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Editorial

Management Science

Donald G. Perrin

The printing press brought us out of the dark ages by making knowledge transportable and freely available. It made newspapers and recreational reading possible for the masses and stimulated a universal desire to learn how to read and write.

The industrial revolution increased productivity 100 fold through introduction of machines. Horse drawn barges moved the products to the cities for unprecedented low cost. Factories developed wealth that defied hand carriage of gold by stage coach and banking was born. The steam engine enabled factories to be set up anywhere, and gave us railroads and the internal combustion engine. Innovations in production and transportation changed the world and made goods and travel affordable for larger populations. In the process, dissidents in England became the trainers, educators and technocrats for the new economy.

Forests consumed to operate the factories were replaced by coal, coke, natural gas and petroleum. Electricity made energy transportable. Chemical energy (dry cells and rechargeable batteries) made it portable. Renewable energy resources such as hydroelectric, wind power and solar panels provide supplemental power for homes, businesses, factories, and places of learning.

Communications underwent its own genesis. Art was expanded by photography and theatre was enlarged through motion pictures. Messaging graduated from smoke signals, semaphore, couriers and town criers to electronic communications – Morse-code, telephone, phonograph, radio and television. Wire was supplemented and sometimes replaced by wireless communications.

The Hollerith (punch card) machine to store and process information was replaced by electronic computers. The mainframe with a network of dumb terminals became a distributed broadband network of powerful PCs. The ARPA defense network became the peoples' Internet and the computer stimulated its own revolution in the search for knowledge and ability to interactively share information in any electronic format. Expert systems, management science, artificial intelligence, and robotics represent the next wave of innovations.

Innovations and paradigm shifts have exponentially increased productivity compared to methods used before the industrial revolution. Business, industry, government, health care, military and community gain added benefits through Management Science which mathematically optimizes resources and processes for the greatest profit. Agriculture, manufacturing, transportation, communications, and energy continue to increase their productivity through management science and technology.

Now for my questions:

1. Is it possible to have the same increase in productivity in education (communications, intelligence, critical thinking, problem solving, teaching and learning) that we have seen in other sectors of the economy?
2. Is education as implemented today adequate to meet the human and technical needs of this and future generations?
3. Is collaboration and teamwork our preferred growth path because of finite limits and constraints for individual learning and human development?

Editor's Note: This in-depth analysis of research in self-regulated learning points to the need for well designed studies to fill gaps in the theory and praxis for adult learners and online education. There is evidence that self regulation is an important, if not essential skill for effective learning and performance.

Self-Regulated Learning in Online Education:
A Review of the Empirical Literature

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Abstract

The present article reviews the empirical literature on self-regulation in online education. The purpose of the article is to provide educational researchers and practitioners with an understanding of extant research on academic self-regulation and its influence on student success in online environments. Included in this review is a short discussion of the recent emergence of online learning as a viable alternative to traditional classroom instruction, as well as a critique of the empirical literature within the field of online distance education. This article addresses the applicability of employing a social cognitive view of self-regulation as a theoretical framework for understanding student success in online learning situations. The article concludes with a review of the empirical research on self-regulation in online education, including gaps in the literature and suggestions for future inquiry.

Keywords: distance learning, learning strategies, metacognition, motivation, online education, academic self-regulation, social cognitive theory.

Introduction

Distance education is hardly a new phenomenon in the United States. Since the development of the postal service in the 19th century, correspondence courses have provided distance education to students across the country (Phipps & Merisotis, 1999). This trend continued well into the 20th century with the advent of television and radio—media technologies that allowed for expanded opportunities to learn at a distance (Simonson, Smaldino, Albright, & Zvacek, 2003). Today, computer-mediated communications and the Internet have resulted in a "rapid and explosive development of interest in and discussion about distance education" (Moore, 2003a, p. xiii). Even prestigious universities who once shunned distance education are now making substantial investments in distance learning technologies (Larreamendy-Joerns & Leinhardt, 2006; Moore, 2003b). Concurrently, business and military organizations are attracted to the potential for computer-mediated distance learning to provide "anytime, anywhere" access to education and training, thereby greatly reducing training costs and increasing accessibility to training materials (Fletcher, Tobias, & Wisher, 2007).

Distance Education Defined

So what is distance education? Although a single unifying definition is difficult to locate in the literature, Moore and Kearsley (2005) have provided a comprehensive description of this unique educational phenomenon. In their view, "distance education is planned learning that normally occurs in a different place from teaching, requiring special course design and instruction techniques, communication through various technologies, and special organizational and administrative arrangements" (Moore & Kearsley, 2005, p. 2). This broad definition encompasses many different learning and teaching formats, including paper-based correspondence courses, audio and video conferencing, and computer-mediated instruction. Although these formats are distinct from one another, geographical separation of teacher and student tends to be the defining characteristic.

Online Distance Education

In the last decade, distance education has changed significantly with the advent of computer-mediated learning, two-way interactive video, online or Web-based learning, and a host of other learning technologies (Simonson et al., 2003). Today there is little doubt that the Internet has become the technology-of-choice for learning and teaching at a distance (Dabbagh & Bannan-Ritland, 2005). Much of this popularity stems from the fact that the Internet is an inherently flexible technology that can be applied in a variety of ways and in a plethora of educational contexts—from simple course administration and student management to teaching entire degree programs online (Wisher & Olson, 2003). Furthermore, the recent expansion of widespread broadband access has brought the Internet into millions of homes, schools, and businesses, thereby providing students and teachers with the opportunity to exploit the Internet's innate flexibility as a learning and teaching tool (Moore & Kearsley, 2005).

Almost without exception, institutions have recognized the Internet's value as an educational tool and are developing online distance learning programs. For example, a recent survey of 2,200 U.S. colleges and universities by the Sloan Consortium (2006) found that 96% of large institutions (greater than 15,000 total enrollments) have some online offerings; 62% of Chief Academic Officers rated learning outcomes in online education as the same or superior to traditional, face-to-face instruction; 58% of schools identified online education as a critical long-term strategy; and overall online enrollment increased from 2.4 million in 2004 to 3.2 million in 2005.

Likewise, the U.S. military has recognized the utility of online education. In 1999 the Office of the Under Secretary of Defense created a collaborative effort between the public and private sectors to develop the standards, tools, and learning content necessary to harness the power of information technologies to modernize military training (Advanced Distributed Learning, n.d.). Known as the Advanced Distributed Learning (ADL) initiative, this effort was designed to make education and training available to the military's more than three million personnel anytime, anywhere (Curda & Curda, 2003). Not surprisingly, online instruction is considered a critical component of the ADL initiative (Fletcher et al., 2007).

Research on Distance Education

Traditionally, research in the area of online education, specifically, and distance education, more generally, has focused on group comparisons; that is, online/distance learners versus traditional classroom students (Berge & Mrozowski, 2001; Bernard et al., 2004b; Phipps & Merisotis, 1999; Russell, 1999; Sitzmann, Kraiger, Stewart, & Wisher, 2006). With few exceptions, results from these studies suggest that, "the learning outcomes of students using technology at a distance are similar to the learning outcomes of students who participate in conventional classroom instruction" (Phipps & Merisotis, 1999, p. 1). Additionally, the attitudes and satisfaction of distance learners have been generally characterized as positive (Dabbagh & Bannan-Ritland, 2005; Hara & Kling, 1999).

Recently, however, several authors (Abrami & Bernard, 2006; Bernard, Abrami, Lou, & Borokhovski, 2004a; Bernard et al., 2004b; Dillon & Greene, 2003; Gibson, 2003; Perraton, 2000; Phipps & Merisotis, 1999; Saba, 2000) have identified major deficiencies in past research on distance learning. Along with a surplus of methodological problems, which have long plagued the empirical literature, two important issues have been identified. First, a large proportion of the distance education research has emphasized comparisons of achievement outcomes *between* groups of distance and traditional learners, at the expense of any consideration for *within* group variation in achievement and satisfaction among distance learners. Second, much of the research has lacked a theoretical or conceptual framework. In response to these problems, experts in the field of distance education (Abrami & Bernard, 2006; Bernard et al., 2004a, 2004b; Perraton,

2000; Phipps & Merisotis, 1999; Saba, 2000) have challenged researchers to (1) focus future studies on within group differences among distance learners; specifically, those attributes—motivational, cognitive, and otherwise—that contribute to success in distance learning environments; and (2) conduct research that is grounded in learning theory and which builds on the work of others.

Self-Regulated Learning

As online education has grown, so too has interest in academic self-regulation (Schunk & Zimmerman, 1998). Academic self-regulation, also known as self-regulated learning (SRL), has been defined as, "an active, constructive process whereby learners set goals for their learning and then attempt to monitor, regulate, and control their cognition, motivation, and behavior, guided and constrained by their goals and the contextual features of the environment" (Pintrich, 2000, p. 453). Self-regulated learners are generally characterized as active participants who efficiently control their own learning experiences in many different ways, including establishing a productive work environment and using resources effectively; organizing and rehearsing information to be learned; maintaining positive emotions during academic tasks; and holding positive motivational beliefs about their capabilities, the value of learning, and the factors that influence learning (Schunk & Zimmerman, 1994, 1998). Moreover, self-regulation is not an all-or-nothing phenomenon. Instead, students are self-regulating to the extent that they are cognitively, motivationally, and behaviorally involved in their own learning activities (Zimmerman, 2000b).

