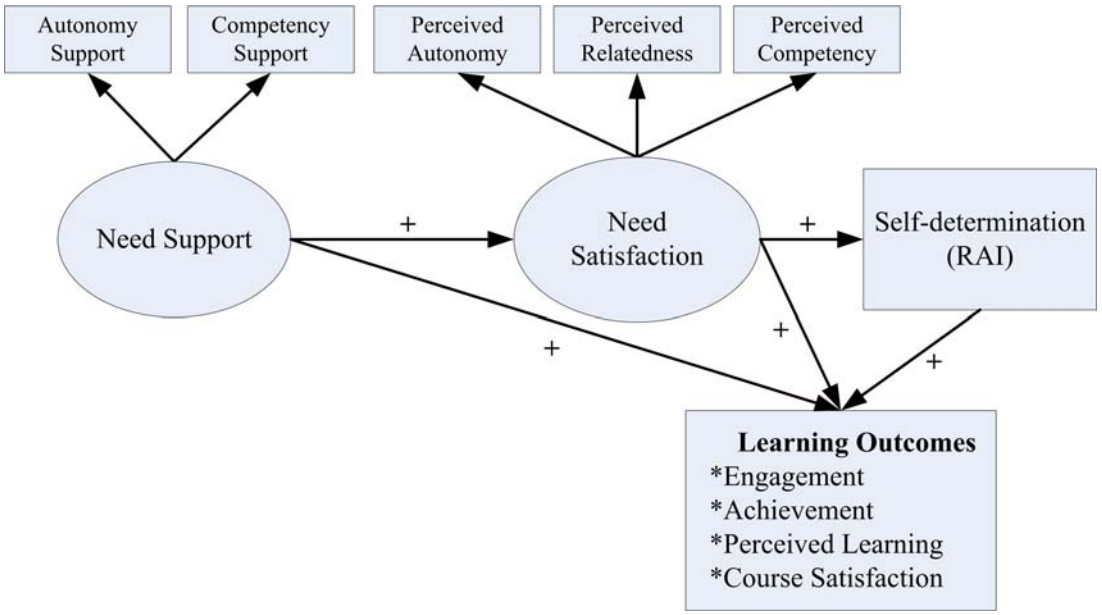

Figure 6. The SDT full model for online learners' motivation

learning outcome variable was evaluated at a time. Therefore, in this study, there were six parallel models: 1) *Hours per Week Studying*, 2) *Number of Hits*, 3) *Expected Grade*, 4) *Final Grade*, 5) *Perceived Learning*, and 6) *Course Satisfaction* models.

Structural equation modeling (SEM) was applied to evaluate the six parallel models. Structural equation modeling, which combines the features of factor analysis and path analysis, allows researchers to investigate the hierarchical and intercorrelated relationships of variables within a theoretical model (Watson & Gore, 2006). In addition to estimating the directions and strengths of variable relationships, another benefit of SEM is that it provides a variety of indexes to evaluate the overall *model fit* – the extent to which a theoretical model is consistent, or fits, with empirical data (Quintana & Maxwell, 1999). Structural equation modeling has been prevalently used across social science studies. Standage et al. (2005), for example, used SEM to

test self-determination theory in physical education, as has been discussed in the *Literature Review* chapter.

To perform SEM analyses, a partial correlation matrix was generated first to partial out the influence of demographic variables. Then, the partial correlation matrix consisting *need support*, *need satisfaction*, *motivation*, and *learning outcome* variables were coded into the AMOS 7.0 program to calculate the overall model fit. Because this study has a small-to-medium sample size, the following fit indices were used along with the maximum likelihood (ML) estimation method to generate fit values:

1. Standardized Root Mean Square Residual (SRMR);
2. Comparative Fit Index (CFI);
3. Goodness of Fit Index (GFI);
4. Adjusted Goodness of Fit Index (AGFI);
5. Non-Normed Fit Index (NNFI);
6. Root Mean Square Error of Approximation (RMSEA); and,
7. Incremental Fit Index (IFI).

Aside from the overall model fit data, the interrelationships between variables were evaluated by path coefficients and their test results. For example, according to the hypothesized SDT model, *need support* should have a positive path towards *need satisfaction*. By looking at the significance and directions of the path coefficient, the researcher was able to determine whether or not this path was substantiated by empirical data.

Research Question Three: What is the relative salience of autonomy, relatedness, and competency on online learners' motivation and learning outcomes? was accessed by simultaneous multiple regression analysis (using SPSS 15.0). In each analysis, a single type of motivation or learning outcome was regressed on the three predictors – *perceived autonomy*,

perceived competency, and *perceived relatedness*. The researcher was able to determine the relative salience of autonomy, relatedness and competency by comparing standardized regression coefficients in each analysis. A summary table of the regression analyses was generated, which helped the researcher to detect any trends or patterns that emerged from the regression results.

The Pilot Study

The pilot study was conducted in the fall of 2007 with three purposes: first, to create the "*SETWEB/SPECTRUM Competency Support Scale*;" second, to initially test the tenability of SDT in an online context; third, to detect potential problems and find ways for improvement.

Pilot Study Administration Procedures

After the approval from both the Institutional Review Board (IRB) and the SETWEB/SPECTRUM administrators, an email requesting participation went out to students via the program listserv. The email detailed the purposes of this study, explained the confidentiality policy, and provided a link to the Pilot Study online survey. Unfortunately, a week after the call for subjects, only eight people participated. Subsequently, a second email was sent to students as a reminder, but only yielded five more participants. Realizing the difficulty in increasing participation through the listserv, the researcher turned to the instructors for help. An email was sent to every instructor within WebCT to request his or her assistance in securing participants. Approximately two-thirds of the instructors responded to the email and sent requests to students. Within a week, the number of participants jumped from 13 to 66. Nevertheless, participation was still far from satisfactory.

Pilot Study Data Analysis

Based on the pilot study data, the researcher went ahead to validate the fifteen-item competency support questionnaire. For more detailed description of the questionnaire see the *Instrumentation* section of this chapter.

Regarding participants' motivational profile, participants scored highest on *identified regulation*, with the mean score of 5.78 on a 7-point scale. Participants scored lowest on *amotivation*, with the mean score of 1.46. These results showed that the majority of participants regard learning in the online programs as important for themselves. Participants reported similar scores on *intrinsic motivation*, *external regulation*, and *introjected regulation*. Paired sample t-tests showed that there were no significant differences between these mean scores. Table 7 presents participants' mean scores on the five types of motivation.

Table 7
Participants' Mean Scores on the Five Types of Motivation (Pilot Study)

Intrinsic Motivation	Identified Regulation	Introjected Regulation	External Regulation	Amotivation
4.56	5.78	4.39	4.13	1.46

Note: Participants' motivation are loaded on a 7-point scale, 1 = not at all true; 7 = very true.

As with the test of the SDT model, the sample size ($N = 66$) was too small to conduct a structural equation modeling analysis. According to Bentler and Chou (1987), the sample size should be at least five times the number of parameters when the data is normally distributed. Anderson and Gerbing (1988) argued that the minimum sample size should be between 100 and 150. Following Bentler and Chou's rationale, the sample size of this study should be at least 85 (5 x 17 parameters).

Correlation analyses provided some preliminary results despite the absence of a SEM analysis. *Need support* positively correlated to *need satisfaction* ($r = .61$, $p < .01$). *Need satisfaction* also positively correlated to *course satisfaction* ($r = .41$, $p < .05$), the learning outcome variable. *Identified regulation*, being the most significant motivation factor among participants, was found to positively correlate to *course satisfaction* ($r = .33$, $p < .01$). Conversely, *amotivation* correlated negatively to *course satisfaction* ($r = -.21$, $p = .11$), although the test result was non-significant. The above results supported self-determination theory.

However, the correlation analysis showed two issues that failed to support SDT. First, *need satisfaction* did not significantly correlate to any type of motivation. Second, except for *identified regulation*, the rest of the motivation types failed to correlate to course satisfaction. Regarding the first issue, after a closer look at the dataset, it was found that there were too many missing values. While the valid samples for *need support* and c*ourse satisfactio*n both reached 60, *need satisfaction* only had twenty-nine. Perhaps it was the missing values that skewed the test results. For the second issue, the results seem insufficient to determine the effects of motivation on learning outcomes. Due to practical concerns, only one outcome variable, *course satisfaction*, was collected in the pilot study. *Engagement*, *achievement*, and *perceived learning*, along with *course satisfaction*, were included in the formal study to evaluate the effect of the five types of motivation on different learning outcomes.

Ways for Improving this Study

The pilot study provided valuable information for the improvement of this study. Specifically, *increasing participation rates* and *reducing missing values* were identified as the most critical issues facing this study. Here these two issues are discussed in more detail.

Increasing participation rates. The most salient problem that occurred during the pilot study was the low participation rate. Although an email request had been sent to the listserv on two occasions, the participation rate was still far from satisfactory. Therefore, email was no longer used as the primary recruitment method in the formal study – it became *supplemental*, used only to remind students to take the online surveys.

In contrast to the limited effect of the listserv, course instructors were able to provide valuable help in gaining participants in the pilot study. Due to this fact, seeking administrator and instructors' help became the primary way in the formal study to insure a satisfactory participation rate. The online surveys had been embedded into the summer course design as an ungraded assignment after obtaining permission from the SETWEB program administrator. Additionally, an email request was sent to all instructors requesting their help to encourage participation. Furthermore, the researcher was able to mention this study in advance to potential participants in face-to-face situations. Potential participants were made aware of this study during SETWEB Orientations held in December 2007 and May 2008. The SETWEB administrator announced this study to new students and encouraged their participation.

Preventing missing values. Another problem within the pilot study concerned missing values: many participants still left certain questions unanswered. Upon investigation, the researcher found that the problem came in large part from the layout of the SurveyMonkey survey (a commercial website for surveys). The radio buttons were too small, and the spaces between buttons were too large. Worse, the line space between question items was also too small. Participants may have been confused when they answered the survey questions. Three procedures were used in the formal study to prevent/remedy the problem of missing values. First, the researcher redesigned the layout of the SurveyMonkey survey. The radio buttons and the fonts were enlarged, and the spacing between adjacent radio buttons was reduced. The line

spacing between any two items was increased to prevent any possible confusion. Figure 7 presents a snapshot of the improved layout design.

Secondly, a notification was placed at the end of the survey to remind participants to double check for missing answers. A third procedure involved imputing missing values using the SPSS Missing Value Analysis plug-in, of which the procedures will be detailed in the *Data Screening* section of the *Results* chapter.

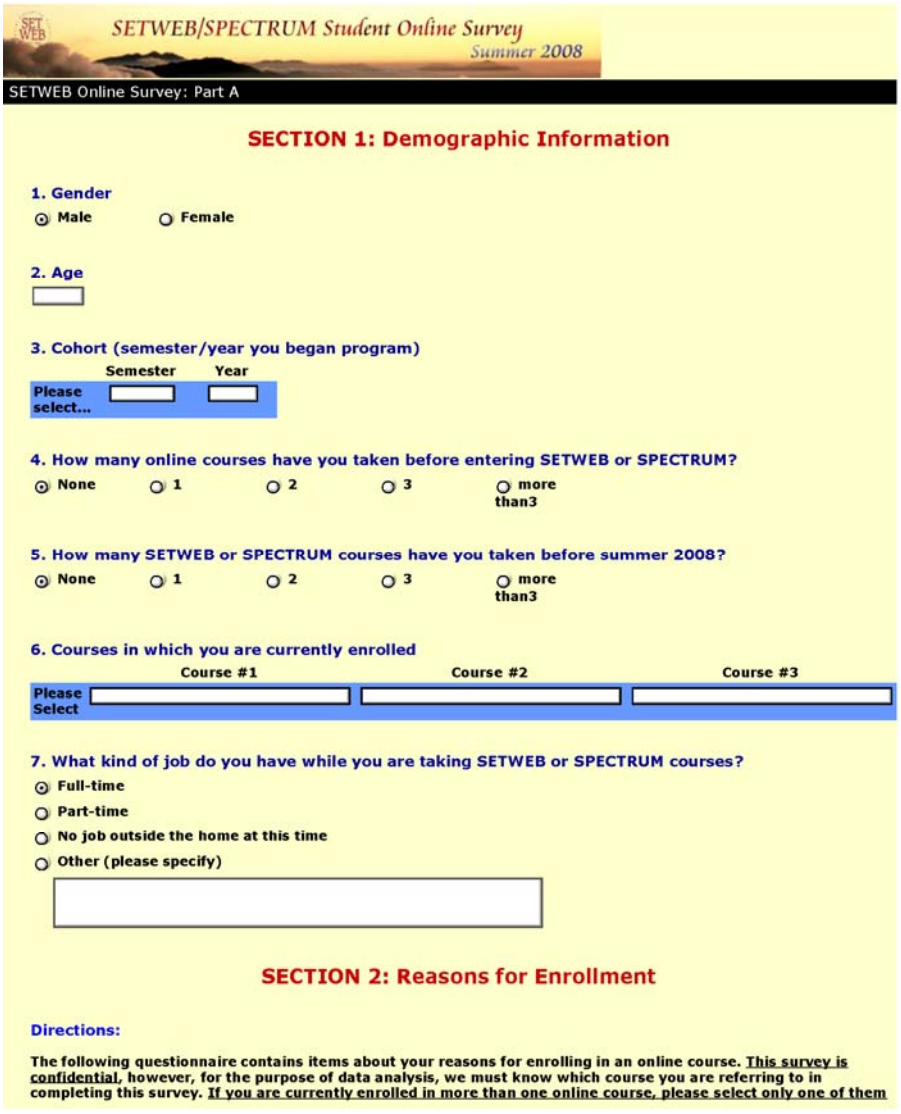

Figure 7. The improved survey layout

Timeline

Table 8 presents a timeline showing the logistics and phases of this study. The IRB application for the formal study was approved in May 12, 2008 by the Human Subject Office (see appendix B for the IRB cover page and Appendix C for the online consent form). The researcher conducted this study in the summer of 2008. Data collection – the pre-test and the post-test – lasted for one and a half months. Data analysis and the writing of the report proceeded from the beginning of August 2008 to the end of January, 2009.

Table 8

Timeline for this Study

Milestones	Timeline	Task
Preparation of study	5/1-5/30, 2008	1. Seek the administrators and instructors' support for recruiting participants. 2. Inform students the upcoming research during the SETWEB Orientation 3. Create the *SETWEB/SPECTRUM Competency Support Scale* 4. Re-design the layout of the SurveyMonkey online survey.
IRB approval	4/1-5/12, 2008	Submit IRB to the Human Subjects Office
Pre-test	6/5-6/14, 2008	Conduct the Part A online survey.
Post-test	7/14-7/23, 2008	Conduct the Part B online survey.
Course grades due	8/5/2008	Seek program secretary's help to match student grades
Data analysis/ write-up	8/6/2008 – 1/31/2009	1. Match participants' pre-test and post-test data for the analysis of motivational changes 2. Perform data analysis 3. Perform dissertation write-up.
Defend dissertation	3/25/2009	Defend dissertation

CHAPTER IV

RESULTS

This chapter begins with a description of the data screening processes, including examination of missing values, outliers, and normality. Next, descriptive statistics are presented. The final part of this chapter details findings pertaining to the research questions of this study:

1. What is the primary locus of motivation for students enrolled in an online course?
2. What is the degree to which the SDT framework can be substantiated in an online learning environment?
3. What is the relative salience of autonomy, relatedness, and competency on online learners' motivation and learning outcomes?

Data Screening

Before conducting formal analyses, datasets were checked and modified for missing values, outliers, and normality. Missing values were screened by the Missing Value Analysis plug-in of the SPSS program in addition to eye-examining the scatter plot of each variable. The screening process indicated that no systematic missing pattern was detected, and the maximum missing rate across all variables was 2.6%. The above value lies within the acceptance region suggested by Cohen and Cohen (1983) to keep the missing rate under 10% when the missing pattern is non-systematic. Considering that this study requires a sufficient number of participants to perform structural equation modeling, the researcher decided to impute missing values using the SPSS Missing Value Analysis plug-in. The *expectation maximization* (EM) algorithm was used

because it provides unbiased estimates when the data are missing at random (Schafer & Graham, 2002).

Outliers were screened by examining standardized scores of each variable. Because the sample size was larger than 200, this study applied the criteria that any case with a *z* score greater than |3.5| be deemed an outlier. Ten cases were identified as outliers for the pre-test, and five cases were identified as outliers for the post-test. A preliminary data analysis indicated that the results did not change significantly after deleting outliers; therefore, the outliers were removed from the dataset to avoid possible interference with the results.

Normality was screened by examining the skewness and the kurtosis of each variable. Results from a descriptive analysis showed that *amotivation* had both the highest skewness (2.48 for the pre-test and 2.86 for the post-test) and kurtosis (5.81 for the pre-test and 8.33 for the post-test), even after outliers were removed. Following Kline's (2005) suggestion to keep values less than |3.0| for skewness and |8.0| for kurtosis, the *amotivation* data (both the pre-test and the post-test) have been transformed using the log10 algorithm. The skewness and kurtosis statistics are presented in Table 9 in the following *Descriptive Analysis* section.

Descriptive Analysis

Table 9 presents mean, standard deviation, skewness, and kurtosis of measurement variables, as categorized by *motivation*, *need support*, *need satisfaction*, and *learning outcomes.* Except for *hours per week studying* (HR), *number of hits* (HIT), *expected grade* (EG), and *final grade* (FG), all measurement variables were made on a 7-point Likert scale anchored by 1 (not at all true) to 7 (very true) for consistency.

Concerning the *motivation* variables, pre-test and post-test data consistently indicated that participants scored highest on *identified regulation* ($M = 5.98$, $SD = 1.00$ for the pre-test; $M =$

5.74, *SD* = 1.12 for the post-test) and lowest on *amotivation* (*M* = 1.21, *SD* = .45 for the pre-test; *M* = 1.28, *SD* = .63 for the post-test). Further analysis of participants' motivation profiles will be presented later in the *Research Question 1* section.

Table 9

Descriptive Summary of Measurement Variables

Category	Variable	Point of Measurement	*N*	*M*	*SD*	Skewness	Kurtosis
Motivation	AM (before log transformation)	Pre-test	270	1.21	.45	2.48	5.81
		Post-test	262	1.28	.63	2.86	8.33
	AM (after log transformation)	Pre-test	270	.61	.12	2.00	2.94
		Post-test	262	.74	.15	2.11	3.65
	EXT	Pre-test	270	4.13	1.57	-.24	-.78
		Post-test	262	4.09	1.63	-.13	-.84
	INTRO	Pre-test	270	3.98	1.68	-.20	-1.03
		Post-test	262	3.81	1.72	-.09	-1.04
	IDEN	Pre-test	270	5.98	1.00	-1.13	.72
		Post-test	262	5.74	1.12	-1.04	.72
	IM	Pre-test	270	4.56	1.39	-.41	-.67
		Post-test	262	4.33	1.47	-.36	-.59
Need Support	AS	Post-test	262	5.18	1.47	-.88	.06
	CS	Post-test	262	5.19	1.14	-.55	-.26
Need Satisfaction	PA	Post-test	262	3.42	1.09	.32	.04
	PC	Post-test	262	5.13	1.01	-.57	.41
	RE	Post-test	262	4.43	1.25	.11	-0.65
Learning Outcomes	HR	Post-test	262	4.39	1.47	-.34	-1.18
	HIT	Post-test	154	785.42	431.34	1.36	1.92
	EG	Post-test	245	1.67	.47	-.74	-1.44
	FG	Post-test	151	92.58	5.16	-1.35	2.06
	LN	Post-test	262	5.31	1.05	-.58	.45
	SA	Post-test	262	5.49	1.17	-.68	-.23

Note: AM = amotivation; EXT = external regulation; INTRO = introjected regulation; IDEN = identified regulation; IM = intrinsic motivation; AS = autonomy support; CS = competency support; PA = perceived autonomy; PC = perceived competency; RE = perceived relatedness; HR = hours per week studying; HIT = number of hits; EG = expected grade; FG = final grade; LN = perceived learning; SA = course satisfaction

Regarding the *need support* category, the mean scores of *autonomy support* (M = 5.18, SD = 1.47) and *competency support* (M = 5.19, SD = 1.14) both exceeded 5.0 on a 7-point scale. More divergent results were found in the *needs satisfaction* category. Participants scored highest on *perceived competency* (M = 5.13, SD = 1.01), followed by *perceived relatedness* (M = 4.43, SD = 1.25). Participants scored lowest on *perceived autonomy*, with a mean score of 3.42 (SD = 1.09), which lied below the mid-point (4.0) of a 7-point scale.

Participants' *hours per week studying* (HR), an indicator of *engagement*, were coded into a 6-point scale (1 = less than two hours; 2 = three to four hours; 3 = five to six hours; 4 = seven to eight hours; 5 = nine to ten hours; 6 = more than 10 hours). The average score on the six point scale was 4.39 (SD = 1.47), and around 35% of the participants reported that they spent more than ten hours per week studying the target online course. Furthermore, on average, participants hit/accessed course content pages 785.42 times (SD = 431.34).

Two learning outcome variables, *perceived learning* (LN) and *course satisfaction* (SA) were scored on a 7-point scale. Both of the mean scores (M = 5.31, SD = 1.05 for *perceived learning*; M = 5.49, SD = 1.17 for *course satisfaction*) exceeded 5.0. *Expected grade* (EG), with the answer "B" coded as 1 and the answer "A" coded as 2 (all participants answered either A or B), yielded a mean score of 1.67 (SD = .47). *Final grade* (FG), which was scored on a 0-100 scale, yielded a mean score of 92.58 (SD = 5.16). Notably, the distribution of both *expected grade* and *final grade* were negatively skewed, which means that there were more participants who expected/received higher grades than those who expected/received lower grades. Despite this fact, the raw data for the two variables were left unchanged because neither the skewness nor kurtosis exceeded the threshold for log transformation (skewness > |3.0| and kurtosis |8.0|). The next section presents results pertaining to the three research questions of this study. An overview of the research findings (see Table 10) is placed before a detailed explanation of the results.

Table 10

Overview of Research Findings Pertaining to the Three Research Questions

Research Question	Related Theme/Postulate	Finding	Answer to Research Question
Question 1: What is the primary locus of motivation for students enrolled in an online course?	Online students' motivation profiles	Students scored highest on *identified regulation*, followed by *intrinsic motivation*. Students scored lowest on *amotivation*.	*Identified regulation* is the primary locus of online learners' motivation. However, it decreases over time.
	Changes in online students' motivation	*Identified regulation* and *intrinsic motivation to know* significantly decreased over time.	
	Demographics and students' motivation	During the pre-test, males were more *intrinsically motivated* than females; during the post-test, participants aging less than 30 years old were more *amotivated* than those in the 40-49 age group	
Question 2: What is the degree to which the SDT framework can be substantiated in an online learning environment?	Postulate 1. Intrinsic motivation (IM), extrinsic motivation (EM), and amotivation (AM) are distinct constructs which can be used to interpret important consequences.	1. Factor analysis indicated that the item grouping within each factor appeared exactly the same as the original AMS scale, which supported SDT's theorizing that the five types of motivation are distinct constructs. 2. *Amotivation*, *identified regulation*, and *intrinsic motivation* each significantly predicted three learning outcomes; *external regulation* only predicted one learning outcome. *Introjected regulation* failed to explain any type of learning outcome.	This study substantiated much of SDT's theorizing, including the distinctiveness of motivation types, the positive effect of contextual support on intrinsic motivation, and the five motivations generally conforming to the simplex pattern. However, this study also yielded several inconclusive or even contradicting results such as the positive effect of *external* and *introjected regulations* on learning outcomes.
	Postulate 2. Intrinsic motivation, extrinsic motivation, and amotivation lie on a continuum of self-determination	The correlations among the five types of motivation conformed to the simplex structure, except for the correlation between *intrinsic motivation* and *introjected regulation*.	
	Postulate 3. Contextual supports of autonomy, competency, and relatedness enhance intrinsic motivation and internalization, and vice versa	1. *Autonomy support* was associated with the increase of *intrinsic motivation* and the decrease of *amotivation*. *Competency support* was associated with the decrease of *amotivation*. This supports SDT. 2. No *significant* results were found for the effects of *autonomy and competency supports* on *internalization*, contradicting SDT.	

Table 10 (continued)

Overview of Research Findings Pertaining to the Three Research Questions

Research Question	Related Theme/Postulate	Finding	Answer to Research Question
Question 2: What is the degree to which the SDT framework can be substantiated in an online learning environment?	Postulate 4. Self-determined motivation (intrinsic motivation, and integrated and identified regulations) leads to positive outcomes while non-self-determined motivation (amotivation, external and introjected regulations) results in negative outcomes	1. *Identified regulation* and *intrinsic motivation* were both positively associated with *hours per week studying*, *perceived learning*, and *course satisfaction.* Furthermore, *amotivation* was negatively associated with *hours per week studying*, *expected grade*, *perceived learning*, and *course satisfaction*. This supports SDT. 2. However, *external and introjected regulations,* which are assumed by SDT to associate negatively with learning outcomes, were associated positively with *hours per week studying*, *expected grade*, *perceived learning*, and *course satisfaction*.	This study substantiated much of SDT's theorizing, including the distinctiveness of motivation types, the positive effect of contextual support on intrinsic motivation, and the five motivations generally conforming to the simplex pattern. However, this study also yielded several inconclusive or even contradicting results such as the positive effect of *external* and *introjected regulations* on learning outcomes.
	SDT full-model test	1. Four models: 1) *Hours per Week Studying*, 2) *Number of Hits*, 3) *Final Grade,* and 4) *Course Satisfaction* yielded proper fit. 2. The path "need support → need satisfaction → self-determination" was significant for all fitted models, supporting SDT. 3. The path from self-determination (a composite motivation score) to learning outcome was insignificant across all fitted models, contradicting the results from which the five types of motivation were individually assessed.	
Question 3: What is the relative salience of autonomy, relatedness, and competency on online learners' motivation and learning outcomes?	Motivation	*Perceived autonomy* was the most salient predictor for *intrinsic motivation* and *extrinsic*, *introjected* and *identified regulations*. *Perceived competency* was most salient for *amotivation*.	Overall, *perceived autonomy* is a more salient predictor for online learners' motivation. However, the relative salience of *autonomy*, *relatedness*, and *competency* varies by categories of learning outcomes.
	Learning outcomes	*Perceived autonomy* was the most salient predictor for *student engagement*, while *perceived competency* was most salient for *perceived learning* and *student achievement*. *Perceived relatedness* was the most salient predictor for course satisfaction.	

Research Question 1: What is the Primary Locus of Motivation for Students Enrolled in an Online Course?

Online Students' Motivation Profiles

A descriptive analysis (N = 270, 60 male, 209 female, 1 gender not specified) on the *pre-test* responses showed that at the outset of a particular online course, participants scored highest on *identified regulation* (M = 5.98, SD = 1.00) and lowest on *amotivation* (M = 1.21, SD = .45). Follow-up paired sample t-tests were applied to detect mean differences between the five motivation types. Results indicated that, except for the comparison between *introjected* and *external regulations* (t = 1.55, n.s.), all of the motivation mean scores were significantly different from each other. Judging from the motivation mean scores and the t-test results, participants' pre-test motivation, from highest to lowest are:

1. Identified regulation
2. Intrinsic motivation
3. Introjected regulation and external regulation
4. Amotivation

A very similar motivation profile was found from participants' post-test data (N = 262, 57 male, 203 female, 2 gender not specified). Participants scored highest on *identified regulation* (M = 5.74, SD = 1.12) and lowest on *amotivation* (M = 1.28, SD = .63). Paired-sample t-tests indicated that all of the motivation mean scores were significantly different from each other. Therefore, students' motivation scores, from highest to lowest, are:

1. Identified regulation
2. Intrinsic motivation
3. External regulation

4. Introjected regulation

5. Amotivation

Results from the pre-test, the post-test, as well as the pilot study (discussed earlier in the *Methodology* chapter) all indicated that *identified regulation* was the primary locus of motivation for online learners. Table 11 illustrates the motivation profiles of participants; Table 12 presents the t-test results.

Changes in Online Students' Motivation

Paired-sample t-tests ($N = 201$) were performed to detect participants' motivational changes as an expansion of the data analysis for *Research Question 1*. Results showed that *identified regulation* significantly decreased over time ($t = -2.56$, $p < .05$), while *amotivation*, *external regulation*, *introjected regulation*, and *intrinsic motivation* remained statistically unchanged (see Table 13). Considering that the original *Academic Motivation Scale* suggests three types of intrinsic motivation (*intrinsic motivation to know*, *to accomplish*, and *to experience stimulation*), the researcher decided to individually test the motivational changes of the three types of intrinsic motivation. *Intrinsic motivation to know*, which is more relevant to learning contexts, was also found to decrease significantly ($t = -2.49$, $p < .05$).

Demographics and Online Students' Motivation

Five demographic variables, *gender*, *age*, *employment status*, and *prior online learning experience* (including the number of online courses taken *before* and *after* entering the SETWEB/SPECTRUM), were tested with one-way analysis of variance (ANOVA) to detect any group difference on motivation. The connections between *gender* and *intrinsic motivation* in the pre-test, $F(1, 267) = 4.29$, $p < .05$, and *age* and *amotivation* in the post-test, $F(4, 254) = 3.34$, $p < .05$ yielded significant results (see Table 14). Post hoc comparisons indicated that during the

Table 11

Participants' Mean Scores on the Five Types of Motivation (Formal Study)

		Amotivation	External Regulation	Introjected Regulation	Identified Regulation	Intrinsic Motivation
Pre-test	Mean	1.21	4.13	3.98	5.98	4.56
(*n* = 270)	SD	.45	1.57	1.68	1.00	1.39
Post-test	Mean	1.28	4.09	3.81	5.74	4.33
(*n* = 262)	SD	.63	1.63	1.72	1.12	1.47

Table 12

Paired Sample T-tests on the Mean Scores of the Five Types of Motivation

Paired Variable	Point of Measurement	Mean difference	*df*	*t*	*p*
1. AM – EXT	Pre-test	-2.93	269	-30.13***	.000
	Post-test	-2.82	261	-26.94***	.000
2. AM – INTRO	Pre-test	-2.77	269	-26.32***	.000
	Post-test	-2.54	261	-21.89***	.000
3. AM – IDEN	Pre-test	-4.77	269	-68.89***	.000
	Post-test	-4.47	261	-52.60***	.000
4. AM – IM	Pre-test	-3.35	269	-37.05***	.000
	Post-test	-3.06	261	-29.02***	.000
5. EXT – INTRO	Pre-test	.15	269	1.55	.123
	Post-test	.28	261	2.93**	.004
6. EXT – IDEN	Pre-test	-1.84	269	-20.70***	.000
	Post-test	-1.65	261	-18.26***	.000
7. EXT – IM	Pre-test	-.43	269	-4.35***	.000
	Post-test	-.24	261	-2.45*	.015
8. INTRO – IDEN	Pre-test	-2.00	269	-22.47***	.000
	Post-test	-1.93	261	-20.89***	.000
9. INTRO – IM	Pre-test	-.58	269	-9.08***	.000
	Post-test	-.52	261	-6.96***	.000
10. IDEN – IM	Pre-test	1.42	269	19.08***	.000
	Post-test	1.41	261	19.31***	.000

Note: 1. * Coefficient is significant at the 0.05 level (2-tailed);
** Coefficient is significant at the 0.01 level (2-tailed)
*** Coefficient is significant at the 0.001 level (2-tailed)
2. AM = amotivation; EXT = external regulation; INTRO = introjected regulation; IDEN = identified regulation; IM = intrinsic motivation

Table 13

Paired Sample T-tests on Participants' Motivational Changes

Variable	Pre-test Motivation (n = 200)		Post-test Motivation (n = 200)		Motivational Change			
	M1	*SD*	*M2*	*SD*	*M2-M1*	*t*	*p*	*df*
Amotivation	1.18	.41	1.21	.51	.03	.88	.380	200
External Regulation	3.97	1.53	4.08	1.58	.11	1.35	.178	200
Introjected Regulation	3.84	1.65	3.85	1.72	.02	.22	.823	200
Identified Regulation	5.95	1.02	5.79	1.06	-.16	-2.56*	.011	200
IM-To Know	5.03	1.35	4.84	1.39	-.19	-2.49*	.014	200
IM-To Accomplish	4.42	1.49	4.37	1.60	-.05	-.65	.515	200
IM-Stimulation	3.95	1.41	3.91	1.50	-.04	-.58	.564	200
IM-Total Score	4.47	1.32	4.37	1.42	-.10	-1.45	.149	200

Note: * Coefficient is significant at the 0.05 level (2-tailed)

pre-test, males (M = 4.88) were more *intrinsically motivated* than females (M = 4.46). Additionally, during the post-test, participants aging less than 30 years old (M = 1.47) were more *amotivated* than those in the 40-49 age group (M = 1.14).