Recently, several scholars have suggested that SRL skills may be particularly important for students participating in online education (Dabbagh & Kitsantas, 2004; Garrison, 2003; Hartley & Bendixen, 2001; Schunk & Zimmerman, 1998). For example, Dabbagh and Kitsantas (2004) have argued that, "in a Web-based learning environment, students must exercise a high degree of self-regulatory competence to accomplish their learning goals, whereas in traditional face-to-face classroom settings, the instructor exercises significant control over the learning process and is able to monitor student attention and progress closely" (p. 40.). Likewise, in one of earliest discussions of self-regulation and its applicability to open learning environments, Kinzie (1990) identified self-regulatory skills as one of three critical requirements for student success. She concluded, in part, that the effective use of SRL strategies is essential in flexible learning situations due to the high degree of student autonomy resulting from the instructor's physical absence.

In general, investigators who study academic self-regulation are attempting to understand how students become masters of their own learning processes (Schunk & Zimmerman, 1994, 1998). Over the last three decades, scholars interested in academic self-regulation within traditional classrooms have consistently found moderate to strong positive relations between students' motivational engagement, their use of SRL strategies, and, ultimately, their academic achievement (Pintrich, 1999; Pintrich & De Groot, 1990; Pintrich & Garcia, 1991). For example, in one of the earliest studies to employ a SRL perspective, Pintrich and De Groot (1990) surveyed 173 seventh graders and found that higher levels of task value (i.e., the extent to which students find a task interesting, important, and/or valuable; Eccles & Wigfield, 1995) and self-efficacy (students' confidence in their ability to complete specific learning tasks; Bandura, 1997) were related to students' use of learning strategies. Furthermore, the researchers found that task value, self-efficacy, and learning strategies use were all correlated with higher levels of achievement, as measured by final course grades, essays and reports, and in-class seatwork.

Although there are various conceptualizations of academic self-regulation (for a review, see Boekaerts, Pintrich, & Zeidner, 2000), several researchers have found social cognitive models of SRL to be particularly useful in analyzing student success in online education (for a review, see Militiadou & Savenye, 2003). Social cognitive models highlight important motivational factors,

such as students' self-efficacy beliefs and goal orientation, as well as learning strategies that appear to benefit students in these highly independent learning situations. Furthermore, a number of investigators have recently emphasized the importance of social and environmental factors on student success in online education (e.g., Gunawardena & Zittle, 1997; Richardson & Swan, 2003). Consequently, a social cognitive perspective on self-regulation, which addresses the interrelationship between the learner, the learner's behavior, and the social environment (Bandura, 1986, 1997), appears to lend itself well to an understanding of how successful learners function in online situations.

Review of the Literature

The studies examined in this review were located by searching the publicly available literature from 1995 through 2006. Because the Internet has only recently become the technology-of-choice for learning and teaching at a distance (Moore & Kearsley, 2005), the search was limited to articles that were published after 1994. Electronic searches were performed using various queries, including, for example, self-regulat* AND online, self-regulat* AND Web, and self-regulat* AND distance. The following databases were searched: Academic Search Premier, ERIC, PsychARTICLES, Psychology and Behavioral Sciences Collection, PsycINFO, Web of Science, and Dissertation Abstracts on ProQuest. Once located, abstracts for each study were read and articles that were deemed relevant to the framework described above were retained. Retained articles were printed and read in their entirety.

Understanding the Relationships Between Variables

Much of the research on self-regulation in online education has focused on identifying the motivational, cognitive, and behavioral characteristics of effective self-regulated learners, as well as trying to understand how these components relate to each other and to other adaptive academic outcomes. Using primarily non-experimental, correlational methods, most studies have mirrored the earlier research on self-regulation in traditional classrooms (see, for example, Pintrich & De Groot, 1990; Pintrich & Garcia, 1991). In general, these investigations have attempted to discern if the relationships found in conventional classrooms generalize to online learning environments. Table 1 provides a summary of the non-experimental, correlational studies examined in this review.

Social cognitive theorists assume that effective self-regulation depends, in large part, on students' confidence in their ability to attain designated types of performances (i.e., their perceived self-efficacy; Bandura, 1997; Zimmerman, 2000a, 2000b). According to Schunk (2005), "self-regulated learners are more self-efficacious for learning than are students with poorer self-regulatory skills; the former believe that they can use their self-regulatory skills to help them learn" (p. 87). As such, researchers interested in using a social cognitive view of self-regulation to understand student performance in online settings have studied, more than any other construct, self-efficacy and its relations to other variables. Overall, results have revealed that when compared to their counterparts with lower perceived self-efficacy, efficacious students report more use of learning strategies (Artino & Stephens, 2006; Joo, Bong, & Choi, 2000); greater satisfaction with their learning experience (Artino, in press; Lim, 2001); increased likelihood of enrolling in future online courses (i.e., choice behaviors; Artino, in press; Lim 2001); and superior academic performance (Bell & Akroyd, 2006; Hsu, 1997; Joo et al., 2000; Lee, 2002; Lynch & Dembo, 2004; Wang & Newlin, 2002). For example, in one of the more comprehensive studies of self-efficacy and its relationship to academic performance, Bell and Akroyd (2006) surveyed 201 undergraduates enrolled in a variety of asynchronous online courses and found that

Table 1

Non-Experimental, Correlational Studies of Self-Regulation in Online Education

Author	Date	Sample	Online Context	Key Findings
Artino	in press	*n* = 204 military members	Self-paced, online training	Task value, self-efficacy, and prior experience with online learning were positive predictors of satisfaction, perceived learning, and intentions to enroll in future online courses.
Artino & Stephens	2006	*n* = 96; 42 graduates, 54 undergraduates	Asynchronous college courses	Task value and self-efficacy for learning and performance were positive predictors of cognitive and metacognitive learning strategies use.
Bell & Akroyd	2006	*n* = 201 undergraduates	Asynchronous college courses	Grade point average (GPA), expectancy, and an interaction term (GPA x expectancy) were positive predictors of academic performance.
DeTure	2004	*n* = 73 undergraduates	Asynchronous college courses	Online technologies self-efficacy and cognitive style were poor predictors of academic performance.
Hsu	1997	*n* = 169 undergraduates	Asynchronous college courses	Task value was positively related to metacognition, but only self-efficacy was positively related to academic performance.
Joo, Bong, & Choi	2000	*n* = 152 junior high school students	Web-based search task	Self-efficacy for self-regulated learning positively related to academic self-efficacy, cognitive strategy use, and Internet self-efficacy. Only academic and Internet self-efficacy were positively related to academic performance.
Lee	2002	*n* = 69 undergraduates	Asynchronous college courses	Task value was a significant predictor of satisfaction, whereas self-efficacy was the only significant predictor of academic performance.
Lim	2001	*n* = 235 graduates and undergraduates	Asynchronous college courses	Computer self-efficacy was a significant predictor of satisfaction and intentions to enroll in future online courses.
Lynch & Dembo	2004	*n* = 94 undergraduates	Courses with both face-to-face and asynchronous components	Self-efficacy for learning and performance and verbal ability significantly predicted academic performance.
Miltiadou	2000	*n* = 30 undergraduates	Asynchronous college courses	Online technologies self-efficacy negatively predicted academic performance. Task value and mastery goal orientation significantly predicted satisfaction.
Wang & Newlin	2002	*n* = 122 undergraduates	Synchronous and asynchronous college courses	Self-efficacy for online learning was positively correlated with academic performance.

students' self-efficacy[1] for learning and performance was among the three most powerful predictors of final course grade ($\beta = 1.65$, $p < .001$). Moreover, the researchers found that an interaction term (college grade point average [GPA] X self-efficacy) was also a significant individual predictor of final course grade ($\beta = -2.35$, $p < .001$), indicating that self-efficacy beliefs had a greater effect on course grade for students with lower GPAs.

Along with end-of-course grades, several investigators have used student satisfaction with online education as the outcome of interest since satisfaction has been shown to predict course drop-out rates, as well as students' intentions to enroll in future online courses (for a review, see Dabbagh & Bannan-Ritland, 2005; Moore & Kearsley, 2005; Simonson et al., 2003). For instance, in a study of student satisfaction and choice behaviors, Lim (2001) surveyed 235 adult learners at five American universities and found that computer self-efficacy, along with a linear combination of experiential variables, explained 15% of the variance in students' overall satisfaction and 12% of the variance in their intentions to enroll in future online courses. And while the effect sizes found in Lim's (2001) study are considered moderate (Cohen, 1988), Artino (in press) found much larger effects when attempting to predict military students' satisfaction (model $R^2 = .65$) and choice behaviors (model $R^2 = .40$) using a linear combination of students' prior experience, task value, and self-efficacy within the context of self-paced, online training (i.e., computer-based courses accessed through the Internet and completed without an instructor). In this case, however, self-efficacy for learning with self-paced, online training emerged as a significant individual predictor of satisfaction but not choice behaviors. On the other hand, task value—defined as the extent to which students find a task interesting, important, and/or valuable (Eccles & Wigfield, 1995)—was the strongest individual predictor of *both* satisfaction and choice behaviors. With respect to choice behaviors, these results are consistent with research conducted in traditional classrooms by Eccles and Wigfield (1995), who have shown that value beliefs tend to be better predictors of intentions to take future courses, as well as actual enrollment in those courses, than expectancy beliefs (e.g., self-efficacy).