In summary, this study found that *identified regulation* was the primary locus of online learners' motivation. Follow-up analyses revealed that online learners' *identified motivation* and *intrinsic motivation to know* decreased over time. Except for gender in the pre-test and age in the post-test, demographic variables in general do not have significant impacts on online learners' motivation.

Research Question 2: What is the Degree to Which the SDT Framework can be Substantiated in an Online Learning Environment?

Answers to this research question are organized around the four postulates of SDT, as have been discussed in the *Literature Review* chapter. Results of SDT full-model tests are also presented in this section to illustrate the interrelationships among *need support*, *need satisfaction*, *motivation*, and *learning outcomes*, as well as the extent to which the SDT models (six parallel

Table 14

One-way Analyses of the Five Types of Motivation with Demographic Variables

		Amotivation		External Motivation		Introjected Regulation		Identified Regulation		Intrinsic Motivation	
		F	*p*	*F*	*p*	*F*	*p*	*F*	*p*	*F*	*p*
Gender	Pre-test (*df* = 1, 267)	.12	.72	.94	.33	1.24	.27	1.47	.23	4.29*	.04
	Post-test (*df* = 1, 258)	.09	.77	.35	.55	.08	.78	1.46	.23	.00	.98
Age	Pre-test (*df* = 4, 264)	1.25	.29	.50	.74	1.64	.16	2.37	.05	1.63	.17
	Post-test (*df* = 4, 254)	3.34*	.01	1.68	.15	.37	.83	1.48	.21	.60	.66
Job	Pre-test (*df* = 3, 266)	2.09	.10	1.15	.33	1.48	.22	1.61	.19	1.61	.19
	Post-test (*df* = 3, 258)	1.74	.16	.57	.64	.26	.86	1.71	.17	.64	.59
Course Before	Pre-test (*df* = 2, 267)	.07	.93	.78	.46	.32	.72	.64	.53	.46	.63
	Post-test (*df* = 2, 259)	.25	.78	.63	.54	.84	.43	.14	.87	1.79	.17
Course After	Pre-test (*df* = 2, 264)	1.80	.17	.93	.40	.38	.68	.43	.65	.05	.95
	Post-test (*df* = 2, 259)	2.13	.12	.54	.58	1.71	.18	.77	.46	1.02	.36

Note: 1. * Coefficient is significant at the 0.05 level (2-tailed)

2. Course Before = Number of online courses taken *before* entering SETWEB/ SPECTRUM;
Course After = Number of online courses taken *after* entering SETWEB/ SPECTRUM

models each contains a single outcome variable) can be substantiated in an online learning environment.

Postulate 1. Intrinsic Motivation (IM), Extrinsic Motivation (EM, Including External, Introjected, Identified, and Integrated Regulations), and Amotivation (AM) are Distinct Constructs Which Can be Used to Interpret Important Consequences

An exploratory factor analysis using the principal component method with varimax rotation was conducted to test the factor structure of the twenty-eight-item *Academic Motivation Scale*. Five factors (eigenvalue >1) appeared as a result. As shown in Table 15, the item grouping of the five factors appeared exactly the same as the original AMS scale. Moreover, the factor loadings for all twenty-eight items exceeded .40. This result provided support for *Postulate 1* that intrinsic *motivation* (IM), *extrinsic motivation* (EM, including *external*, *introjected*, and *identified regulations*), and *amotivation* (AM) are distinct constructs.

Stepwise regression analysis was used to further test whether the five distinct types of motivation can interpret a variety of learning outcomes. The five motivation variables (*amotivation*, *extrinsic regulation*, *introjected regulation*, *identified regulation*, and *intrinsic motivation*) were regressed on the six outcome variables, including 1) *hours per week studying*, 2) *number of hits*, 3) *expected grade*, 4) *final grad*, 5) *perceived learning*, and 6) *course satisfaction*.

Amotivation, *identified regulation*, and *intrinsic motivation* each significantly predicted three learning outcomes as shown in Table 16. *Intrinsic motivation*, for instance, significantly predicted 1) *hours per week studying*, 2) *expected grade*, and 3) *perceived learning*. *External regulation* only predicted one learning outcome: *number of hits.* Unexpectedly, *introjected regulation* failed to explain any type of learning outcome. Another unexpected result was that none of the five types of motivations significantly predicted *final grade*. Cumulatively, this

study supports SDT's postulate that *intrinsic motivation (IM), extrinsic motivation (EM), and amotivation* (AM) can be used to interpret important (learning) consequences.

Table 15

Factor Loadings of the Academic Motivation Scale Items

Item	Varimax Rotated Factor Loadings				
	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5
IM 4	.83	.15	.20	.00	.13
IM 3	.82	.31	-.04	.03	.00
IM 2	.78	.11	.25	-.13	.15
IM 6	.78	.30	.16	-.15	.22
IM 5	.77	.09	.19	-.28	.25
IM 1	.76	-.04	.25	-.17	.20
IM 11	.75	.27	.22	-.12	.12
IM 7	.73	.24	.12	.02	.32
IM 12	.72	.28	.20	-.13	.32
IM 8	.72	.26	.16	.00	.10
IM 9	.68	.36	.16	-.28	.25
IM 10	.67	.26	-.03	.13	.41
INTRO 3	.35	.78	.22	.02	.18
INTRO 2	.38	.71	.25	.16	.5
INTRO 1	.46	.67	.12	-.09	.12
INTRO 4	.46	.60	.28	-.22	.26
EXT 4	.05	.34	.73	.07	.20
EXT 1	.18	-.05	.71	-.05	.02
EXT 2	.29	.26	.69	.06	.16
EXT 3	.26	.38	.68	.07	13
AM 4	-.08	-.01	.04	.86	.02
AM 3	-.06	.09	-.16	.86	-.16
AM 2	.00	-.08	.04	.75	-.17
AM 1	-.19	.00	.10	.68	-.04
IDEN 4	.35	.18	.00	-.12	.77
IDEN 1	.33	.05	.13	-.16	.67
IDEN 3	.17	.24	.34	-.15	.63
IDEN 2	.24	-.02	.49	-.10	.56

Note: IM = intrinsic motivation; INTRO = introjected regulation; EXT = external regulation; AM = amotivation; IDEN = identified regulation

Table 16
Summary of Regression Analyses that Tested the Effects of the Five Types of Motivation on Learning Outcomes

Category	Outcome Variable	Significant Predictors (ordered by level of significance)
Engagement	Hours per week studying (HR)	IM
	Number of hits (HIT)	IDEN, EXT
Achievement	Expected grade (EG)	IM, AM
	Final grade (FG)	None
Learning	Perceived learning (LN)	IM, AM, IDEN
Satisfaction	Course satisfaction (SA)	AM, IDEN

Note: AM = amotivation; EXT = external regulation; INTRO = introjected regulation; IDEN = identified regulation; IM = intrinsic motivation.

Postulate 2. Intrinsic Motivation, Extrinsic Motivation, and Amotivation Lie on a Continuum of Self-determination

Past studies (e.g., Ryan & Connell, 1989; Vallerand & Bissonnette, 1992) tested this postulate by examining whether the six types of motivation conform to a simplex or ordered correlation structure (Guttman, 1954). This study generally supports the self-determination continuum. Except for the correlation between *intrinsic motivation* and *introjected regulation* (r = .72), which was higher than the correlation between *intrinsic motivation* and *identified regulation* (r = .61), the remaining correlations conformed to the simplex structure (see Table 17).

Table 17
Correlation Matrix among the Five Types of Motivation

Variable	1	2	3	4	5
1. AM	—				
2. EXT	.09	—			
3. INTRO	-.07	.57	—		
4. IDEN	-.18	.49	.51	—	
5. IM	-.19	.48	.72	.61	—

Note: AM = amotivation; EXT = external regulation; INTRO = introjected regulation; IDEN = identified regulation; IM = intrinsic motivation

Postulate 3. Contextual Supports of Autonomy, Competency, and Relatedness Enhance Intrinsic Motivation and Internalization, and Vice Versa

To test this postulate, one-way ANOVA was used to examine if different levels of autonomy and competency supports affect participants' motivation and internalization to varying degrees. Participants were divided into three groups according to their percentile ranks (*Low*: below 33.3; *Medium*: between 33.3 and 66.6; *High*: above 66.6) on the *autonomy support* and *competency support* scores. Dependent variables included the *changes* of the five types of motivations, as well as the *Index of Internalization*. The *Index of Internalization* was represented by the *change* of the *Relative Autonomy Index* (RAI, Grolnick & Ryan, 1987), which was calculated based on the following formula to represent the degree of self-determination:

(EXT * (-2) + INTRO * (-1) + IDEN * 1 + IM * 2)

Therefore, the *Index of Internalization* (RAI change) can be denoted as:

(Pre-test RAI – Post-test RAI)

Table 18 presents a summary of ANOVA results. Significant differences were found in levels of *autonomy support* on the changes of *amotivation*, F (2, 197) = 5.90, $p < .01$, and *intrinsic motivation*, F (2, 197) = 5.90, $p < .01$. Moreover, significant differences were found in levels of *competency support* on the change of *amotivation*, F (2, 197) = 4.43, $p < .05$. No significant results were found for *internalization* (RAI change), as well as the changes of *external*, *introjected*, and *identified regulations*.

Follow-up post hoc comparisons (see Table 19) indicated that for the *autonomy support* (AS) factor, the high AS perception group was significantly different from the medium perception group ($p < .05$) in terms of the change of *intrinsic motivation*. More specifically, the mean score for the high AS perception group was positive (increase of *intrinsic motivation*), whereas the mean score for the medium AS perception group was negative (decrease of *intrinsic*

motivation). Another finding was that the low AS perception group had a greater increase of *amotivation* than the medium ($p < .05$) and high AS perception groups ($p < .01$). The mean scores for the low and medium AS perception groups were positive (increase of *amotivation*), whereas the mean score for the high AS perception group was negative (decrease of *amotivation*). Regarding the *competency support* factor, it was found that the low CS perception group had a greater increase of *amotivation* than the medium ($p < .05$) and high CS perception groups ($p < .01$). More specifically, the mean score for the low CS perception group was positive (increase of *amotivation*), whereas the mean scores for the medium and high CS perception groups were negative (decrease of *amotivation*). No significant results were found for the effect of *competency support* on *internalization*, nor were there changes in *intrinsic motivation* and *external*, *introjected*, and *identified regulations*. Cumulatively, the above empirical evidence partially supported SDT, because autonomy and competency supports increased *intrinsic motivation*, decreased *amotivation*, but did not affect *internalization*.

Postulate 4. Self-determined Motivation (Intrinsic Motivation, Integrated and Identified Regulations) Leads to Positive Outcomes While Non-self-determined Motivation (Amotivation, External and Introjected Regulations) Results in Negative Outcomes

Correlation and one-way ANOVA results partially supported this postulate. The bivariate correlations matrix for motivation and outcome variables is presented in Table 20. *Amotivation* was negatively associated with *hours per week studying* ($r = -.16$, $p < .05$), *expected grade* ($r = -.17$, $p < .01$), *perceived learning* ($r = -.42$, $p < .01$), and *course satisfaction* ($r = -.43$, $p < .01$), all of which supported SDT's postulate 4. Additionally, *identified regulation* and *intrinsic motivation* were both positively associated with *hours per week studying* ($r = .21$ & $.28$, respectively, both $p < .01$), *perceived learning* ($r = .43$ & $.47$, respectively, both $p < .01$), and

Table 18

One-way Analyses of the Motivational Changes with Autonomy and Competency Supports

	Change in Amotivation (df = 2, 197)		Change in External Regulation (df = 2, 197)		Change in Introjected Regulation (df = 2, 197)		Change in Identified Regulation (df = 2, 197)		Change in Intrinsic Motivation (df = 2, 197)		Internalization (RAI change) (df = 2, 197)	
	F	*p*	*F*	*p*	*F*	*p*	*F*	*p*	*F*	*p*	*F*	*p*
AS	5.90**	.003	1.63	.199	2.06	.130	2.69	.071	3.14*	.045	.375	.688
CS	4.43*	.013	2.96	.744	.01	.995	1.78	.171	1.11	.331	.560	.572

Note: * Coefficient is significant at the 0.05 level (2-tailed)

** Coefficient is significant at the 0.01 level (2-tailed)

*** Coefficient is significant at the 0.001 level (2-tailed)

Table 19

Post Hoc Analyses after One-Way Analyses of Motivational Changes with Autonomy and Competency Supports

		Amotivation			External Regulation			Introjected Regulation			Identified Regulation			Intrinsic Motivation			Internalization (RAI change)		
Variable	Group	n	*M*	*SD*	n	*M*	*SD*	n	*M*	*SD*	n	*M*	*SD*	n	*M*	*SD*	n	*M*	*SD*
AS	(1) Low	68	.76	2.83	68	-.37	4.98	68	.03	5.71	68	-1.19	3.21	68	-2.25	11.53	68	-.50	2.48
	(2) Medium	63	.05	1.28	63	.56	3.83	63	-.84	4.39	63	-.93	3.76	63	-3.04	12.08	63	-.81	2.28
	(3) High	69	-.42	1.60	69	1.06	5.04	69	.89	4.49	69	.10	3.38	69	1.49	9.95	69	-.48	2.49
	Post Hoc (LSD)		1>2* 1>3**			N/A			N/A			N/A			3>2*			N/A	
CS	(1) Low	70	.70	2.77	70	.15	5.06	70	.08	5.89	70	-1.30	3.49	70	-2.48	11.93	70	-.83	2.48
	(2) Medium	61	-.03	1.04	61	.34	4.58	61	.00	4.03	61	-.31	3.70	61	-1.50	10.19	61	-.50	2.27
	(3) High	69	-.30	1.84	69	.75	4.43	69	.08	4.66	69	-.34	3.23	69	.35	11.59	69	-.42	2.49
	Post Hoc (LSD)		1>2* 1>3**			N/A			N/A			N/A			N/A			N/A	

Note: 1. * Coefficient is significant at the 0.05 level (2-tailed)

** Coefficient is significant at the 0.01 level (2-tailed)

*** Coefficient is significant at the 0.001 level (2-tailed)

2. AS = autonomy support; CS = competency support

Table 20

Bivariate Correlations among Motivation and Outcome Variables

Variable	1	2	3	4	5	6	7	8	9	10	11
1. AM	—										
2. EXT	.09	—									
3. INTRO	-.07	.57**	—								
4. IDEN	-.18**	.49**	.51**	—							
5. IM	-.19**	.48**	.72**	.61**	—						
6. HR	-.16*	.07	.21**	.21**	.28**	—					
7. HIT	-.09	-.10	.10	.17*	.09	.34**	—				
8. EG	-.17**	.06	.13*	.12	.17**	.21**	.14	—			
9. FG	.02	-.07	-.15	-.12	-.16	.10	.20*	.29**	—		
10. LN	-.42**	.21**	.31**	.43**	.47**	.24**	.03	.13*	-.23**	—	
11. SA	-.43**	.16*	.20**	.35**	.31**	.11	.11	.05	-.11	.61**	—

Note: 1. * Coefficient is significant at the 0.05 level (2-tailed)
** Coefficient is significant at the 0.01 level (2-tailed)
2. AM = amotivation; EXT = external regulation; INTRO = introjected regulation; IDEN = identified regulation; IM = intrinsic motivation; HR = hours per week studying; HIT = number of hits; EG = expected grade; FG = final grade; LN = perceived learning; SA = course satisfaction

course satisfaction (r = .35 & .31, respectively, both $p < .01$), providing further support for SDT's *Postulate 4*. However, counter-evidence was also found in the correlation analysis. *External* and *introjected regulations*, which are assumed by SDT to associate negatively with learning outcomes, both correlated positively with *perceived learning* (r = .21 & .31, respectively, both $p < .01$) and *course satisfaction* (r = .16 & .20, respectively, both $p < .01$). Another counter-evidence was that *introjected regulation* was positively correlated with *hours per week studying* (r = .21, $p < .01$) and *expected grade* (r = -.17, $p < .01$), contradicting SDT's theorizing.

One-way ANOVA was applied to further examine if different levels of motivation affected participants' learning outcomes to varying degrees. Dependent variables included *hours per week studying*, *number of hits*, *expected grade*, *final grade*, *perceived learning*, and *course*

satisfaction. Participants were divided into three groups according to their percentile ranks (*Low*: below 33.3; *Medium*: between 33.3 and 66.6; *High*: above 66.6) on *intrinsic motivation* and *external, introjected, and identified regulation* scores. Due to its high kurtosis and positive skewness even after log transformation, *amotivation* was categorized into only two (high and low, divided by the median) groups. Consistent with the correlation analysis results, any pair of variables that showed significant correlations had significant main effects in ANOVA, and vise versa (see Table 21). Post hoc comparisons, as shown in Table 22, indicated that the *low amotivation* group significantly scored higher than the *high amotivation* group in terms of *hours per week studying* ($p < .05$), *perceived learning* ($p < .001$), and *course satisfaction* ($p < .001$), supporting SDT. Post hoc comparisons also revealed a pattern that, for *intrinsic motivation* and *external*, *introjected*, and *identified regulations*, a higher motivation group yielded higher mean scores of learning outcomes than a lower motivation group. Therefore, consistent with the correlation analysis findings, ANOVA results of *amotivation*, *identified regulation*, and *intrinsic motivation* supported SDT, yet the results of *external* and *introjected regulations* were at odds with SDT.

SDT Full Models

This study tested the "full model" of SDT as shown earlier in Figure 6. A partial correlation matrix controlling for all demographic variables (see Table 23) was coded into the AMOS 7.0 program for *structural equation modeling* (SEM) analyses. The *maximum likelihood* (ML) estimation method was used, and one learning outcome at a time was accessed in each model. A summary of model fit indices is presented in Table 24. Detailed SEM results are presented below, as organized by the six parallel SDT models: 1) *Hours per Week Studying*,

Table 21

One-way Analyses of Learning Outcomes with the Five Types of Motivation

	Hours per Week Studying (df = 2, 242)		Number of Hits (df = 2, 151)		Expected Grade (df = 2, 242)		Final Grade (df = 2, 148)		Perceived Learning (df = 2, 259)		Course Satisfaction (df = 2, 259)	
	F	*p*	*F*	*p*	*F*	*p*	*F*	*p*	*F*	*p*	*F*	*p*
AM	3.91*	.049	2.23	.137	2.28	.132	.95	.331	28.20***	.000	35.77***	.000
EXT	.08	.922	1.80	.168	.19	.826	2.18	.117	4.42*	.013	4.13*	.017
INTRO	6.22**	.002	1.04	.357	1.53	.220	5.86**	.004	9.16***	.000	3.88*	.022
IDEN	5.09**	.007	4.58*	.012	1.51	.223	2.84	.062	22.75***	.000	12.14***	.000
IM	10.67**	.000	.75	.476	5.03**	.007	3.01	.052	40.56***	.000	18.79***	.000

Note: 1. * Coefficient is significant at the 0.05 level (2-tailed)

** Coefficient is significant at the 0.01 level (2-tailed)

*** Coefficient is significant at the 0.001 level (2-tailed)

2. AM = amotivation; EXT = external regulation; INTRO = introjected regulation; IDEN = identified regulation; IM = intrinsic motivation.

Table 22

Post Hoc Analyses after One-way Analyses of Learning Outcomes with the Five Types of Motivation

		Hours per week Studying			Number of Hits			Expected Grade			Final Grade			Perceived Learning			Course Satisfaction		
Variable	Group	n	*M*	*SD*	n	*M*	*SD*	n	*M*	*SD*	n	*M*	*SD*	n	*M*	*SD*	n	*M*	*SD*
AM	(1) Low	176	4.51	1.43	113	816.59	455.80	176	1.70	0.46	112	92.34	5.53	189	33.07	5.56	189	57.41	10.31
	(2) High	69	4.09	1.59	41	699.51	345.91	69	1.60	0.49	39	93.28	3.88	73	28.67	7.03	73	48.37	12.51
	Post Hoc (LSD)		1>2*			N/A			N/A			N/A			1>2***			1>2***	
EXT	(1) Low	72	4.38	1.45	50	877.40	510.44	72	1.65	0.48	49	92.37	5.87	82	30.60	6.37	82	53.30	12.37
	(2) Medium	86	4.35	1.54	53	759.94	381.89	86	1.67	0.47	53	93.69	4.39	86	31.43	6.64	86	53.41	11.66
	(3) High	87	4.44	1.48	51	721.73	386.04	87	1.69	0.46	49	91.60	5.06	94	33.31	5.70	94	57.62	10.63
	Post Hoc (LSD)		N/A			N/A			N/A			N/A			3>1** 3>2*			3>1* 3>2*	
INTRO	(1) Low	75	4.18	1.41	53	716.51	382.01	75	1.60	0.48	50	92.58	3.58	84	30.07	7.12	84	52.08	13.08
	(2) Medium	83	4.12	1.53	45	816.27	478.10	83	1.67	0.47	45	94.49	4.58	88	31.38	5.77	88	55.60	11.18
	(3) High	87	4.83	1.43	56	825.86	435.57	87	1.73	0.44	56	91.06	6.25	90	33.96	5.42	90	56.80	10.31
	Post Hoc (LSD)		3>1** 3>2**			N/A			N/A			2>3**			3>1*** 3>2**			2>1* 3>1**	

Table 22 (continued)

Post Hoc Analyses after One-way Analyses of Learning Outcomes with the Five Types of Motivation

		Hours per week Studying			Number of Hits			Expected Grade			Final Grade			Perceived Learning			Course Satisfaction		
Variable	Group	*n*	*M*	*SD*	*n*	*M*	*SD*	n	*M*	*SD*	n	*M*	*SD*	n	*M*	*SD*	n	*M*	*SD*
IDEN	(1) Low	75	4.11	1.39	45	734.78	386.35	75	1.60	0.48	41	92.50	5.00	79	28.89	6.49	79	50.45	12.13
	(2) Medium	91	4.25	1.56	56	693.52	325.63	91	1.68	0.47	56	93.75	3.34	96	31.45	5.80	96	54.79	11.15
	(3) High	79	4.82	1.41	53	925.53	526.93	79	1.73	0.44	54	91.44	6.49	87	34.96	5.23	87	59.03	10.36
	Post Hoc (LSD)		3>1** 3>2*			3>1* 3>2**			N/A			N/A			3>1*** 3>2*** 2>1**			3>1*** 3>2* 2>1*	
IM	(1) Low	78	3.97	1.47	52	729.44	403.84	78	1.62	0.48	51	92.65	4.88	85	28.48	6.60	85	50.56	12.51
	(2) Medium	85	4.22	1.46	52	796.42	426.50	85	1.59	0.49	50	93.80	4.73	88	31.01	5.46	88	53.45	11.23
	(3) High	82	4.97	1.36	50	832.20	464.96	82	1.80	0.40	50	91.30	5.63	89	35.88	4.34	89	60.43	8.88
	Post Hoc (LSD)		3>1*** 3>2***			N/A			3>1* 3>2**			N/A			3>1*** 3>2*** 2>1**			3>1*** 3>2***	

Note: 1. * Coefficient is significant at the 0.05 level (2-tailed)

** Coefficient is significant at the 0.01 level (2-tailed)

*** Coefficient is significant at the 0.001 level (2-tailed)

2. AM = amotivation; EXT = external regulation; INTRO = introjected regulation; IDEN = identified regulation; IM = intrinsic motivation; HR = hours per week studying; HIT = number of hits; EG = expected grade; FG = final grade; LN = perceived learning; SA = course satisfaction

Table 23

The Partial Correlation (Controlling for Demographic Variables) Matrix for Structural Equation Modeling Analyses

Variable	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1. AM	—															
2. EXT	.07	—														
3. INTRO	-.09	.57**	—													
4. IDEN	-.21**	.49**	.52**	—												
5. IM	-.22**	.49**	.73**	.62**	—											
6. AS	-.40**	.14*	.22**	.34**	.32**	—										
7. CS	-.31**	.22**	.25**	.37**	.33**	.79**	—									
8. PA	-.29**	.29**	.48**	.43**	.53**	.42**	.37**	—								
9. PC	-.37**	.14*	.28**	.28**	.33**	.34**	.34**	.33**	—							
10. RE	-.32**	.19**	.30**	.36**	.40**	.63**	.66**	.44**	.36**	—						
11. HR	-.15*	.12	.24**	.22**	.27**	.07	.09	.11	.13	.15*	—					
12. HIT	-.10	-.09	.09	.17*	.06	.09	.02	.25**	.12	.23**	.24**	—				
13. EG	-.15*	.07	.13*	.12	.17**	.02	.03	.11	.43**	.07	.22**	.17	—			
14. FG	.06	-.06	-.14	-.14	-.14	-.20*	-.11	-.12	.14	-.18*	.09	.21*	.29**	—		
15. LN	-.41**	.23**	.33**	.44**	.48**	.58**	.59**	.43**	.54**	.48**	.21**	.01	.13	-.24**	—	
16. SA	-.44**	.17**	.21**	.36**	.31**	.80**	.86**	.43**	.43**	.68**	.10	.12	.05	-.10	.60**	—

Note: 1. * Coefficient is significant at the 0.05 level (2-tailed)

** Coefficient is significant at the 0.01 level (2-tailed)

*** Coefficient is significant at the 0.001 level (2-tailed)

2. AM = amotivation; EXT = external regulation; INTRO = introjected regulation; IDEN = identified regulation; IM = intrinsic motivation; AS = autonomy support; CS = competency support; PA = perceived autonomy; PC = perceived competency; RE = perceived relatedness; HR = hours per week studying; HIT = number of hits; EG = expected grade; FG = final grade; LN = perceived learning; SA = course satisfaction

Table 24

Summary of SDT Model Fit Indices

	χ^2	significance	*df*	χ^2/df	SRMR	CFI	GFI	AGFI	NNFI	RMSEA	IFI
Fit Criteria	Smaller better	n.s.	N/A	< 3.0	< .05	> .90	> .90	> .90	> .90	< .08	> .90
HR	13.18	.28	11	1.20	.02	.99	.99	.96	.99	.03	.99
HIT	18.14	.08	11	1.65	.03	.99	.98	.95	.98	.05	.99
EG	61.02	.00	11	5.55	.07	.92	.94	.85	.84	.13	.92
FG	37.43	.00	11	3.40	.05	.95	.96	.91	.91	.10	.95
LN	52.29	.00	11	4.75	.05	.94	.95	.86	.89	.12	.94
SA	20.19	.04	11	1.84	.03	.99	.98	.94	.98	.06	.99

Note: HR = hours per week studying; HIT = number of hits; EG = expected grade; FG = final grade; LN = perceived learning; SA = course satisfaction

2) *Number of Hits*, 3) *Expected Grade*, 4) *Final Grade*, 5) *Perceived Learning*, and 6) *Course Satisfaction* models.

Model 1. Hours per Week Studying. Figure 8 illustrates standardized path coefficients and fit indices of the "*Hours per Week Studying*" model. An examination of fit indices suggested a good fit of data, χ^2 (11, N = 262) = 13.18, n.s.; SRMR = .02, CFI = .99, NNFI = .99, RMSEA = .03. Regarding the structural paths, *need support* positively predicted *need satisfaction*, and in turn *need satisfaction* positively predicted *self-determination*. *Hours per week studying*, the outcome variable, was positively predicted by *need satisfaction*. However, *need support* and *self-determination* did not have a significant direct effect on the outcome variable.

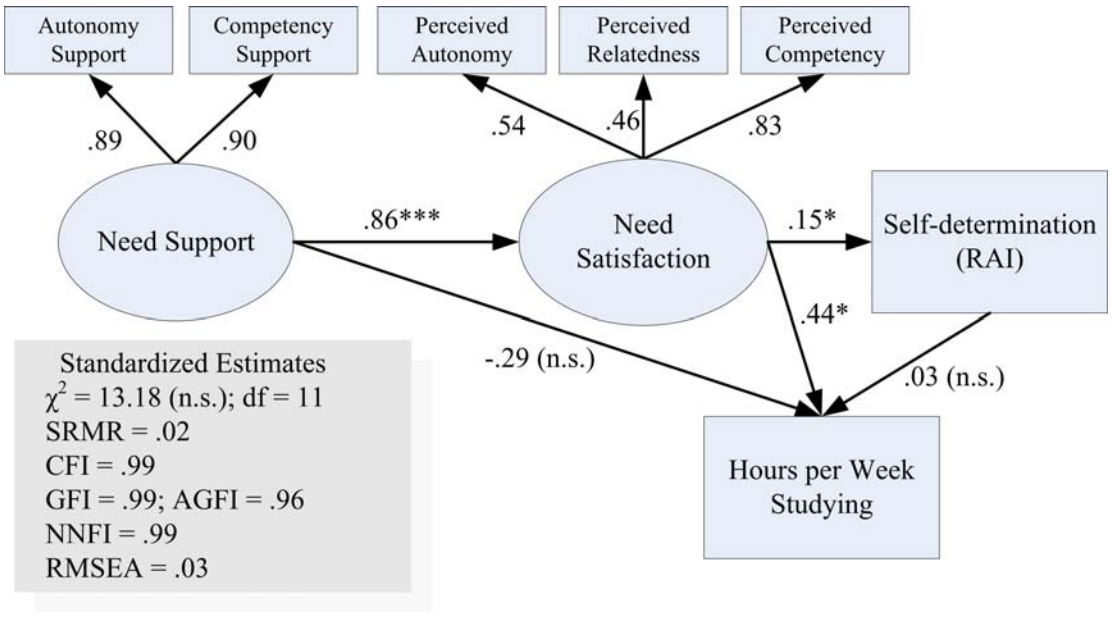

Figure 8. Standardized path coefficients and fit indices of the Hours per Week Studying Model[3]

[3] For Figures 8 to 13, * Coefficient is significant at the 0.05 level (2-tailed); ** Coefficient is significant at the 0.01 level (2-tailed); *** Coefficient is significant at the 0.001 level (2-tailed); and, n.s. = non-significant.