Other researchers have attempted to use task value as a predictor of adaptive academic outcomes in online settings. In general, results have shown task value to be positively related to students' metacognition and use of learning strategies (Artino & Stephens, 2006; Hsu, 1997); overall satisfaction (Artino, in press; Lee, 2002); and future enrollment choices (Artino, in press). Unfortunately, only three of the studies reviewed (Artino, in press; Hsu, 1997; Lee, 2002) examined the extent to which task value related to academic performance and learning. In two of these studies (Hsu, 1997; Lee, 2002), the researchers failed to find a significant relationship between task value and course performance when self-efficacy was also included as a predictor. On the other hand, Artino (in press) found that task value was a strong individual predictor of students' *perceived* learning (partial $r^2 = .28$) when task value was included with self-efficacy and prior experience in a regression model (model $R^2 = .50$). In this case, however, the use of a self-report measure of learning was a significant limitation, as this type of subjective measure may bear little resemblance to more direct, performance-oriented outcomes (Mabe & West, 1982; Pace, 1990).

Although investigators have given some attention to the relationships between several motivational components of self-regulation and various academic outcomes (e.g., satisfaction,

[1] Bell and Akroyd (2006) utilized a self-efficacy scale from the Motivated Strategies for Learning Questionnaire (MSLQ; Pintrich, Smith, Garcia, & McKeachie, 1993). It is worth noting that the definition of self-efficacy used to develop the MSLQ's self-efficacy scale is a bit broader than other measures of self-efficacy, which usually limit themselves to assessing confidence in one's ability to attain designated types of performances and do not include expectancy for success (see Bandura, 1997). Accordingly, Bell and Akroyd (2006) referred to their self-efficacy scale as a measure of expectancy.

academic performance, and choice behaviors), very little research has been conducted on how these motivational components relate to students' academic behaviors, such as their use of cognitive and metacognitive learning strategies. Two exceptions are the studies conducted by Artino and Stephens (2006) and Joo et al. (2000). For example, using path analytic techniques, Joo et al. (2000) found that academic self-efficacy and self-efficacy for SRL both significantly and positively predicted students' self-reported use of cognitive and metacognitive learning strategies. However, contrary to expectations, neither cognitive nor metacognitive strategies use was related significantly to performance outcomes. Thus, the researchers failed to confirm their hypothesis that learning strategies use mediates the relationship between self-efficacy and student performance. Based on these results, the authors questioned the usefulness of self-reports of strategy use. Furthermore, they recommended that future studies employ more direct, behavioral indicators of learning strategies use to help clarify how students' motivational characteristics relate to their capacity to apply learning strategies in online environments.

In summary, findings from non-experimental, correlational studies seem to support results from research in traditional classrooms indicating that students' motivational beliefs about a learning task are related to positive academic outcomes. The existing research in this area, however, suffers from several limitations. First and foremost, results are strictly correlational in nature; therefore, one cannot infer causality from the observed relationships. Although, overall, the results suggest moderate to strong relations between motivational components and adaptive outcomes, the direction of influence between the variables is sometimes ambiguous. For example, although many of the study designs imply that academic performance results, in part, from students' motivational beliefs, these causal relations could be reversed. Hence, additional research is needed before the exact direction of operation of these social cognitive components can be fully understood.

Second, many of the studies reviewed have suggested that the performance outcomes employed suffered from range restriction, a significant issue in college courses where, often times, the majority of students receive a grade of either A or B. Range restriction has the effect of downwardly biasing the effect size (Cohen, Cohen, West, & Aiken, 2003). Therefore, the failure of several studies to find a significant relationship between motivational components of self-regulation and overall academic performance may have been exacerbated by the restricted range of the criterion measure. Considering this limitation, it is important that future studies utilize other measures of academic success, such as assessments of critical thinking skills and online engagement; outcomes than can be measured through content and discourse analysis of online discussion boards (Hara, Bonk, & Angeli, 2000; Jeong, 2003).

A third limitation of the extant research on self-regulation in online education is a failure to control for prior knowledge when attempting to understand the relations between task value and academic performance. As Tobias (1994) warned in his review of the literature on interest, "research is needed in which both interest and prior knowledge about the same topic are assessed so that the percentages of independent variance attributable to these two constructs may be determined" (p. 50). Because task value includes an interest component, this recommendation is particularly relevant to studies of online education that use task value as an independent variable.

Finally, the online learning literature is rather limited with respect to the student characteristics investigated. Although self-efficacy and task value have received some emphasis, none of the research reviewed considered the effects of other personal factors, such as different types of affect (mood and emotions); factors that social cognitive theoreticians consider critical to an understanding of individual performance in academic settings (Bandura, 1997; Linnenbrink & Pintrich, 2002; Pekrun, Goetz, Titz, & Perry, 2002).

Self-Regulation and Learner Control

Some researchers have examined how student differences and characteristics of the online environment interact with each other to influence learning. In many ways, these investigations mirror the classic Aptitude-Treatment Interaction (ATI) studies conducted by Cronbach and Snow (1977) that were designed to determine which instructional strategies are more or less effective for particular individuals with specific abilities. As a theoretical framework, ATI posits that optimal learning results when the instruction is closely matched to the aptitudes of the learner.

Using an ATI framework, Eom and Reiser (2000) examined the effects of Self Regulated Learner (SRL) strategies use on achievement and motivation in 37 sixth and seventh graders taking a computer-based course. Essentially, the authors were trying to determine how varying the amount of learner control within the computer-based course might effect the achievement and motivation of students who rated themselves as either high or low in SRL skills. Using a self-report instrument, students were classified as being either high or low self-regulated learners and then were randomly assigned to either a learner-controlled or program-controlled version of a computer-based course. Results revealed that, regardless of how students rated their SRL skills, learners in the program-controlled condition (i.e., learners who had very little control over their progression through the course), "scored significantly higher on a posttest than did learners in the learner-controlled condition" (Eom & Reiser, 2000, p. 247). Additionally, the researchers found that poorer performance in the learner-controlled condition was particularly evident in the students who rated themselves as low self-regulated learners. In fact, students who rated themselves as low in SRL skills scored higher on the posttest (approximately 76.4% higher) when taking the program-controlled condition as compared to the learner-controlled condition. Although this interaction was not statistically significant (perhaps due to inadequate power), the trend supported the researchers' hypothesis that students with low SRL skills are not as able to learn from computer-based courses that provide high quantities of learner control as students with high self-regulating skills.

In another ATI-type investigation, McManus (2000) attempted to determine what combinations of online course non-linearity (i.e., the extent to which learners were given the opportunity to proceed through the course in a non-linear fashion) and the use of advance organizers (i.e., the presence or absence of short overviews of new material at the beginning of each lesson) would work best for 119 undergraduates reporting different levels of self-regulation. Students' declarative knowledge was measured by a 12-item, multiple-choice test, and their procedural knowledge was measured by a 20-item, performance assessment. Although the researcher found no significant main effects or interactions, results revealed a near significant interaction between non-linearity and self-regulation ($p = .054$). According to McManus, these results "suggest that highly self-regulating learners learn poorly in mostly linear Web-based hypermedia learning environments, where they have very few choices, while medium self-regulating learners learn poorly in highly non-linear environments where they are given too many choices" (p. 219). Despite the non-significance of this interaction, the results are promising in that they suggest the ATI framework may be a useful approach that allows researchers to study how individual learner differences and features of the online environment interact with each other to influence learning and performance.

Taken together, the research on self-regulation and learner control in computer-based environments has failed to find statistically significant results. It is worth noting, however, that these studies, like many others, suffer from serious limitations. For example, in McManus's (2000) work, scores from the SRL sub-scales possessed marginal internal reliabilities (Cronbach's alphas ranged from .35 to .67), thereby compromising the ability of the study to uncover noteworthy effects (Thompson, 2003). Additionally, both studies reviewed here

attempted to study online instruction by utilizing instruments developed for traditional classrooms. Although some measurement instruments may work equally well in classroom and online settings, considering the differences between the two learning environments, an instrument that works well in the classroom may not be valid in online and/or computer-based learning situations (Tallent-Runnels et al., 2006). It is important, then, that future studies employ appropriate survey instruments that, at the very least, have been pilot tested in the learning environment of interest. Certainly, if the reliability and validity of the measurement instruments used in online education research are not assessed, findings based on those instruments are, at best, questionable (DeVellis, 2003; Tallent-Runnels et al., 2006; Thompson, 2003).

Supporting Self-Regulation in Online Learning Environments

Many experts believe that online learning environments require the learner to assume greater responsibility for the learning process (Dabbagh & Kitsantas, 2004; King et al., 2001; Schunk & Zimmerman, 1998). Furthermore, many of these same experts argue that self-regulatory skills are essential for success in these highly autonomous learning situations and that the development of these skills can be supported by Web-based pedagogical tools (WBPT; Azevedo, 2005; Dabbagh & Kitsantas, 2004; Zimmerman & Tsikalas, 2005). Accordingly, several researchers have attempted to determine the characteristics of effective WBPT, as well as the extent to which various self-regulatory skills might be supported and/or enhanced by these tools (see Table 2 for a summary of these studies). For example, Kramarski and Gutman (2006) randomly assigned 65 ninth graders to one of two online learning environments designed to teach mathematics: one with self-regulatory support (SRS) in the form of metacognitive questioning and the other without explicit support for self-regulation. Results showed that when pre- and post-test scores were compared, students in the SRS group significantly outperformed their counterparts in the non-supported group on all outcome measures, including performance on mathematical explanations, procedural and transfer tasks, and use of SRL strategies. In terms of effect sizes, post-test improvements in the SRS group were moderate on SRL strategies use (d = .45) to large on mathematical explanations (d = 2.24; Cohen, 1988).

Using a similar conceptual framework, Azevedo, Cromley, and Seibert (2004) confirmed the positive benefits of online self-regulatory support. In this case, however, the researchers randomly assigned 51 undergraduates to one of three computer-based scaffolding conditions: adaptive scaffolding (AS; i.e., a teacher or tutor who continuously diagnoses students' understanding), fixed scaffolding (FS), and no scaffolding (NS). Using a mixed-methods approach, the authors found that AS facilitated positive shifts in students' mental models (as assessed through the coding of student diagrams) significantly more than FS and NS. Furthermore, the researchers analyzed verbalizations of students' learning activities and found that a significantly larger number of participants in the AS condition planned their learning, monitored their progress, and used learning strategies. Results from this study were particularly noteworthy because the authors used both qualitative and quantitative methods to analyze both performance and process data.

In summary, results from this line of research have been promising and suggest the following practical and theoretical implications: (1) Web-Based Pedagogical Tools (WBPT) can be an effective way to support and/or enhance students' self-regulatory skills (Azevedo et al., 2004; Dabbagh & Kitsantas, 2005; Kauffman, 2004; Kramarski & Gutman, 2006; Niemi, Nevgi, & Virtanen, 2003); (2) adaptive scaffolding appears to be more effective in supporting students self-regulatory processes and academic performance than fixed or no scaffolding (Azevedo et al., 2004); (3) different types of WBPTs support different self-regulatory processes (Dabbagh & Kitsantas, 2005; Kauffman, 2004; Kramarski & Gutman, 2006); and (4) WBPTs may be more effective for novice learners with under-developed self-regulatory skills than for veteran learners with more advanced SRL skills (Niemi et al., 2003).

Table 2

Studies of Computer-Based Tools Designed to Support Students' Self-Regulation

Author	Date	Sample	Online Context	Key Findings
Azevedo, Cromley, & Seibert	2004	*n* = 51 undergraduates	Hypermedia learning course	Adaptive scaffolding (AS) facilitated shifts in students' mental models significantly more than fixed scaffolding (FS) and no scaffolding (NS). Students in the AS condition used more SRL strategies than students in the FS and NS conditions.
Dabbagh & Kitsantas	2005	*n* = 65 graduates	Asynchronous college courses	Different types of Web-based pedagogical tools (WBPT) supported different SRL processes. Content creation and delivery tools supported the SRL processes of goal setting, help seeking, self-evaluations, and task strategies; collaborative and communication tools supported goal setting, time planning and management, and help seeking; and assessment tools supported task strategies, self-monitoring, and self-evaluation.
Kauffman	2004	*n* = 119 undergraduates	Online WebQuest*	The cognitive strategy prompting (i.e., note-taking) had the strongest influence on achievement. Self-efficacy building feedback and self-monitoring prompts had modest effects on achievement.
Kramarski & Gutman	2006	*n* = 65 ninth graders	Online mathematics course	Compared to students in the course without self-regulatory support, students in the course supported with self-metacognitive questioning significantly outperformed their counterparts in math explanations, procedural tasks, transfer tasks, and use of self-monitoring strategies.
Niemi, Nevgi, & Virtanen	2003	*n* = 108 undergraduates	Asynchronous college courses	The online virtual tutor was most useful for students who had difficulties in learning, were at an early stage in their university studies, and who had unstable SRL skills. Additionally, the tool worked best when the teacher gave guidance on how to properly employ it.

**Note*. A WebQuest is an inquiry-based instructional tool designed to facilitate search and synthesis of information from multiple sources (Dodge, 1997 as cited in Kauffman, 2004).

In terms of research quality, these self-regulatory scaffolding studies tended to use superior research methods when compared to much of the empirical work on self-regulation in online education. For example, in three of five WBPT studies, researchers randomly assigned participants to treatment and control/comparison groups, thereby enhancing the internal validity of their experiments and improving their ability to establish causal relationships (Shadish, Cook, & Campbell, 2002). Additionally, all of the investigators used multiple outcome measures and employed both qualitative and quantitative methods to analyze their data. Taken together, these studies have taken a positive step toward improving the methodological quality of research in online distance education (Abrami & Bernard, 2006; Bernard et al., 2004a).

Conclusions

Clearly, more well-designed research is needed on self-regulation and its influence on student success in online learning environments. To date, most studies in this burgeoning field have been descriptive in nature and have suffered from numerous methodological limitations. Despite these limitations, however, the studies reviewed here seem to support the linkages between students' motivational beliefs about a learning task, their use of learning strategies, and their performance in online settings. Furthermore, although the empirical support is thin, it appears that highly self-regulated learners may have more success in learner-controlled environments than their peers with poorer self-regulatory skills. Finally, some of the highest quality research in online education seems to indicate that providing students with self-regulatory scaffolding can be an effective instructional method—one that instructional designers might do well to consider including as integral to their online courses.

Ultimately, the existing empirical literature supports the trends established in research with more traditional classrooms; specifically, that self-regulation is an important, if not essential skill for effective learning and performance (Miltiadou & Savenye, 2003; Schunk & Zimmerman, 1994, 1998). Therefore, future research should continue to explore self-regulation in online education, with the intent of determining which instructional elements, as well as which existing personal characteristics, behaviors, and attitudes, contribute to achievement in and satisfaction with this emergent form of instruction (Bernard et al., 2004).

References

Abrami, P. C., & Bernard, R. M. (2006). Research on distance education: In defense of field experiments. *Distance Education, 24*(1), 5-26.

Advanced Distributed Learning. (n.d.). *History of ADL*. Retrieved June 4, 2007, from http://www.adlnet.gov/about/history.aspx

Artino, A. R. (in press). Online military training: Using a social cognitive view of motivation and self-regulation to understand students' satisfaction, perceived learning, and choice. *Quarterly Review of Distance Education*.

Artino, A. R., & Stephens, J. M. (2006). Learning online: Motivated to self-regulation? *Academic Exchange Quarterly, 10*(4), 176-182.

Azevedo, R. (2005). Using hypermedia as a metacogntive tool for enhancing student learning? The role of self-regulated learning. *Educational Psychologist, 40*, 199-209.

Azevedo, R. Cromley, J. G., & Seibert, D. (2004). Does adaptive scaffolding facilitate students' ability to regulate their learning with hypermedia? *Contemporary Educational Psychology, 29*, 344-370.

Bandura, A. (1986). *Social foundations of thought and action: A social cognitive theory*. Englewood Cliffs, NJ: Prentice Hall.

Bandura, A. (1997). *Self-efficacy: The exercise of control*. New York: W. H. Freeman and Company.

Bell, P. D., & Akroyd, D. (2006, October). Can factors related to self-regulated learning predict learning achievement in undergraduate asynchronous web-based courses? [Electronic version]. *International Journal of Instructional Technology and Distance Learning, 3*(10), 5-16.

Berge, Z. L., & Mrozowski, S. (2001). Review of research in distance education, 1990 to 1999. *The American Journal of Distance Education, 15*(3), 15-19.

Bernard, R. M., Abrami, P. C., Lou, Y., & Borokhovski, E. (2004a). A methodological morass? How we can improve quantitative research in distance education. *Distance Education, 25*(2), 175-198.

Bernard, R. M., Abrami, P. C., Lou, Y., Borokhovski, E., Wade, A., Wozney, L., Wallet, P. A., Fiset, M., & Huang, B. (2004b). How does distance education compare with classroom instruction? A meta-analysis of the empirical literature. *Review of Educational Research, 74*, 379-439.

Boekaerts, M., Pintrich, P. R., & Zeidner, M. (Eds). (2000). *Handbook of self-regulation*. San Diego: Academic.

Cohen, J. (1988). *Statistical power analysis for the behavioral sciences* (2nd ed.). Hillsdale, NJ: Lawrence Earlbaum Associates.

Cohen, J., Cohen, P., West, S. G., & Aiken, L. S. (2003). *Applied multiple regression/correlation analysis for the behavioral sciences* (3rd ed.). Mahwah, NJ: Lawrence Erlbaum Associates.

Cronbach, L. J., & Snow, R. E. (1977). *Aptitudes and instructional methods.* New York: Irvington.

Curda, S. K., & Curda, L. K. (2003). Advanced distributed learning: A paradigm shirt for military education. *The Quarterly Review of Distance Education, 4*, 1-14.