Model 2. Number of Hits. Figure 9 illustrates standardized path coefficients and fit indices of the *Number of Hits* model. An examination of fit indices suggested a good fit of data, χ^2 (11, N = 262) = 18.14, n.s.; SRMR = .03, CFI = .99, NNFI = .98, RMSEA = .05. Regarding the structural paths, *need support* positively predicted *need satisfaction*, and in turn *need satisfaction* positively predicted *self-determination*. *Number of hits*, the outcome variable, was positively predicted by *need support* and *need satisfaction*. However, *self-determination* did not have a significant direct effect on the outcome variable.

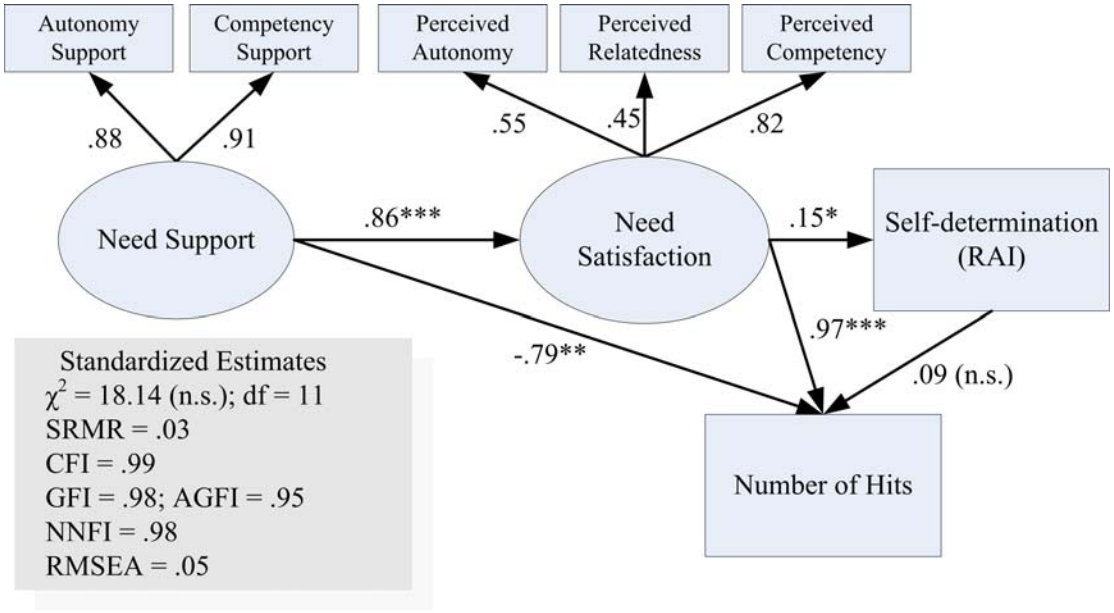

Figure 9. Standardized path coefficients and fit indices of the Number of Hits Model

Model 3. Expected Grade. Figure 10 illustrates standardized path coefficients and fit indices of the *Expected Grade* model. An examination of fit indices suggest a poor fit of data, χ^2 (11, N = 262) = 61.02, p < .001; SRMR = .07 (> .05), CFI = .92, NNFI = .84 (< .90), RMSEA = .13 (> .08). Therefore, the SDT-based *Expected Grade* model was not supported by empirical data gathered in this study.

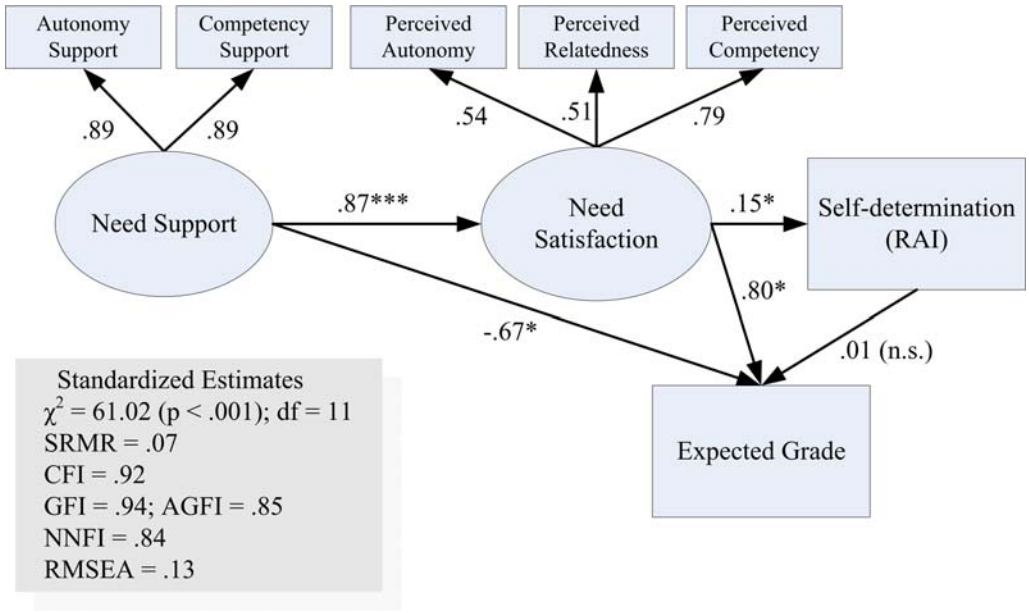

Figure 10. Standardized path coefficients and fit indices of the Expected Grade Model

Model 4. Final Grade. Figure 11 illustrates standardized path coefficients and fit indices of the "*Final Grade*" model. An examination of fit indices suggested an acceptable fit of data, χ^2 (11, N = 262) = 37.43, p < .001; SRMR = .05, CFI = .95, NNFI = .91, RMSEA = .10 (> .08).

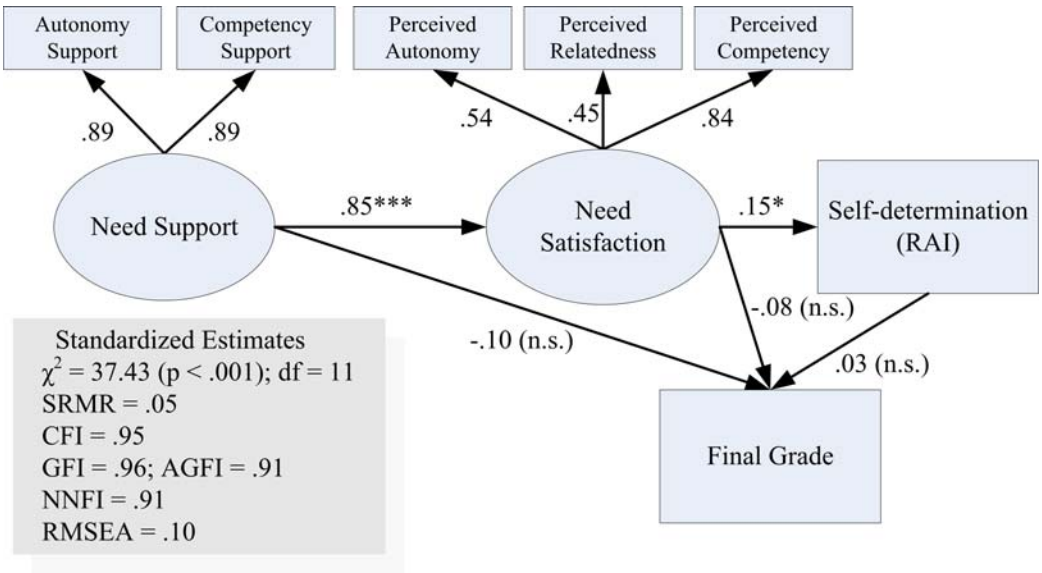

Figure 11. Standardized path coefficients and fit indices of the Final Grade Model

Regarding the structural paths, *need support* positively predicted *need satisfaction*, and in turn *need satisfaction* positively predicted *self-determination*. Unexpectedly, none of the predictive variables (*need support, need satisfaction, and self-determination*) significantly predicted participants' *final grade*. This finding is in line with an earlier finding (in the *Postulate 1* subsection) that showed none of the five types of motivations significantly predicted participants' *final grade*.

Model 5. Perceived Learning. Figure 12 illustrates standardized path coefficients and fit indices of the *Perceived Learning* model. An examination of fit indices suggested a poor fit of data, χ^2 (11, N = 262) = 52.29, p < .001; SRMR = .05, CFI = .94, NNFI = .89 (< .90), RMSEA = .12 (> .08). Therefore, the SDT-based *Perceived Learning* model was not supported by empirical data gathered in this study.

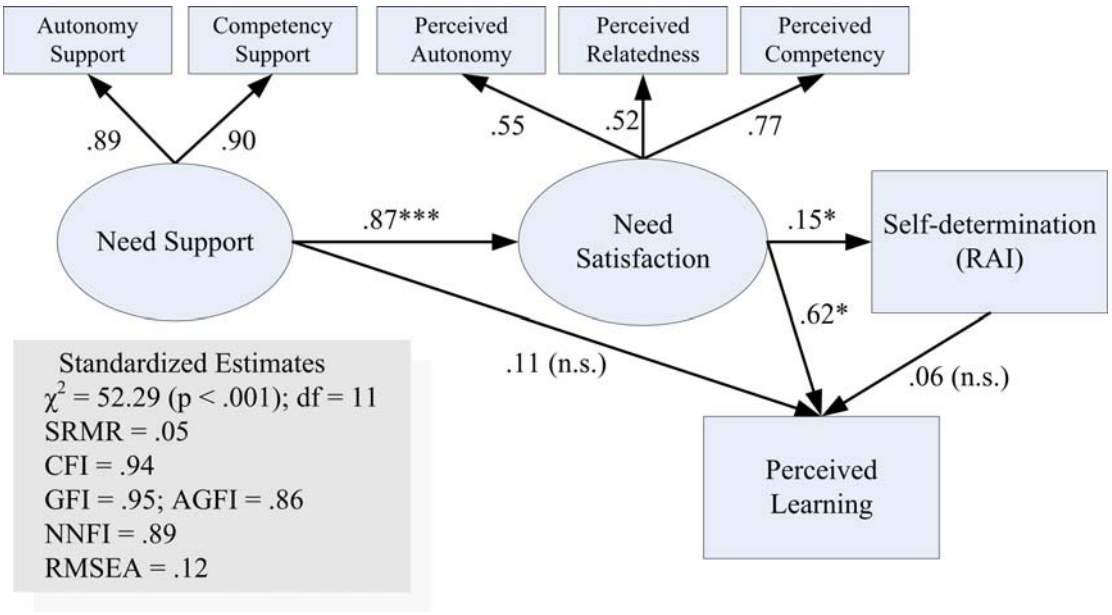

Figure 12. Standardized path coefficients and fit indices of the Perceived Learning Model

Model 6. Course Satisfaction. Figure 13 illustrates standardized path coefficients and fit indices of the *Course Satisfaction* model. An examination of fit indices suggested a good fit of data, χ^2 (11, N = 262) = 20.19, $p < .05$; SRMR = .03, CFI = .99, NNFI = .98, RMSEA = .06. Regarding the structural paths, *need support* positively predicted *need satisfaction*, and in turn *need satisfaction* positively predicted *self-determination*. *Course satisfaction*, the outcome variable, was positively predicted by *need support*. However, *need satisfaction* and *self-determination* did not have a significant direct effect on the outcome variable.

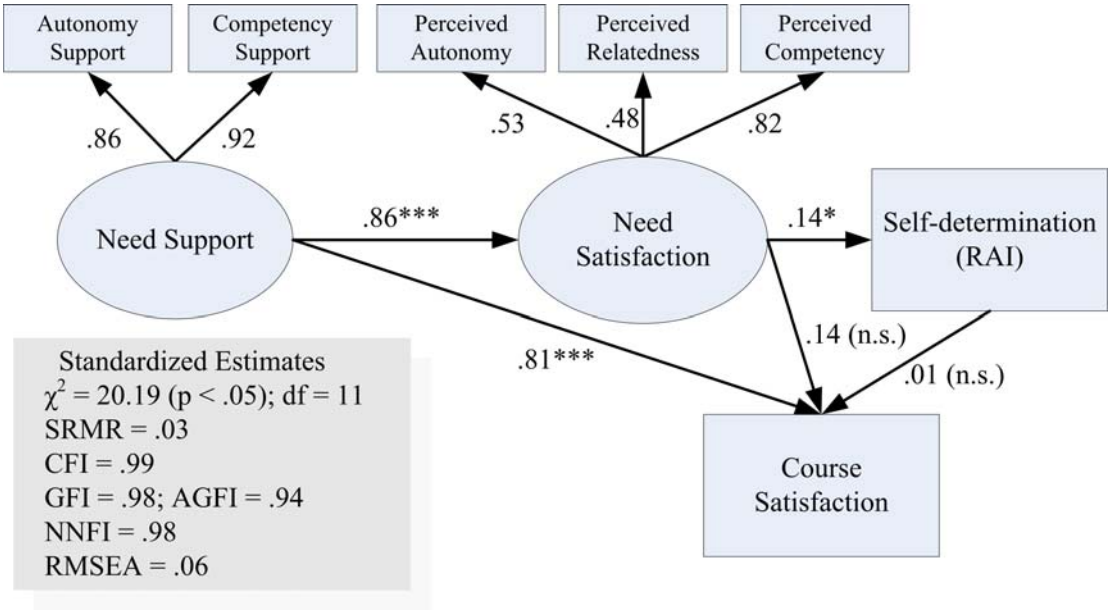

Figure 13. Standardized path coefficients and fit indices of the Course Satisfaction Model

Four patterns were discovered when the researcher examined across the four fitted models (i.e., *Hours per Week Studying*, *Number of Hits*, *Final Grade*, and *Course Satisfaction* models). First, the path "*need support* → *need satisfaction* → *self-determination*" was significant for all four fitted models, supporting SDT. Secondly, for the category of *engagement* (including *hours per week studying* and *number of hits*), *need satisfaction* was the strongest and positive predictor

of learning outcomes. However, for the *Course Satisfaction* model, *need support* was the strongest predictor. The differentiated main predictor of learning outcomes was not specifically assumed by SDT. Third, although the total effect (direct effect + indirect effect) of *need support* on *learning outcome* remained positive for the *Hours per Week Studying*, *Number of Hits*, and *Final Grade* models, the direct effect for all three models was *negative*. Last, an unexpected finding was that *self-determination* failed to directly predict any of the learning outcomes in this study, which contradicted SDT.

Research Question 3: What is the Relative Salience of Autonomy, Relatedness, and Competency on Online Learners' Motivation and Learning Outcomes?