Dabbagh, N., & Bannan-Ritland, B. (2005). *Online Learning: Concepts, strategies, and application*. Upper Saddle River, NJ: Pearson Education, Inc.

Dabbagh, N., & Kitsantas, A. (2004). Supporting self-regulation in student-centered Web-based learning environments. *International Journal on E-Learning, 3*(1), 40-47.

Dabbagh, N., & Kitsantas, A. (2005). Using Web-based pedagogical tools as scaffolds for self-regulated learning. *Instructional Science, 33*, 513-540.

DeTure, M. (2004). Cognitive style and self-efficacy: Predicting student success in online distance education. *The American Journal of Distance Education, 18*(1), 21-38.

DeVellis, R. F. (2003). *Scale development: Theory and applications* (2nd Ed.). Thousand Oaks, CA: Sage Publications.

Dillon, C., & Greene, B. (2003). Learner differences in distance learning: Finding differences that matter. In M. G. Moore and W. G. Anderson (Eds.), *Handbook of distance education* (pp. 235-244). Mahwah, NJ: Lawrence Erlbaum Associates.

Eccles, J., & Wigfield, A. (1995). In the mind of the actor: The structure of adolescents' achievement task values and expectancy-related beliefs. *Personality and Social Psychology Bulletin, 21*, 215-225.

Eom, Y., & Reiser, R. A. (2000). The effects of self-regulation and instructional control on performance and motivation in computer-based instruction. *International Journal of Instructional Media, 27*(3), 247-261.

Fletcher, J. D., Tobias, S., & Wisher, R. A. (2007). Learning anytime, anywhere: Advanced distributed learning and the changing face of education. *Educational Researcher, 36*, 96-102.

Garrison, D. R. (2003). Self-directed learning and distance education. In M. G. Moore and W. G. Anderson (Eds.), *Handbook of distance education* (pp. 161-168). Mahwah, NJ: Lawrence Erlbaum Associates.

Gibson, C. C. (2003) Learners and learning: The need for theory. In M. G. Moore and W. G. Anderson (Eds.), *Handbook of distance education* (pp. 147-160). Mahwah, NJ: Lawrence Erlbaum Associates.

Gunawardena, C. N., & Zittle, F. J. (1997). Social presence as predictors of satisfaction within a computer-mediated conferencing environment. *The American Journal of Distance Education, 11*(3), 8-26.

Hara, N., Bonk, C. J., & Angeli, C. (2000). Content analysis of online discussion in an applied educational psychology course. *Instructional Science, 28*, 115-152.

Hara, N., & Kling, R. (1999). Students' frustrations with a Web-based distance education course. *First Monday, 4*(12). Retrieved December 7, 2005, from http://www.firstmonday.org/issues/issue4_12/hara/index.html

Hartley, K., & Bendixen, L. D. (2001). Educational research in the Internet age: Examining the role of individual characteristics. *Educational Researcher, 30*(9), 22-26.

Hsu, J. T. (1997). Value, expectancy, metacognition, resourced management, and academic achievement: A structural model of self-regulated learning in a distance education context. *Dissertation Abstracts International,* 59(5), 1458. (UMI No. 9835152)

Jeong, A. C. (2003). The sequential analysis of group interaction and critical thinking in online threaded discussions. *The American Journal of Distance Education, 17*(1), 25-43.

Joo, Y., Bong, M., & Choi, H. (2000). Self-efficacy for self-regulated learning, academic self-efficacy, and Internet self-efficacy in Web-based instruction. *Educational Technology Research and Development, 48*(2), 5-17.

Kauffman, D. F. (2004). Self-regulated learning in Web-based environments: Instructional tools designed to facilitate cognitive strategies use, metacognitive processing, and motivational beliefs. *Journal of Educational Computer Research, 31*, 139-161.

King, F. B., Young, M. F., Drivere-Richmond, K., & Schrader, P. G. (2001). Defining distance learning and distance education. *Association for the Advancement of Computing in Education Journal, 9*(1), 1-14.

Kinzie, M. B. (1990). Requirements and benefits of effective interactive instruction: Learning control, self-regulation, and continuing motivation. *Educational Technology Research and Development, 38*(1), 5-21.

Kramarski, B, & Gutman, M. (2006). How can self-regulated learning be supported in mathematical e-learning environments? *Journal of Computer Assisted Learning, 22*, 24-33.

Larreamendy-Joerns, J., & Leinhardt, G. (2006). Going the distance with online education. *Review of Educational Research, 76*, 567-605.

Lee, C. (2002). The impact of self-efficacy and task value on satisfaction and performance in a Web-based course. *Dissertation Abstracts International, 63*(05), 1798. (UMI No. 3054599)

Lim, C. K. (2001). Computer self-efficacy, academic self-concept, and other predictors of satisfaction and future participation of adult distance learners. *The American Journal of Distance Education, 15*(2), 41-51.

Linnenbrink, E. A., & Pintrich, P. R. (2002). Achievement goal theory and affect: An asymmetrical bidirectional model. *Educational Psychologist, 37*, 69-78.

Lynch, R., & Dembo, M. (2004). The relationship between self-regulation and online learning in a blended learning context. [Electronic version]. *International Review of Research in Open and Distance Learning, 5*(2).

Mabe, P. A., & West, S. G. (1982). Validity of self-evaluation of ability: A review and meta-analysis. *Journal of Applied Psychology, 67*(3), 280-296.

McManus, T. F. (2000). Individualizing instruction in a Web-based hypermedia learning environment: Nonlinearity, advance organizers, and self-regulated learners. *Journal of Interactive Learning Research, 11*, 219-251.

Miltiadou, M. (2000). Motivational constructs as predictors of success in the online classroom. *Dissertation Abstracts International, 61*(9-A), 3527. (UMI No. 9987898)

Miltiadou, M., & Savenye, W. C. (2003). Applying social cognitive constructs of motivation to enhance student success in online distance education. *Association for the Advancement of Computing in Education Journal, 11*(1), 78-95.

Moore, M. G. (2003a). The book in brief: Overview. In M. G. Moore and W. G. Anderson (Eds.), *Handbook of distance education* (pp. xiii-xxiii). Mahwah, NJ: Lawrence Erlbaum Associates.

Moore, M. G. (2003b). Preface. In M. G. Moore and W. G. Anderson (Eds.), *Handbook of distance education* (pp. ix-xii). Mahwah, NJ: Lawrence Erlbaum Associates.

Moore, M. G., & Kearsley, G. (2005). *Distance education: A systems view* (2nd ed.). Belmont, CA: Wadsworth.

Niemi, H., Nevgi, A., & Virtanen, P. (2003). Towards self-regulation in Web-based learning. *Journal of Educational Media, 28*, 49-72.

Pace, C. R. (1990). *The undergraduates: A review of their activities and progress in college in the 1980's*. Los Angeles, CA: Center for the Study of Evaluation, University of California, Los Angeles.

Pekrun, R., Goetz, T., Titz, W., & Perry, R. P. (2002). Academic emotions in students' self-regulated learning and achievement: A program of qualitative and quantitative research. *Educational Psychologist, 37*, 99-105.

Perraton, H. (2000). Rethinking the research agenda [Electronic version]. *International Review of Research in Open and Distance Learning, 1*(1), 1-11.

Phipps, R., & Merisotis, J. (1999). *What's the difference? A review of contemporary research on the effectiveness of distance learning in higher education*. Washington, DC: The Institute for Higher Education Policy.

Pintrich, P. R. (1999). The role of motivation in promoting and sustaining self-regulated learning. *International Journal of Educational Research, 31*, 459-470.

Pintrich, P. R. (2000). The role of goal orientation in self-regulated learning. In M. Boekaerts, P. R. Pintrich, and M Zeidner (Eds.), *Handbook of self-regulation* (pp. 451-502). San Diego: Academic.

Pintrich, P. R., & DeGroot, E. V. (1990). Motivational and self-regulated learning component of classroom academic performance. *Journal of Educational Psychology, 82*, 33-40.

Pintrich, P. R., & Garcia, T. (1991). Student goal orientation and self-regulation in the college classroom. In M. L. Maehr and P. R. Pintrich (Eds.), *Advances in motivation and achievement: Goals and self-regulatory processes* (Vol. 7, pp. 371-402). Greenwich, CT: JAI.

Pintrich, P. R., Smith, D. A. F., Garcia, T., & McKeachie, W. J. (1993). Reliability and predictive validity of the Motivated Strategies for Learning Questionnaire (MSLQ). *Educational and Psychological Measurement, 53*, 801-813.

Richardson, J., & Swan, K, (2003). Examining social presence in online courses in relation to students' perceived learning and satisfaction. *Journal of Asynchronous Learning Networks, 7*(1) 68-88.

Russell, T. L. (1999). *The no significant difference phenomena*. Chapel Hill, NC: Office of Instructional Telecommunications, North Carolina State University.

Saba, F. (2000). Research in distance education: A status report [Electronic version]. *International Review of Research in Open and Distance Learning, 1*(1), 1-9.

Schunk, D. H. (2005). Self-regulated learning: The educational legacy of Paul R. Pintrich. *Educational Psychologist, 40*, 85-94.

Schunk, D. H., & Zimmerman, B. J. (Eds.). (1994). *Self-regulation of learning and performance: Issues and educational applications*. Hillsdale, NJ: Lawrence Erlbaum Associates.

Schunk, D. H., & Zimmerman, B. J. (Eds.). (1998). *Self-regulated learning: From teaching to self-reflective practice.* New York: The Guilford Press.

Shadish, W. R., Cook, T. D., & Campbell, D. T. (2002). *Experimental and quasi-experimental designs for generalized causal inference*. Boston: Houghton-Mifflin.

Simonson, M., Smaldino, S., Albright, M., & Zvacek, S. (2003). *Teaching and learning at a distance*. Upper Saddle River, NJ: Pearson Education.

Sitzmann, T., Kraiger, K., Stewart, D., & Wisher, R. A. (2006). The comparative effectiveness of Web-based and classroom instruction: A meta-analysis. *Personnel Psychology, 59*, 623-664.

The Sloan Consortium. (2006, November). *Making the grade: Online education in the United States, 2006*. Retrieved March 14, 2007, from http://www.sloan-c.org/publications/survey/pdf/making_the_grade.

Tallent-Runnels, M. K., Thomas, J. A., Lan, W. Y., Cooper, S., Ahern, T. C., Shaw, S. M, & Liu, X. (2006). Teaching courses online: A review of the research. *Review of Educational Research, 76*(1), 93-135.

Thompson, B. (2003). Understanding reliability and coefficient alpha, really. In B. Thompson (Ed.), *Score reliability: Contemporary thinking on reliability issues* (pp. 3-24). Mahwah, NJ: Sage.

Tobias, S. (1994). Interest, prior knowledge, and learning. *Review of Educational Research, 64*, 37-54.

Wang, A. Y., & Newlin, M. H. (2002). Predictors of Web-student performance: The role of self-efficacy and reasons for taking an on-line class. *Computers in Human Behavior, 18*, 151-163.

Wisher, R. A., & Olson, T. M. (2003). *The effectiveness of Web-based instruction* (United States Army Research Institute for the Behavioral and Social Sciences Publication No. 1802). Alexandria, VA: Author.

Zimmerman, B. J. (2000a). Attaining self-regulation: A social cognitive perspective. In M. Boekaerts, P. R. Pintrich, and M Zeidner (Eds.), *Handbook of self-regulation* (pp. 13-39). San Diego, CA: Academic.

Zimmerman, B. J. (2000b). Self-regulation and academic learning: Self-efficacy enhancing interventions. In M. Boekaerts, P. R. Pintrich, and M Zeidner (Eds.), *Handbook of self-regulation* (pp. 631-649). San Diego, CA: Academic.

Zimmerman, B. J., & Tsikalas, K. E. (2005). Can computer-based learning environments (CBLEs) be used as self-regulatory tools to enhance learning? *Educational Psychologist, 40*, 267-271.

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Editor's Note: This article studies how Chinese adult learners view the teaching style preferences of their instructors. In the process it explores the relationship of pedagogy and andragogy and raises additional questions for research.

Adult Learners' Perceptions of the Teaching Preferences of Online Instructors

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Abstract

This study was an investigation of adult learners' perceptions of the teaching preferences of online instructors in Beijing, China. Data were collected from a large sample of 358 participants who took online courses in Beijing, China to determine their perceptions of the teaching preferences of their online instructors. Conti's (1983, 2004) survey instrument was adopted and modified to fit this study. The results of the study showed that Chinese adult learners' online instructors used a linear pedagogical model to teach adult learners although there were some andragogical elements used in instruction of adult learners in cyberspace in China. Different models of teaching were discussed in this study.

Keywords: pedagogy, andragogy, cyberspace, teaching preferences, perceptions, online courses, online instructors, constructivist, problem-based learning, model.

Introduction

Although the history of distance education in China is as long as the history of distance education in the West, online teaching in China did not formally begin until the outbreak of "Severe Acute Respiratory Syndrome (SARS) in 2003. Prior to 2003, scholars, educators and the general public frowned upon online teaching. Anyone who obtained an online degree from a Western industrialized country was despised. The outbreak of SARS initiated the change. To control the spread of SARS, the Ministry of Education and relevant regions, cities, and schools suspended classroom teaching and implemented distance teaching (Yang, 2003). To guarantee that students could continue their learning off campus, the China Education Television Station opened the channel "Classroom of the Air." Other forms of distance education including online teaching played a vital role. The Beijing Municipal Education Commission opened a website titled "Online Classroom." Following this initiative, some colleges and universities throughout China used their campus networks to carry out online education. However, putting classroom teaching on computer screens did not make adequate use of the interactive and diversified features of online learning.

Online education requires teaching strategies that are different to traditional classroom teaching. In addition to the widely accepted teaching strategies such as constructivist approaches (Brooks & Brooks, 1993) and problem-based learning (PBL) models (Duch, 2005), the andragogical approach to online teaching is believed to be highly effective among adult learners (Wang, 2005). This andragogical approach is derived directly from principles of andragogy, which put adult learners' experience and interests above everything else. Do online instructors in China use the same strategies preferred by their Western counterparts to achieve greater learning outcomes such as learners' personal transformation and emancipation (Freire, 1970, 1973)? For a long time, outsiders speculate that education including online education in China tends to emphasize knowledge, content, teacher-centered classrooms and exam results (Boyle, 2000). In the West, online education favors critical thinking skills, realistic use of knowledge, student-centered

classrooms and processes of learning. Adult learners regardless of which culture they are from, may possess the same needs, same interests and possibly the same rich reservoir of prior experience. When it comes to online learning, they deserve the same quality instruction. What is under researched is that online instructors in China may still be using their traditional methods to teach adult learners on the internet to promote desired outcomes in human capabilities (Wang & Colletta, 1991). Do adult learners in China agree to these methods of instruction online?

With these remarks, the researcher is especially interested in finding out how adult learners in China perceive the teaching preferences of online instructors. To seek answers, the following question was formulated: what are the teaching preferences Chinese online instructors from their students' perspectives in terms of

- Andragogical approach to teaching versus
- Pedagogical approach to teaching in the electronic classroom?

A basic understanding of how online teaching is practiced in a different social context can assist both faculty and administrators in effectively addressing online education in the academy in the 21st century. To meet the needs and interests of adult learners, their perceptions are important to faculty and administrators who shoulder the responsibility of planning and delivering effective online programs. The purpose of this study was to determine the teaching preferences of online instructors from the lens of Chinese adult learners.

Theoretical Framework

Online teaching has transformed the way students enroll in courses and complete degree programs. Because of the synchronous and asynchronous nature of online teaching and learning, adult learners obtain their college degrees without making physical trips to campuses. Instead of commuting or traveling to a college or university for face-to-face courses, an adult learner is only a click away from a wide variety of courses and degree programs at a wide range of tuition rates (Rhoda, 2005, p. 150). Because today's adult learners are filled with the demands of an occupation, household tasks, family obligations, and childcare responsibilities, numerous studies indicate that adult learners seek the convenience and flexibility of online teaching in the pursuit of a college degree. The traditional mode of teaching, which normally works well with children, does not apply to the adult learners' facilitation of online learning.

Knowles (1975) predicted that teaching of adults in the 21st century would be delivered electronically. The de-institutionalization of education, in the form of open and independent learning systems would take away the four walls of a classroom. The backbone of an online program is the technology that delivers the online curricula. Self-directed adult learners who do not need much direction and support may choose to take online courses (Wang, 2005). To help these learners learn in cyberspace, Knowles (1970, 1973, 1975, 1984, 1986, 1998, and 2005) produced a formula based on his redefinition of andragogy, which was originally coined in 1833 in Germany, Europe. Applied to the 21st century online teaching, Knowles's formula is to:

- Set a cooperative online learning climate.
- Create mechanisms for mutual planning online.
- Enable the formulation of learning objectives online based on the diagnosed needs and interests.
- Design online sequential activities for achieving the objectives.
- Execute the design by selecting methods, materials, and resources for online learning.

- Evaluate the quality of the learning experience while re-diagnosing needs for further online learning.

A closer examination of Knowles's formula shows clearly that this kind of online teaching is drastically different from pedagogy, which is defined as the art and science of teaching children. For online teaching, adult learners' needs, interests, mutual planning and cooperative mode of learning take center stage, whereas online instructors' own teaching preferences may become secondary.

Characteristics of Adult Learners

Characteristics of adult learners are directly derived from principles of adult education. Since these principles are universal, they apply to adult learners in any social settings. Naturally, characteristics of adult learners in one culture should not be drastically different from those in other cultures. The very first principle is the need to know. Because of this principle, adult learners are goal-oriented learners (Houle, 1961). Once they are enrolled in a course, adult learners know what goals to attain. The second principle is self-concept, indicating that adult learners are capable of teaching themselves. The third principle is prior experience. Over the years, adult learners have accumulated a reservoir of life experience that can serve as the best resources for learning. The fourth principle is orientation to learning and the fifth principle is readiness to learn. Because of these principles, adult learners are practical learners. They focus on the aspects of a lesson related to their lives. Their learning is relevancy-oriented. In other words, adult learners tend to focus on learning that can be applied to their work and lives. The last principle is motivation to learn. Instructors know for sure that adult learners are primarily motivated by internal motivators such as self-esteem, quality of life, job satisfaction etc. although external motivators are still useful to some extent (Knowles, Holton III & Swanson, 1998, 2005).