Simultaneous multiple regression was used to test the relative salience of students' *perceived autonomy*, *perceived competency*, and *perceived relatedness*. The dependent variables include the five types of motivation and the six learning outcomes: 1) *hours per week studying*, 2) *number of hit*, 3) *expected grade*, 4) *final grade*, 5) *perceived learning*, and 6) *course satisfaction*. Collinearity was checked in each multiple regression analysis. None of the predictive variables exceeded the threshold of 10 for the *variance inflation factor* (VIF). Regarding the overall regression model, none of the analyses revealed a condition index (CI) value greater than 30. The above results indicated that there were no severe collinearnality among variables. Below is a detailed report of the relative salience of *perceived autonomy*, *competency*, and *relatedness* on online learners' motivation and learning outcomes:

The Relative Salience of Perceived Autonomy, Competency, and Relatedness on Online Learners' Motivation

Amotivation. A simultaneous regression indicated that participants' *perceived competency* had the highest (in absolute value) standardized regression coefficient ($\beta = -.275$) when

predicting *amotivation*, followed by *perceived relatedness* (β = -.154) and *perceived autonomy* (β = -.116). Therefore, the relative salience (order) of students' *perceived autonomy*, *relatedness*, and *competency* on *amotivation* is:

1. Perceived competency
2. Perceived relatedness
3. Perceived autonomy

Furthermore, *perceived competency* (t = - 4.46, $p < .001$) and *perceived relatedness* (t = -2.38, $p < .05$) significantly and negatively predicted *amotivation*. The total R^2 was .170, and the adjusted R^2 was .164, which means that the two predictors explained 16.4% of the variance of *amotivation*.

External regulation. A simultaneous regression indicated that participants' *perceived autonomy* had the highest standardized regression coefficient (β = .232) when predicting *external regulation*, followed by *perceived relatedness* (β = .079) and *perceived competency* (β = .033). Therefore, the relative salience of students' *perceived autonomy*, *relatedness*, and *competency* on *external regulation* is:

1. Perceived autonomy
2. Perceived relatedness
3. Perceived competency

Furthermore, only *perceived autonomy* (t = 3.41, $p < .001$) significantly predicted *external regulation*. The total R^2 was .077, and the adjusted R^2 was .074, which means that *perceived autonomy* explained 7.4% of the variance of *external regulation*.

Introjected regulation. A simultaneous regression indicated that participants' *perceived autonomy* had the highest standardized regression coefficient (β = .399) when predicting *introjected regulation*, followed by *perceived competency* (β = .112) and *perceived relatedness*

(β = .08). Therefore, the relative salience of students' *perceived autonomy*, *relatedness*, and *competency* on *introjected regulation* is:

1. Perceived autonomy
2. Perceived competency
3. Perceived relatedness

Furthermore, only *perceived autonomy* ($t = 6.45$, $p < .001$) significantly predicted *introjected regulation*. The total R^2 was .222, and the adjusted R^2 was .219, which means that *perceived autonomy* explained 21.9% of the variance of *introjected regulation*.

Identified regulation. A simultaneous regression indicated that participants' *perceived autonomy* had the highest standardized regression coefficient (β = .308) when predicting *identified regulation*, followed by *perceived relatedness* (β = .169) and *perceived competency* (β= .107). Therefore, the relative salience of students' *perceived autonomy*, *relatedness*, and *competency* on *identified regulation* is:

1. Perceived autonomy
2. Perceived relatedness
3. Perceived competency

Furthermore, *perceived autonomy* ($t = 4.89$, $p < .001$) and *perceived relatedness* ($t = 2.65$, $p < .01$) significantly predicted *identified regulation*. The total R^2 was .206, and the adjusted R^2 was .200, which means that the two predictors explained 20.0% of the variance of *identified regulation*.

Intrinsic motivation. A simultaneous regression indicated that the participants' *perceived autonomy* had the highest standardized regression coefficient (β = .425) when predicting *intrinsic motivation*, followed by *perceived relatedness* (β = .175) and then *perceived competency*

(β = .127). Therefore, the relative salience of students' *perceived autonomy*, *relatedness*, and *competency* on *intrinsic motivation* is:

1. Perceived autonomy
2. Perceived relatedness
3. Perceived competency

Furthermore, *perceived autonomy* ($t = 7.40$, $p < .001$), *perceived competency* ($t = 2.30$, $p < .05$), and *perceived relatedness* ($t = 3.02$, $p < .001$) all significantly predicted *intrinsic motivation*. The total R^2 was .346, and the adjusted R^2 was .338, which means that the three predictors explained 33.8% of the variance of *intrinsic motivation*.

The Relative Salience of Perceived Autonomy, Competency, and Relatedness on Online Learners' Learning Outcomes

Hours per week studying. A simultaneous regression indicated that the participants' *perceived autonomy* had the highest standardized regression coefficient (β = .112) when predicting participants' *hours per week studying*, followed by *perceived relatedness* (β = .069) and *perceived competency* (β = .053). Therefore, the relative salience of students' *perceived autonomy*, *relatedness*, and *competency* on *hours per week studying* is:

1. Perceived autonomy
2. Perceived relatedness
3. Perceived competency

Unexpectedly, none of the above three variables significantly predicted *hours per week studying*. The three variables together explained 2.3 % of the variance of *hours per week studying* in the regression model.

Number of hits. A simultaneous regression indicated that the participants' *perceived autonomy* had the highest standardized regression coefficient (β = .227) when predicting participants' *number of hits*, followed by *perceived relatedness* (β = .115) and *perceived competency* (β = .005). Therefore, the relative salience of students' *perceived autonomy*, *relatedness*, and *competency* on *number of hits* is:

1. Perceived autonomy
2. Perceived relatedness
3. Perceived competency

Furthermore, only *perceived autonomy* ($t = 2.63$, $p < .05$) significantly predicted online students' *number of hits*. The R^2 was .074, and the adjusted R^2 was .068, which means that *perceived autonomy* explained 6.8% of the variance of *number of hits*.

Expected grade. A simultaneous regression indicated that participants' *perceived competency* had the highest (in absolute value) standardized regression coefficient (β = .471) when predicting *expected grade*, followed by *perceived relatedness* (β = -.096) and *perceived autonomy* (β = -.017). Therefore, the relative salience of students' *perceived autonomy*, *relatedness*, and *competency* on participants' *expected grade* is:

1. Perceived competency
2. Perceived relatedness
3. Perceived autonomy

Furthermore, only *perceived competency* ($t = 7.42$, $p < .001$) significantly predicted *expected grade*. The R^2 was .185, and the adjusted R^2 was .182, which means that *perceived competency* explained 18.2% of the variance of participants' *expected grade*.

Final grade. A simultaneous regression indicated that participants' *perceived competency* had the highest (in absolute value) standardized regression coefficient (β = .215) when predicting

participants' *final grade*, followed by *perceived relatedness* (β = -. 213) and *perceived autonomy* (β = -.112). Therefore, the relative salience of students' *perceived autonomy*, *relatedness*, and *competency* on participants' *final grade* is:

1. Perceived competency
2. Perceived relatedness
3. Perceived autonomy

Furthermore, *perceived competency* ($t = 2.59$, $p = .01$) and *perceived relatedness* ($t = -2.45$, $p < .05$) significantly predicted *final grade*. The total R^2 was .075, and the adjusted R^2 was .063, which means that the two variables explained 6.3% of the variance of *final grade*.

Perceived learning. A simultaneous regression indicated that participants' *perceived competency* had the highest standardized regression coefficient (β = .376) when predicting *perceived learning*, followed by *perceived relatedness* (β = .255) and *perceived autonomy* (β = .204). Therefore, the relative salience of students' *perceived autonomy*, *relatedness*, and *competency* on *perceived learning* is:

1. Perceived competency
2. Perceived relatedness
3. Perceived autonomy

Furthermore, *perceived autonomy* ($t = 3.74$, $p < .001$), *perceived competency* ($t = 7.21$, $p < .001$), and *perceived relatedness* ($t = 4.64$, $p < .001$) all significantly predicted *perceived learning*. The total R^2 was .414, and the adjusted R^2 was .407, which means that the three predictors explained 40.7% of the variance of *perceived learning*.

Course satisfaction. A simultaneous regression indicated that participants' *perceived relatedness* had the highest standardized regression coefficient (β = .549) when predicting *course satisfaction*, followed by *perceived competency* (β = .190) and *perceived autonomy* (β = .128).

Therefore, the relative salience of students' *perceived autonomy*, *relatedness*, and *competency* on *course satisfaction* is:

1. Perceived relatedness
2. Perceived competency
3. Perceived autonomy

Furthermore, *perceived relatedness* ($t = 10.90$, $p < .001$), *perceived competency* ($t = 3.99$, $p < .001$), and *perceived autonomy* ($t = 2.56$, $p < .05$) all significantly predicted *course satisfaction*. The total R^2 was .508, and the adjusted R^2 was .503, which means that the three predictors explained 50.3% of the variance of *course satisfaction*.

Table 25 presents a summary of the regression analyses discussed in this section. Three phenomena were discovered when the researcher scanned through the summary table. First, the most salient predictor varied from categories of motivation and learning outcomes. *Perceived autonomy* was the most salient predictor for *intrinsic* and *extrinsic motivation* (including *external*, *introjected* and *identified regulations*); however, *perceived competency* was most salient for *amotivation*. Regarding learning outcomes, *perceived autonomy* was the most salient predictor for *engagement* (including *hours per week studying* and *number of hits*), while *perceived competency* was most the most salient predictor for *perceived learning* and *achievement* (including *expected grade* and *final grade*). Interestingly, online students' *course satisfaction* was most predicted by *perceived relatedness*.

Secondly, the number of significant predictors increased by participants' level of self-determination. *External* and *introjected regulations*, which are less self-determined types of motivation, were predicted by only one factor, *perceived autonomy*. *Identified regulation*, a more self-determined type of motivation, was predicted by two factors: *perceived autonomy* and

Table 25
Summary of Regression Analyses that Tested the Relative Salience of Perceived Autonomy, Perceived Relatedness, and Perceived Competency on Motivation and Learning Outcomes

Category	Variable	Relative Salience	Significant Predictors	Percentage of Variance Explained
Motivation	Amotivation	PC > RE > PA	PC, RE	16.4%
	External Regulation	PA > RE > PC	PA	7.4%
	Introjected Regulation	PA > PC > RE	PA	21.9%
	Identified Regulation	PA > RE > PC	PA, RE	20.0%
	Intrinsic Motivation	PA > RE > PC	PA, RE, PC	33.8%
Engagement	Hours per Week Studying	PA > RE > PC	None	2.3%
	Number of Hits	PA > RE > PC	PA	6.8%
Achievement	Expected Grade	PC > RE > PA	PC	18.2%
	Final Grade	PC > RE > PA	PC, RE	6.3%
Learning	Perceived Learning	PC > RE > PA	PC, RE, PA	40.7%
Satisfaction	Course Satisfaction	RE > PC > PA	RE, PC, PA	50.3%

Note: 1. PA= perceived autonomy; PC= perceived competency; RE= perceived relatedness.
2. The relative salience of PA, PC, and RE was determined based on the absolute value of the standardized regression coefficient.

perceived relatedness. *Intrinsic motivation*, the most self-determined type of motivation, was predicted by all three factors: *perceived autonomy*, *perceived relatedness*, and *perceived competency*.

Third, the variance of an outcome variable explained by significant predictors varied significantly, ranging from 6.3% to 50.3%. Significant predictors explained more than 20% of the variance of *intrinsic motivation* (33.8%), *introjected regulation* (21.9%), and *identified regulation* (20.0%). However, *external regulation* had a relatively low percentage of variance

explained (7.4%). Regarding learning outcomes, *perceived learning* (40.7%) and *course satisfaction* (50.3%) had the highest percentage of variance explained by significant predictors. On the other hand, the percentages for *hours per week studying*, *number of hits*, and *final grade* were all below 10%. The next chapter discusses research findings, concludes this study, and recommends directions for future studies.

CHAPTER V

DISCUSSION, CONCLUSION, LIMITATIONS, AND RECOMMENDATIONS FOR FUTURE STUDIES

Discussion

Online Students' Motivation Profiles

In this study, *identified regulation* repeatedly appeared as online learners' primary locus of motivation. This means that online students identify the importance of particular courses in relation to their perception that those courses will make them better teachers in the future. Deci and Ryan (1985) argued that *identified regulation* is a highly desired type of motivation in education because not every learning activity is inherently interesting or enjoyable. With a high level of identified regulation, students internalize the goals and values of their online courses, and they become more self-determined to participate in course activities.

Learner characteristics, along with the nature of the SETWEB and SPECTRUM programs may explain participants' high scores on *identified regulation*. Participants are adult learners, with an average age of 37 years old. Compton, Cox, and Laanan (2006) argued that adult learners have multiple responsibilities in life, and they have focused goals for their education, typically to obtain or promote their work skills. While SETWEB and SPECTRUM provide a clear goal for students to pursue, a renewable teaching certificate, the participants may be even more cognizant of the importance of the online courses to help them obtain their teaching certificates, as well as promoting their future careers.

Intrinsic motivation, the most self-determined and highly endorsed form of motivation, scored second highest among participants. This result shows that, in addition to identifying the importance of the online courses for their future careers (*identified regulation*), participants also experienced pleasure and satisfaction while learning course materials, and felt a sense of accomplishment when they participated in course activities. *Amotivation*, on the other hand, scored lowest among participants. Together, online students' motivation profiles indicate an inclination toward self-determined motivation which, as has been reported in many past studies, is associated with positive learning outcomes.

Despite that the data showed participants scored highest on *identified regulation* and followed by *intrinsic motivation*, this study also found that online students' *identified regulation*, as well as their *intrinsic motivation to know*, decreased over a month period of time. This result is consistent with other cross-sectional or longitudinal studies such as Xie at al. (2006), and Otis, Grouzet, and Pelletier (2005). Xie et al. conducted a follow-up study on the decrease of student motivation. In that study, students reported insufficient time to complete course requirements, and mandatory online discussions with no other alternatives, were the primary factors in decreased student motivation.

The "decreasers" reported in Xie et al.'s (2006) study may be applicable to explain the decrease of student motivation in this study, because these decreasers are also evident in the SETWEB/SPECTRUM context. SETWEB and SPECTRUM students are especially busy in summer due to the shortened (1.5 months) duration of the summer term. Furthermore, students reported a relatively low score of *perceived autonomy* ($M = 3.42$ on a 7-point scale), indicating that students do not perceive abundant freedom of action in their online courses. An implication gained from students' motivational change is that online instructors should be attentive to online students' motivation status throughout the semester, and provide ongoing support to keep

students motivated. Rendering flexible and alternative options while maintaining manageable coursework for online students are suggested pathways.

Demographic variables in general did not have significant relationships with online learners' motivation, except for two statistical results. First, at the beginning of the online course, males were more intrinsically motivated than females; this result contradicts general research findings that females are more intrinsically motivated, or more self-determined than males (Vallerand & Bissonnette, 1992; Vallerand, Fortier, & Guay, 1997). Secondly, at the end of the course, participants in the 40-49 age group were less amotivated than those under 30 years old. It is difficult to compare findings across similar studies because little research has been done to examine gender and age difference under the SDT framework and in the online learning environment. What caused males to be more intrinsically motivated than females at the beginning of the course, and why were there no gender differences at the end of the course? What factors made online students aging 40-49 less amotivated than those under 30 when the students proceeded toward the end of the course? These unsolved and interesting questions warrant future studies.