In addition to these generic characteristics of adult learners recognized in the literature, Bash (2003) identified two more characteristics based on his observation. One characteristic is that adult learners are more likely to express their sense of urgency than their younger fellow students. The other characteristic is that adult learners tend to have higher motivation than their younger fellow students.

Numerous research and studies have revealed similar yet different characteristics that are worth noting. For example, adult learners usually bring to class all the anxiety they need. Adult learners may be limited in flexibility because of their multiple roles or of mindsets (Wang, 2006).

Adult Learners' Perceptions of Teaching Orientations of Online Instructors

Because adult learners have control over their own learning especially in the electronic classroom, they expect their instructors to involve them in planning the process of learning. This is true in all cultures and China is no exception. To satisfy their need to know, adult learners want their instructors to get their perspectives about what topics to cover and let them work on projects that reflect their interests. Because of their rich life experiences, adult learners expect their instructors to connect teaching/learning to their knowledge/experience base. If instructors fail to draw out adult learners' experience and knowledge relevant to the topic, adult learners feel that their experience is not being valued (Knowles, Holton III & Swanson, 1998, 2005). Therefore, they may feel disappointed. Because adult learners are goal-oriented, they appreciate online educational programs that are well-organized and have clearly defined goals for learning. Instructors who can show adult learners how classes can help them attain their educational goals are often rated as the best instructors in the realm of adult learning. Adult learners may not be willing to learn anything new if their instructors fail to demonstrate a relationship between

coursework and "real life" for the students (Bash, 2003). In other words, adult learners want their instructors to address relevancy to learning. Adult learners may not be interested in knowledge for its own sake. Instead, they focus on the aspects of a lesson most useful to them in their work or personal life. In terms of respect, adult learners enjoy those instructors who acknowledge the wealth of experiences that they bring to the electronic classroom. If they are allowed to voice their opinions freely in class, they feel that they are respected.

To accommodate the generic characteristics of adult learners, newer teaching models have emerged in recent years in the realm of online teaching and these models are generally welcomed by adult learners. The Problem-Based Learning (PBL) model enhances learning that is different from lecture based learning and is usually predicted on self-directed learning and collaboration (Duch, 2005). Learners are supposed to teach themselves what they need to know to solve a real problem. Another popular approach features constructivist approaches to teaching which focus on helping adult learners realize their own experience in a collaborative but critical way (Brookfield, 2000). This approach has to do with the recent rise of transformative learning theory. According to this theory, adult learners are supposed to make meaning out of their own experience in a critical manner in order to achieve perspective transformation (Mezirow, 2000; Cranton, 1994; King, 2005; Wang & King, 2006, 2007).

Numerous studies show these online approaches to teaching work well with adult learners simply because they take into consideration adult learners' special characteristics. Adult learners generally frown upon approaches that work well with children because they are different from children. To teach children, instructors have to structure and control the learning process. To help adults learn, instructors are expected to be learning facilitators, resource persons, and process managers. Based on this difference between teaching children and helping adults learn, online teaching becomes effective if it features syllabus-based projects, learning activities, and teaching tools that are designed to create collaborative learning environments and relevant experiences for students (Wang & Kreysa, 2006).

Methodology

Participants

Of the 15.8 million non-traditional learners in China (Chinese Learners, 2004), those who live in the cities have taken at least one or two courses on the internet in addition to taking courses via other forms of distance education programs. Adult learners in Beijing have taken more courses on the internet since the outbreak of SARS. Therefore, these learners are more familiar with online teaching in China. Like their Western counterparts, these adult learners come from all walks of life in Beijing. Participants selected for this study were identified as bone fide non-traditional learners because they were all between 29 and 62 years of age. They took online courses to realize one common goal: to obtain a college degree for their professional development. They all perceived online teaching as important because it directly affects their personal transformation and emancipation. In China, a college degree is viewed as a passport to modern society. Those without a college degree are looked down upon in Chinese society.

To collect data for this study, survey research was utilized. Creswell (2003) identified survey research as generalizing from a sample to a population so that inferences can be made about some characteristics, attitude, or behavior of this population. Among its many advantages, survey research is well suited for situations where breadth over depth of information is needed as an end result of research being conducted (Hill, 2001). To deal with adult learners' perceptions of online teaching, this type of research is suited for this study. In the summer of 2007, the researcher made a survey available to 389 adult learners who were taking online courses in Beijing, China. 358 (92%) of these adult learners volunteered to respond to the survey instrument. The response rate

was high given the nature of survey research. They did not realize the benefits of taking online courses until the outbreak of SARS in 2003 in Beijing.

Instrument

Conti's (1983, 2004) survey instrument is designed to promote the use of andragogy (student-centered teaching) in any teaching settings especially where teachers help adults learn in cyberspace. Because Westerners recognize a distinction between education of children and education of adults, it is all the more important that teachers use the correct method of teaching. This instrument is also designed to determine the general instructional modes of teachers. The modes of teaching can be andragogical or pedagogical depending on one's particular social contexts, teaching philosophies, culture, and administrative preferences. Many experts believe that teaching adult learners online in China should comply with the use of andragogy or collaborative learning process to achieve the best learning outcomes. The andragogical mode of instruction corroborates this collaborative learning process. Therefore, it is appropriate to use this survey instrument. To make the instrument fit the particular Chinese teaching settings, one item in the instrument was changed and six more items were added to include a more andragogical/pedagogical nature of teaching characterized by learning contracts, rote learning, memorization and heavy emphasis on knowledge transmission.

The survey utilizes a Likert scale from five to zero with five being the highest (support for the concept in the factor name) and zero the lowest (support for the opposite concept). The alpha reliability coefficient for the instrument was .94. (N of cases = 358, N of items = 50).

The survey instrument is comprised of seven factors: Learner-Centered Activities; Personalizing Instruction; Relating Experience; Assessing Student Needs; Climate Building; Participation in the Learning Process; and Flexibility for Personal Development. The seven factors comprise the basic elements that make up an instructor's general teaching mode of instruction. High mean scores for factors represent support for the concept implied in the factor name. Low mean scores indicate support for the opposite concept. If a score nears the mean score (2.5), it may indicate support for the concept implied in the factor name; it may also indicate support for the opposite concept.

Data analysis

Data collected in this study were analyzed using SPSS (14.0 for Windows) software. Since the survey instrument contains both positive and negative items, different values are assigned to these items. For positive items, the following values are assigned: "always" equals five, "almost always" equals four, "often" equals three, "seldom" equals two, "almost never" equals one and "never" equals zero. For negative items, the following values are assigned: "always" equals zero, "almost always" equals one, "often" equals two, seldom" equals three, "almost never" equals four and "never" equals five. Omitted items are assigned a neutral value of 2.5.

Analysis was conducted for each item in the research question. For descriptive statistics, mean scores and standard deviations were reported for participants' responses. To provide a better picture of the population surveyed, the overall scale mean scores and standard deviations were also calculated. The findings were entered into tables and figures, and a narrative was developed to report the findings.

Findings

The tables presented below summarize the analysis of survey results on each of the seven factors of Conti's (1983, 2004) instrument. The mean responses for these participants on each of the seven factors are presented in separate tables. Each of the seven factors contains several items that make up the instructor's learner-centered or teacher-dominated teaching methods. The standard deviation scores for these participants are also provided in the tables. For a better picture of the population surveyed, the overall scale mean scores and standard deviations were also included.

Table 1

Mean Responses: Adult Students' Responses on Factor 1
N = 389, n = 358

Factor 1: Learner-Centered Activities Responses	M	SD
2. My instructor uses appropriate forms of disciplinary action when it is needed.	2.31	1.27
4. My instructor encourages me to adopt middleclass values.	3.02	1.42
11. My instructor determines the educational objectives of each of his/her students.	2.50	1.03
12. My instructor plans units that differ as widely as possible from the students' socio-economic backgrounds.	2.30	1.18
13. My instructor gets me to motivate myself by confronting me during group discussions.	1.90	0.89
16. My instructor uses one basic teaching method because he/she has found that most adults have similar learning styles.	2.50	1.15
19. My instructor uses written tests to assess the degree of academic growth rather than to indicate new directions for learning.	2.50	0.87
21. My instructor uses what history has proven that adults need to learn as his/her chief criteria for planning learning episodes.	2.30	1.15
29. My instructor uses methods that foster quiet, productive deskwork.	2.20	1.10
30. My instructor uses tests as his/her chief method of evaluating students.	1.90	1.10
38. My instructor uses materials that were originally designed for students in elementary and secondary schools.	3.10	1.16
40. My instructor measures my long-term educational growth by comparing my total achievement in class to my expected performance as measured by national norms from standardized tests.	2.87	1.35
50. My instructor believes memorization can foster greater autonomy in thinking.	3.46	1.20

Table 1 summarizes the responses for survey items pertaining to the learner-centered activities approach to teaching. Table 1 shows that Chinese online instructors had low scores in seven of the thirteen variables, slightly high scores in three of the variables and three high scores that make up Factor 1. These results suggest that Chinese online instructors supported a teacher-centered methodology, rather than student centered teaching. They favored formal testing over informal evaluation techniques and relied heavily on standardized tests. They emphasized teaching knowledge in class. They exercised disciplinary action when needed, and determined the educational objectives for each student. They tended to practice one basic method of learning. Above all, they believed memorization could foster greater autonomy in thinking.