An unexpected result was that *prior online learning experience* (including the number of courses taken *before* and *after* entering the SETWEB/SPECTRUM) did not have significant impact on online learners' motivation. These findings contradicted Conrad's (2002) and Armatas et al.'s (2003) findings that online learners' affect and attitudes differed based on prior experience. An explanation to the insignificance of prior experience is that the SETWEB/SPECTRUM orientations have provided students with sufficient help, mitigating the effect of prior online learning experience. The researcher further examined student responses on the *Competency Support Scale* and found that the two orientation-related items, "The SETWEB/ SPECTRUM technology orientation was helpful for my study" and "The SETWEB/SPECTRUM

technology orientation provided me with sufficient information" obtained high scores (M = 5.47 and 5.37 respectively on a 7-point scale). Furthermore, the two items both negatively correlated with amotivation, and positively correlated with the other four types of motivation. The results provided evidence of the positive effect of SETWEB/ SPECTRUM orientations, and their potential to mitigate the effect of prior experience on student motivation.

The Tenability of Self-Determination Theory in an Online Learning Environment

Distinctiveness of motivation types. *Intrinsic motivation*, *external*, *introjected*, and *identified regulations*, and *amotivation* were shown to be distinct constructs based on empirical data gathered from an online learning environment. Therefore, this study substantiated SDT's theorizing that human motivation is a complicated, multidimensional inner process, as opposed to a singular, monolithic construct. In online education, students have different reasons to participate in class. They may embrace internal reasons such as interest, joy, or the pursuit of self-fulfillment. Students may also have external reasons to participate in class, such as fear of being outdated, coerced by authorities, or in pursuit of a better salary. The different types of motivation, according to SDT, will in turn have varied influence on students' psychological health, learning outcomes, or in general, their well-being.

An implication for online education is that instructors should not dichotomize students into "motivated" and "unmotivated" groups, because two students with seemingly the same motivation level may have totally different reasons to participate in class. Online instructors should instead be aware that students' differentiated reasons of enrollment may have ongoing impact on their attitudes and behaviors in class, and in turn influence their learning consequences. Online instructors should spend time understanding their students' intentions for study so that they are more able to provide support pertinent to students' individual needs.

The relationship between contextual support and motivation. In this study, contextual supports of autonomy and competency were found to associate positively with online students' *intrinsic motivation* and negatively with their *amotivation*, supporting SDT. More specifically, those who perceived high levels of autonomy and competency supports increased *intrinsic motivation* and decreased *amotivation*, whereas quite the opposite happened in the medium or low perception groups. The results echo numerous researchers' calls to address online learner support, and are in line with many SDT-based studies that show positive effects of contextual support on learner motivation (Deci & Ryan, 1985, for a review). From this researcher's personal experience working with the SETWEB and SPECTRUM programs, instructors, teaching assistants, administrators, and technical support personnel all play important roles in supporting online students. Administrators provide program advertising and consultation. Instructors and teaching assistants handle the flow and logistics of the online course. Technical support personnel provide student orientations, and troubleshoot technical glitches. It is suggested that online learning practitioners work seamlessly together to create a sound support system for online students.

A finding that did not render support for SDT was that online students' *internalization* failed to show significant changes as a function of autonomy and competency supports. Perhaps the one-month period between the pre-test and the post-test was too short to fully reflect participants' internalization of goals and values. It is also possible that the general tendency of students' decrease of motivation have confounded/mitigated the effects of autonomy and competency supports. More cross-sectional or longitudinal studies with a longer time span between two data points, or experimental studies that better control confounding variables are warranted to fill this gap.

Motivation and learning outcomes. This section discusses findings regarding the association between the five types of motivation and learning outcomes, which are connected to SDT's two postulates: 1) different types of motivation can be used to interpret important learning outcomes; 2) self-determined types of motivation result in positive outcomes while nonself-determined types of motivation lead to negative outcomes.

This study found that among the five types of motivations, *intrinsic motivation*, *identified regulation*, and *amotivation* were more able to interpret online students learning outcomes – each motivation type significantly predicted three learning outcomes. *Intrinsic motivation* stood out as the most salient predictor of online students' *hours per week studying*, *expected grade*, and *perceived learning*. *Identified regulation*, being the primary locus of online students' motivation in this study, was the most salient predictor of students' *number of hits*, and the second salient predictor of *course satisfaction*. *Amotivation*, on the other hand, was the most salient and negative predictor of online students' *course satisfaction*, and was the second salient and negative predictor of *expected grade* and *perceived learning*. The findings suggest that facilitating online learners' *intrinsic motivation* and *identified regulation*, and reducing online learners' *amotivation* are more likely to promote desired learning outcomes: *engagement*, *achievement*, *perceived learning*, and *course satisfaction*. The findings also signify the multiple complex influences on online students' learning outcomes due to that fact that different learning outcomes have been influenced by different combinations of motivation types.

Notably, online students' *final grade* was not predicted by any type of motivation. Perhaps it is due to the general high and homogeneous (M = 92.58, CV = 5.57%) student grades. Therefore, online instructors' policies of grading may have confounded the results of this study. Interpretations and generalizations of the results pertaining to students' *final grade* should proceed with caution.

Regarding the direction of impact, consistent with SDT, *intrinsic motivation* and *identified regulation* – the most self-determined types of motivation – were found to associate positively with learning outcomes. *Amotivation*, being the least self-determined motivation, was shown to associate negatively with learning outcomes. The results of this study echo many empirical studies (e.g., Grolnick & Ryan, 1987; Peterson & Seligman, 1984; Ryan & Connell, 1989) that explored the effects of *intrinsic motivation*, *identified regulation*, and *amotivation*, as have been discussed in the *Literature Review* chapter.

External and *introjected regulations*, however, are shown in this study to associate positively with learning outcomes, contradicting SDT's theorizing. A similar result was found in Edmunds and Duda's (2006) study wherein *introjected regulation* positively predicted participants' self-reported exercise behavior. The researcher of this study, in accord with Edmunds and Duda's reasoning, suspects that although *external* and *introjected regulations* may have positive effects in the short run (e.g., a summer online course), they may not bode well in the long term. Longitudinal studies are suggested to test the long-term effect of different types of motivation in the online learning environment.

SDT full models: the interrelationships among need support, need satisfaction, motivation and learning outcomes. Four SDT full models: 1) *Hours per Week Studying*, 2) *Number of Hits*, 3) *Final Grade*, and 4) *Course Satisfaction* have been substantiated/fitted by empirical data through structural equation modeling. Results from the fitted models provided evidence for the mediating effect of *need satisfaction* between *need support* and *motivation/self-determination*. Supports of autonomy and competency positively affected online students' *perceived autonomy*, *relatedness*, and *competency*, the satisfaction of the three basic needs. Students' *need satisfaction*, in turn, positively affected online students' self-determination. Therefore, it could be argued that effective support strategies are those that address online

learners' needs of autonomy, relatedness, and competency. As discussed in the *Literature Review* chapter, there are many instructional strategies proposed to support online learners. For instance, instructors can provide flexible learning options, including assessment (Armatas et al., 2003; Perreault et al., 2002; Willems, 2005), design collaborative learning activities to foster peer interactions (Kreijns et al., 2003; Perreault et al., 2002), and assist students with self-regulation and learning strategies (Motteram & Forrester, 2005; Song et al., 2004). Using strategies tactically will make students motivated and self-determined in their online study.

Furthermore, SDT-based studies have identified strategies to support student autonomy and competency. Reeve and Jang (2006), for instance, listed 11 support strategies of instructors, such as providing meaningful rationales, offering encouragement, and praise as informational feedback. In order for online instructors to better understand their students' needs, and adopt appropriate strategies to support their students, it is suggested that online instructors create an open, interactive, and learner-centered atmosphere for students to freely express their feelings, thoughts, and concerns.

The SDT full model tests yielded another thought-provoking result: the direct effect of *need support* on *learning outcome* was generally negative (except for the *Course Satisfaction* model), whereas the indirect effect (through the mediation of *need satisfaction*) was positive. This finding suggests that haphazard and aimless supports without addressing students' needs may lead to adverse – even worse than "no effects" – outcomes. It is through the enhancement of students' perceptions of autonomy, relatedness, and competency that makes contextual supports effective and meaningful to online students. Again, it is of critical importance that instructors and other online learning practitioners understand their students, and provide support pertinent to their needs.

The SEM results showed that the path from *self-determination* (a composite motivation score) to *learning outcome* was insignificant across all fitted models, contradicting the results from which the five types of motivation were individually assessed. An examination of the overall SEM structural paths helped explain the insignificant link from *motivation* to *learning outcomes*. *Learning outcomes* were in fact directly explained by *need support* and *need satisfaction* categories, as opposed to *motivation/self-determination*. Consequently, from a macro and integrative view, *need support* and *need satisfaction* have more salient and direct effects on online students' learning outcomes.

Although the effect of motivation on learning outcomes remains inconclusive across research findings, this study has shown the intricate dynamics among *need support*, *need satisfaction*, *motivation*, and *leaning outcomes* through SDT full model tests. The opposite results of the direct and indirect effects of *need support* on *learning outcome*s, for instance, would not have been detected through this macro, integrated view. Furthermore, comparisons across fitted models indicated the strong association between *student engagement* and *need satisfaction*, and the salient link from *need support* to *course satisfaction* – these results present the specific dynamics of individual learning outcomes, and reflect the benefit of SEM model comparisons. It appears that exploring the antecedents, correlates, and outcomes in an integrative approach serves as a pathway to enrich our understanding of online learner motivation.

The Relative Salience of Autonomy, Relatedness, and Competency on Motivation and Learning Outcomes

This study examined the relative salience of *perceived autonomy*, *perceived relatedness*, and *perceived competency* on online students' motivation and learning outcomes. Regarding the

motivation category, *perceived autonomy* stood out as the most significant factor that predicted online students' *intrinsic* and *extrinsic motivations*. *Perceived competency*, on the other hand, served as the most salient predictor of online learners' *amotivation*. The results provide important implications for online instruction: online learning practitioners should first address online learners' competency, such as providing technical orientations or consultations in order to avoid students becoming frustrated and amotivated, or even dropping out of class. Online learning practitioners should also adopt appropriate strategies that promote online learners' *perceived autonomy* to keep students motivated and engaged throughout their online study.

Furthermore, *perceived relatedness* was found to be the second salient factor that positively predicted online learners' *identified regulation* and *intrinsic motivation*, and negatively predicted *amotivation*. Therefore, online learning practitioners should create an interactive learning environment that fosters online learners' feelings of affiliation. As suggested by Song et al. (2004), instructors can embed community building strategies, such as encouraging collective reflection and devising small group case studies into their online course activities. Optional face-to-face activities were suggested by Howland and Moore (2002) to compensate for the lack of social presence and to promote a higher level of social engagement.

An interesting pattern was discovered in this study: *external* and *introjected regulations*, which are less self-determined types of motivation, were predicted by only one factor, *perceived autonomy*. *Identified regulation*, a more self-determined type of motivation, was predicted by two factors: *perceived autonomy* and *perceived relatedness*. *Intrinsic motivation*, the most self-determined type of motivation, was predicted by all three factors: *perceived autonomy*, *perceived relatedness*, and *perceived competency*. The above pattern echoes Deci, Eghrari et al.'s (1994) experimental study where zero or one supporting factor lead to participants' *introjected internalization* whereas two or three supporting factors resulted in participants' *integrated*

internalization. This study shed important light on online learner support: multiple support strategies should be integrated into the online learning environment to ensure that *all* three types of needs are addressed. With sufficient supports of autonomy, relatedness, and competency, students are more likely to internalize goals and values of online courses and become self-determined online learners.

Similar to motivation variables, the relative salience of *perceived autonomy*, *perceived relatedness*, and *perceived competency* varied by categories of learning outcomes. *Perceived autonomy* was the most salient factor predicting *student engagement*. *Perceived competency* accounted most for online students' *perceived learning* and *achievement*. *Perceived relatedness* best explained online learner's *course satisfaction*. Moreover, addressing student *autonomy*, *relatedness* and *competency* are more likely to enhance online learners' *perceived learning*, *expected grade*, and *course satisfaction*, judging from the percentage that significant factors explained the variance of outcome variables. The results mentioned directly above provide a reference for online instructors to align instructional strategies with desired outcomes, and to prioritize resources to render support. For instance, if the primary goal of an online instructor is to promote students' perceived learning, he or she can lay more emphasis on supporting student competency. Alternatively, if the instructor intends to enhance student satisfaction toward the online course, he or she can allocate more resources to promote social interactions.

Conclusion

This study comprehensively tested SDT in an online learning environment. Results from this study substantiated much of SDT's theorizing, including the distinctiveness of the five types of motivation, the positive effect of contextual support on learner motivation, and correlations among the five types of motivations generally conforming to the simplex pattern. Additionally,

four out of six SEM models yielded proper fit, and all the fitted models substantiated the mediating effect of *need satisfaction* between *need support* and *self-determination*. Finally, this study found that perceived autonomy, relatedness, and competency synergistically affected online students' self-determination. Taken together, it could be argued that SDT is valid and tenable, and can be used as an appropriate framework for addressing motivation in the online learning environment.

This study contributes to online motivation research by serving as one of the earliest studies that comprehensively tests self-determination theory in the online learning environment. This study also presents seminal results showing the relative salience of *autonomy*, *relatedness* and *competency* on motivation and learning outcomes. The researcher hopes that this study can stimulate more studies that employ the SDT framework and further explore the intricate dynamics of contextual support, need satisfaction, motivation and well-being in the online learning environment.

Furthermore, due to the lack of measurement that accesses competency support of online learners, a competency support scale was created and validated by the researcher. It is hoped that this scale will facilitate research in online learner support. Another favorable outcome would be that the competency support scale inspires further studies, generating new scales appropriate to a variety of online settings such as hybrid learning environments.

Several suggestions are provided for online students. To be more assured and engaged in online learning, students are encouraged to frequently reflect upon their reasons to participate in class, and take initiatives (e.g., forming online study groups) to make their online study more personally meaningful and enjoyable. To formulate realistic expectations toward online learning, it is recommended that students familiarize themselves with the requirements and logistics of their online courses before or at the outset of class. Online students are also encouraged to

express their feelings, needs and concerns, so that instructors and other support personnel are more able to provide help pertinent to student needs. Online students should be aware that they assume the responsibility for their learning, but *not* in the way that they learn "all by themselves." Students are encouraged to open their mind and keenly participate in the online learning community. Whenever learning or technical difficulties arise, instructors, peers, or technical support personnel are great resources to seek help.

This study sheds light on online learner support. Online students' immediate context has significant impact on their motivation and learning outcomes. Online learning practitioners, including administrators, instructors, teaching assistants, and technical support personnel all play important roles in supporting online learners. They should work hand in hand to create a warm and supportive learning environment. They should take initiatives to understand online students' feelings, thoughts, and concerns, so that they are more able to provide support pertinent to their students' needs. To keep students motivated and engaged, online learning practitioners are also advised to be attentive to online students' motivational changes and provide ongoing support such as rendering flexible and alternative options.

Online learning practitioners should be aware that learner autonomy, relatedness, and competency affect significantly but differently on online students' motivation and learning outcomes. To ensure online students' self-determined motivation, supports of all three factors should be addressed in the online learning context. Online learning practitioners can tacitly allocate available resources to support learner autonomy, relatedness, and competency, and align instructional support strategies with intended learning outcomes. In sum, contextual supports of autonomy, relatedness and competency will help online learners become more assured and self-determined, allowing them more enjoyment for their online learning journey.

Limitations

Despite efforts to increase rigor, this study has its limitations. First, this study was conducted in two special education online programs at a large research university in the southeastern USA, which may to some extent limit its level of generalizability. To increase generalizability, future studies may extend this research by surveying across programs, regions, subject matters, or even culture.

Secondly, due to practical concerns, this study employed a correlational research design. Although four SDT models that contained directional paths had been validated through structural equation modeling, the evidence was still insufficient to draw causal conclusions regarding the paths between *need support*, *need satisfaction*, *motivation* and *learning outcomes*. Future studies may employ experimental design to test the tenets of self-determination theory in the online learning environment.

Thirdly, this study adapted Vallerand et al.'s (1992) *Academic Motivation Scale* (AMS) to measure different types of motivation. As discussed in the *Methodology* chapter, while AMS is the best available scale for this study, it does not measure integrated motivation. The lack of a perfect motivation scale somewhat imposed limitations upon this study, which aimed to comprehensively test SDT in an online learning environment.

Despite the aforementioned limitations, this study has generated much needed data to inform the practice of online education. Knowledge gained in this study has suggested ways to facilitate online student support. Results from this study also deepen our understanding of online students' motivation profiles. Additionally, this study expands the knowledge base concerning the complex nature of online learner motivation, its dynamic relationships among various antecedents and derivatives, and the relative salience of online students' perceived autonomy, relatedness, and competency on motivation and learning outcomes. It is hoped that this study

helps online learning practitioners identify better strategies for contextual support, on the basis of which vibrant, motivating online learning environments may flourish.

Recommendations for Future Studies

Self-determination theory has been validated in this study to be tenable in the online learning environment. Self-determination theory provides a comprehensive framework that undergirds main themes in online motivation research, including *autonomy*, *affiliation*, *ability* and *assistance*. Through the lens of SDT, online learning researchers are able to examine the dynamics and interrelationships among need support, need satisfaction, different types of motivation, and a variety of learning outcomes (as shown in the results of this study). Therefore, a suggestion for future studies is to apply SDT in online motivation research. Replication of this study in other online learning environments, for instance, will help establish the generalizebility of the findings of this study. Additionally, future work can be directed toward testing the effectiveness of SDT-based instructional support strategies, such as allowing choice, providing a meaningful rationale, and offering informational feedback. Experimental studies are especially recommended to validate SDT-based instructional support strategies, as well as to verify the causal links among *contextual support*, *need satisfaction*, *motivation* and *learning outcomes* in the online learning environment.

This study yielded several inconclusive results that warrant future studies. Foremost among these is that the path from *self-determination* (a composite motivation score) to *learning outcomes* was insignificant in the full model tests, contradicting the results from which the five types of motivation were individually assessed. More studies are needed to draw conclusions about the association between *motivation* and *learning outcomes*; also, it would be beneficial to

explore reasons why online students' *self-determination* accounts for learning outcomes less than *need support* and *need satisfaction* categories in a macro, full-model view.

Secondly, in this study, *introjected regulation* correlated with *intrinsic motivation* stronger than that of *identified regulation*, making the association among the five types of motivation slightly deviated from the simplex pattern. Future studies, perhaps with qualitative research design, are suggested to examine the reasons why the two opposing types of motivation (*introjected regulation* and *intrinsic motivation*) had such positive and high correlations.

Thirdly, *external* and *introjected regulations* were shown in this study to associate positively with learning outcomes, contradicting SDT's theorizing. A test of *contextual support* on *internalization* also yielded insignificant results across a one-month time span. Longitudinal or cross-sectional studies with a greater time span are suggested to test the consequences of *external* and *introjected regulations* in the long run, as well as the long-term effect of *contextual support* on *internalization* in the online learning environment.

Lastly, two out of six SDT models, namely the *Expected Grade* and the *Perceived Learning* models did not yield proper fit. While testing alternative model structures is beyond the scope of this study, future efforts could be devoted to exploring alternative ways that *contextual support*, *need satisfaction*, *self-determination*, and the two *learning outcomes* interact in online learning contexts.

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Appendix A The Online Survey Instruments

Demographic Survey

1. Gender

   Male__ Female__
2. Age: __
3. Cohort: (semester/year you began program)

   Semester ___Year___
4. Courses for which you are currently enrolled

   a. _____ b. _____ c. _____
5. How many online courses have you taken before entering SETWEB or SPECTRUM?___
6. How many SETWEB or SPECTRUM courses have you taken before summer 2008?_____
7. What kind of job do you have while you are taking SETWEB or SPECTRUM courses?

   Full-time__ Part-time__ No job outside the home at this time__ Other (please specify)__

Instructions

The following questionnaires contain items about your learning experiences in your online course. **This survey is confidential**, however, for the purpose of data analysis, we must know which course you are referring to in completing this survey. **If you are currently enrolled in more than one online courses please select only one of them to complete this survey.**

*** The course that I choose to answer this survey is: _____**

*How many hours per week did you devote to this course?

1) Less than 2 hours;
2) 2-4 hours;
3) 4-6 hours;
4) 6-8 hours;
5) 8-10 hours;
6) More than 10 hours

*What grade do you expect to get for this course?

A__ B__ C__ D__ F__ I__

Please read the items carefully and choose the option that is closest to your **CURRENT** feelings. Please indicate how true the statement is for you, using the following scale as a guide for each item:

1	2	3	4	5	6	7
not at all true		somewhat true			very true	

Need Support

Perceived Autonomy Support Scale

1. I feel that my instructor provides me with useful choices and options.
2. I feel I can be open with my instructor in this course.
3. My instructor makes sure I really understand what is expected of me during the course.
4. My instructor encourages me to ask questions.
5. I place a lot of trust in my instructor.
6. My instructor listens to how I would like to do things.
7. I don't feel very good about the way my instructor talks to me.
8. My instructor tries to understand how I see things before suggesting a new way to do things.

Perceived Competency Support Scale

1. I always get timely help when I encounter technical problems.
2. My instructor or teaching assistant offers sufficient feedback on my course assignments.
3. I usually receive clear directions about how to finish my class activities and projects.
4. Whenever I have problems, I know I can ask other students in this online course.
5. The SETWEB/SPECTRUM technology orientation was helpful for my study.
6. My teacher or teaching assistant provides me with information about how to succeed in this online course.

7. I feel that my classmates help me learn.
8. The SETWEB/SPECTRUM technology orientation provided me with sufficient information.
9. My instructor or teaching assistant helps me whenever I encounter technical problems.
10. I feel that the technical support personnel provide me with sufficient information to solve problems.
11. My instructor or teaching assistant answers my questions in a timely manner.
12. My instructor or teaching assistant encourages me to be a self-motivated learner.
13. I have access to technical support at any time.
14. My instructor or teaching assistant encourages me to manage my time well.
15. I become more comfortable with computers through the help of the instructor, teaching assistant, classmates, and technical support personnel.

Need Satisfaction

Perceived Autonomy Scale

1. In this course I can decide in which activities I want to participate.
2. In this course I have a say regarding what skills I want to practice.
3. I feel that I am taking this online course of my own volition.
4. I have to force myself to do the course activities.
5. I feel a certain freedom of action in this online course.
6. I have some choice in what I want to do in this online course.

Perceived Competency Scale

1. I think I am very good at doing the work in this online course.
2. Compared to my peers, I think I am doing very well in this course.
3. After studying in this online course for awhile, I felt very competent.
4. I am satisfied with my performance in this online course.
5. I am very skilled in this online course.
6. I cannot do this course very well.

Perceived Relatedness Scale

1. I feel that my classmates care about each other.
2. I feel isolated in this online course.
3. I feel a sense of connection to my classmates.
4. I feel that this online course is like a happy family.
5. I feel that I can share my personal insecurities with my classmates.
6. I feel that my classmates understand me.
7. I feel reluctant to speak openly in this course.
8. I feel that I am an important member in this online course.
9. I feel that my classmates have similar personal goals.

Motivation

The Academic Motivation Scale

Reasons for Enrollment: I enrolled in "this" online course:

1. Because with my current degree I would not find a high-paying job later on.
2. Because I experience pleasure and satisfaction while learning new things.
3. Because I think that this online class will help me better prepare for the career I have chosen.
4. For the positive feeling I experience when I am communicating my own ideas to others.
5. Honestly, I don't know; I really feel that I am wasting my time in this class.
6. For the pleasure I experience while pushing myself in my studies.
7. To prove to myself that I am capable of completing this online program.
8. In order to obtain a more prestigious job later on.
9. For the pleasure I experience when I discover new things never seen before.
10. Because eventually, it will enable me to enter the job market in a field I like.
11. For the pleasure that I experience when I read interesting course content.
12. I once had good reasons for studying this online course; however, now I wonder whether I should continue.
13. For the pleasure that I experience while I am pushing myself in one of my personal accomplishments.
14. Because of the fact that when I succeed in this course I feel important.

15. Because I want to have “the good life” later on.
16. For the pleasure I experience in broadening my knowledge about subjects which appeal to me.
17. Because this will help me make a better choice regarding my career orientation.
18. For the pleasure I experience when I feel completely absorbed by what certain authors have written.
19. I can’t see why I attend this online course and frankly, I couldn’t care less.
20. For the satisfaction I feel when I am in the process of accomplishing difficult course activities.
21. To show myself that I am an intelligent person.
22. In order to have a better salary later on.
23. Because my studies allow me to continue to learn about many things that interest me.
24. Because I believe that a few additional years of education will improve my competence as a teacher.
25. For the “high” feeling that I experience while reading about various interesting subjects.
26. I don’t know; I can’t understand what I am doing in this online course.
27. Because this course allows me to experience a personal satisfaction in my quest for excellence in my studies.
28. Because I want to show myself that I can succeed in my studies.

Well-being/Learning Outcomes

Perceived Learning Scale

In this online course,

1. I learned to inter-relate the important issues in the course material.
2. I gained a good understanding of the basic concepts of the material.
3. I learned to identify central ideas of the course and distinguish them from less important information.
4. I developed the ability to remember facts and communicate clearly about the subject matter.
5. I improved my ability to develop generalizations from the course material.
6. I improved my ability to critically analyze concepts and ideas of the subject matter.

Course Satisfaction Scale

1. I am satisfied with the instructor.
2. I am satisfied with my interactions with classmates.
3. I am satisfied with the course activities.
4. I am satisfied with the technologies being used (e.g., WebCT website, video/audio, Horizon Chat, software resources…)
5. I am satisfied with the intellectual support being provided.
6. I am satisfied with the emotional or motivational support being provided.
7. I am satisfied with the technical support being provided.
8. Overall, this online course effectively presents the subject matter.
9. Overall, I am satisfied with this course.
10. I am satisfied with my own level of effort in this course.

Appendix B: The IRB Application Cover Page

Check One
New Application: ☒
Resubmission*: ☐ Revision ☐ (*All changes must be highlighted*)

**NOTE: A new application is required every five years.*

Human Subjects Office
University of Georgia
612 Boyd GSRC
Athens, GA 30602-7411
(706) 542-3199

IRB APPLICATION

MAIL 2 COPIES OF APPLICATION TO ABOVE ADDRESS

(*Check One*) Dr. ☒ Mr. ☐ Ms. ☐	(*Check One*) Dr. ☐ Mr. ☒ Ms. ☐
(*Check One*) Faculty ☒ Undergraduate ☐ Graduate ☐	(*Check One*) Faculty ☐ Undergraduate ☐ Graduate ☒
Robert Maribe Branch; 810 0853710	Kuan-Chung Chen; 8100954530
Principal Investigator **UGA ID – last 10 digits only**	**Co-Investigator** **UGA ID – last 10 digits**
Educational Psychology And Instructional Technology, Aderhold Hall, Room 630A	Educational Psychology And Instructional Technology, Aderhold Hall, Room 604
Department, Building and + Four (*Include department even if living off campus or out of town*)	**Department, Building and + Four**
Mailing Address (if you prefer not to receive mail in dept.)	**Mailing Address (if you prefer not to receive mail in dept.)**
706-542-4253; rbranch@uga.edu	(706) 247-5133; siderali@gmail.com
Phone Number (s) **E-Mail (REQUIRED)**	**Phone Number (s)** **E-Mail**
Robert Maribe Branch	Kuan-Chung Chen
****Signature of Principal Investigator**	**Signature of Co-Investigator** (*use additional cover sheets for more than one Co-Investigator*)

UGA Faculty Advisor:	Robert Maribe Branch	Edu. Psyc & Instructional Tech.630A	rbranch@uga.edu	706-542-4253
	Name	**Department, Bldg+ Four**	**E-Mail (REQUIRED)**	**Phone No.**

****Signature:** Robert Maribe Branch **Date:** 2 Apr 08 **UGA ID – last 10 digits only** 810 0853710

***Your signature indicates that you have read the human subjects guidelines and accept responsibility for the research described in this application.*

If funded: _____ _____
*****Sponsored Programs Proposal#** **Name of Funding Agency**

****By listing a proposal number, you agree that this application matches the grant application and that you have disclosed all financial conflicts of interest (see Q6a)*

TITLE OF RESEARCH: Contextual Support, Motivation, and Wellbeing in the Online Learning Environment: A Test of Self-Determination Theory

NOTE: SUBMIT 4-6 WEEKS PRIOR TO YOUR START DATE

APPROVAL IS GRANTED ONLY FOR 1 YEAR AT A TIME

CHECK ALL THAT APPLY:

Investigational New Drug ☐ **Exceptions to/waivers of Federal regulations** ☐
If yes to the above, provide details:

Data Sets ☒ **Existing Bodily Fluids/Tissues** ☐ **RP Pool** ☐ **Deception** ☐
Illegal Activities ☐ **Minors** ☐ **Moderate Exercise** ☐ **Audio/ Video taping** ☐
MRI/EEG/ECG/NIRS/Ultrasound/ Blood Draw ☐ **X-RAY/DEXA** ☐ **Pregnant Women/Prisoners** ☐

APPENDIX C: The Online Consent Form

I agree to participate in a research study titled "contextual Support, Motivation, and Wellbeing in the Online Learning Environment: A Test of Self-Determination Theory" conducted by Kuan-Chung Chen from the Department of Educational Psychology and Instructional Technology at the University of Georgia (706-247-5133) under the direction of Dr. Robert Maribe Branch, Department of Educational Psychology and Instructional Technology, University of Georgia (706-542-4253). I understand that my participation is voluntary. I can stop taking part without giving any reason, and without penalty. I can ask to have all of the information about me returned to me, removed from the research records, or destroyed. The following points have been explained to me:

1. The purpose of this study is to explore online students' motivation from the self-determination perspective. Specifically, this study focuses on how contextual support within an online program can bring any motivational changes.

2. The benefits are as follows: I will be able to reflect upon my interactions with people, and my motivational change during my study in the SETWEB/SPECTRUM program.

3. If I volunteer to take part in this study, I will be asked to do the following things:

   a. Complete an online survey.

   b. One month later, complete the survey again.

4. I understand that the survey may take about 10-15 minutes to finish.

5. No risks are expected.

6. The survey is confidential, and my identification will not be collected in this study. However, "There is a limit to the confidentiality that can be guaranteed due to the technology itself." (http://www.ovpr.uga.edu/hso/guidelines/13.html)

7. The researcher will answer any further questions about the research, now or during the course of the project, and can be reached by email (siderali@gmail.com) or telephone (706-247-5133).

I understand that by clicking on the "I agree to participate" button below, I am agreeing to take part in this research project. If I do not agree to participate, I can just close this browser window and leave this research site.

I agree to participate

Note: If your browser does not take you to the survey website after clicking on "I agree to participate," Please click HERE

Additional questions or problems regarding your rights as a research participant should be addressed to The Chairperson, Institutional Review Board, University of Georgia, 612 Boyd Graduate Studies Research Center, Athens, Georgia 30602-7411; Telephone (706) 542-3199; E-Mail Address IRB@uga.edu