Table 2

Mean Responses: Adult Students' Responses on Factor 2

N = 389, n = 358

Factor 2: Personalizing Instruction Responses	M	SD
3. My instructor allows senior students more time to complete assignments when I need it.	2.70	1.16
9. My instructor uses lecturing as the best method of presenting subject material to adult students.	1.88	0.57
17. My instructor uses different teaching techniques depending on the students being taught.	3.20	0.94
24. My instructor lets me work at my own pace regardless of the amount of time it takes me to learn a new concept.	2.23	1.18
32. My instructor gears his/her instructional objectives to match my abilities and needs.	3.00	0.94
35. My instructor allows my motives for participating in continuing education to be a major determinant in the planning of learning objectives.	3.10	0.74
37. My instructor gives all students in class the same assignment on a given topic.	1.78	0.95
41. My instructor encourages competition among students.	1.78	1.13
42. My instructor uses different materials with different students.	2.90	0.84
49. My instructor encourages a search for real-life examples, develops assignments related to real-life situations and embeds the content of his/her course in everyday life.	2.37	0.87

Table 2 summarizes responses to the survey items pertaining to the personalizing instruction approach to teaching. Table 2 indicates that Chinese online instructors had low scores in five of the ten variables and high scores in five of the ten variables that comprise Factor 2. These results indicate that Chinese online instructors engaged in a variety of practices that personalize learning to meet the unique needs of each student. Objectives were based on individual methods and abilities. Instruction was self-paced. However, they tended to favor the lecture method, and assigned the same assignment on a given topic. They did not encourage a search for real-life examples, develop assignments related to real-life situations and embed the content of the course in everyday life.

Table 3

Mean Responses: Adult Students' Responses on Factor 3

N = 389, n = 358

Factor 3: Relating to Experience Responses	M	SD
14. My instructor plans learning episodes to take into account my prior experience.	3.44	0.83
31. My instructor plans activities that will encourage my growth from dependence on others to greater independence.	3.21	0.74
34. My instructor encourages me to ask questions about the nature of their society.	2.98	1.25
39. My instructor organizes adult learning episodes according to the problems that I encounter in everyday life.	3.21	0.99
43. My instructor helps students relate new learning to my prior experiences.	4.10	0.89
44. My instructor teaches units about problems of everyday living.	3.20	0.82

Table 3 summarizes responses to the survey items pertaining to the relating to experience approach to teaching. Table 3 indicates that Chinese online instructors had very high scores in all six of the variables in Factor 3. These results show that Chinese online instructors planned learning activities that take into account their students' prior experiences and encouraged students to relate their new learning to prior experiences. To make learning relevant, learning episodes were organized according to the problems that the students encounter in everyday living. Students were encouraged to ask basic questions about the nature of their society.

Table 4

Mean Responses: Adult Students' Responses on Factor 4

N = 389, n = 358

Factor 4: Assessing Student Needs Responses	M	SD
5. My instructor helps me diagnose the gaps between my goals and my present level of performance.	2.70	1.09
8. My instructor participates in the formal counseling of students.	3.22	0.84
23. My instructor has individual conferences with me to help me identify my educational needs.	3.00	1.15
25. My instructor helps me develop short-range as well as long-range objectives.	3.10	0.91

Table 4 summarizes responses to the survey items pertaining to the assessing student needs approach to teaching. Table 4 indicates that Chinese online instructors had high scores in Factor 4, Assessing Student Needs. These results show that Chinese online instructors treated students as adults and attempted to find what each student wants and needs to know. They relied on individual meetings and informal counseling. They diagnosed existing gaps between a student's goals and the present levels of performance. They assisted students in developing short-range as well as long-range objectives.

Table 5

Mean Responses: Adult Students' Responses on Factor 5

N = 389, n = 358

Factor 5: Climate Building Responses	M	SD
18. My instructor encourages dialogue among my students.	3.97	0.87
20. My instructor utilizes the many competencies that most adults already possess to achieve educational objectives.	3.24	0.79
22. My instructor accepts errors as a natural part of the learning process.	4.11	0.82
28. My instructor allows me to take periodic breaks during class.	4.14	0.95
48. My instructor designs activities that build my self-esteem and sense of accomplishment while delivering course content.	3.30	1.23

Table 5 summarizes responses to the survey items pertaining to the climate building approach to teaching. Table 5 shows that Chinese online instructors had high scores in the five variables. The results suggest that Chinese online instructors established a friendly and informal climate as the first step in their andragogical model. Dialogue and interaction with other students was encouraged. Barriers were eliminated by using the numerous competencies that learners already possess as building blocks for educational objectives. Risk taking was encouraged, and errors

were accepted as a natural part of the learning process. Learners could experiment and explore elements related to their self-concept and practice interpersonal skills. Failures served as a feedback device to direct future positive learning.

Table 6

Mean Responses: Adult Students' Responses on Factor 6|
N = 389, n = 358

Factor 6: Participation in the Learning Process	M	SD
1. My instructor allows me to participate in developing the criteria for evaluating my performance in class.	1.78	1.17
10. My instructor arranges the classroom so that it is easy for students to interact.	3.30	0.97
15. My instructor allows me to participate in making decisions about the topics that will be covered in class.	2.00	1.05
36. My instructor has me identify my own problems that need to be solved.	3.11	1.03
45. My instructor negotiates curricular priorities with me at the beginning of each course he/she teaches.	2.13	1.09
46. My instructor uses learning contracts when assessing my learning.	1.09	1.10
47. My instructor involves me when planning lessons.	1.14	1.11

Table 6 summarizes responses to the survey items pertaining to the participation in the learning process approach to teaching. Table 6 indicates that Chinese online instructors had four low scores and three high scores in the seven variables that make up Factor 6. These results suggest that Chinese online instructors had students identify the problems they wished to solve. An adult-to-adult relationship between teacher and students was encouraged. However, they did not involve the students in developing the criteria for evaluating classroom performance. They did not negotiate curricular priorities with students or use learning contracts when assessing students' learning. They never involved students when planning lessons. They did not allow students to participate in making decisions about the topics that would be covered in class.

Table 7

Mean Responses: Adult Students' Responses on Factor 7
N = 389, n = 358

Factor 7: Flexibility for Personal Development Responses	M	SD
6. My instructor provides knowledge rather than serve as a resource person.	1.80	0.78
7. My instructor sticks to the instructional objectives that he/she writes at the beginning of a program.	1.50	0.97
26. My instructor maintains a well-disciplined classroom to reduce interference to learning.	1.30	0.42
27. My instructor avoids discussion of controversial subjects that involve value judgments.	2.60	1.62
33. My instructor avoids issues that relates to my self-concept.	2.00	1.41

Table 7 summarizes responses to the survey items pertaining to the flexibility for personal development approach to teaching. Table 7 shows that Chinese online instructors had low scores in all five variables that comprise Factor 7. The results show that Chinese online instructors viewed themselves as providers of knowledge rather than

facilitators. They determined the objectives for the students at the beginning of the program and adhered to them regardless of the idiosyncrasies that may have arisen from divergent student needs. A well-disciplined classroom was viewed as a stimulus for learning.

Table 8

Mean Responses: All 358 Adult Students' Responses on Seven Factors
N = 389, n = 358

All Factors	M	SD
1. Learner-Centered Activities	2.53	1.14
2. Personalizing Instruction	2.49	0.93
3. Relating to Experience	3.36	0.92
4. Assessing Student Needs	3.00	1.00
5. Climate Building	3.75	0.93
6. Participation in the Learning Process	2.08	1.07
7. Flexibility for Personal Development	1.84	1.04

Table 8 shows that the Chinese online instructors had low scores on items pertaining to four of the seven factors. Table 8 indicates that Chinese online instructors had low scores in Factor 1, Factor 2, Factor 6 and Factor 7. They had high scores in other factors. These results show that although they taught Online courses to some extent in an andragogical manner such as relating to experience, assessing student needs, and building climate, their classroom techniques did not focus upon the learner or include learner-centered activities. Their score in Factor 7 indicates that these participants opposed the collaborative mode of instruction. They viewed themselves as providers of knowledge rather than facilitators. They never used Western educational approaches such as negotiating curricular priorities with students, or using learning contracts. They valued memorization as a great teaching technique. Above all, these Chinese online instructors welcomed this rigidity and lack of sensitivity to the individual.

Discussion

The purpose of this study was to determine and describe the teaching preferences of online instructors from the lens of Chinese adult learners. The findings of this study showed that the 358 adult students surveyed believed that their online instructors basically supported a teacher-centered (pedagogical) approach to teaching in cyberspace although these adult students thought that their online instructors supported a student-centered (andragogical) approach to teaching to some extent.

In terms of the pedagogical approach, these Chinese online instructors tended to favor formal testing over informal evaluation techniques and relied heavily on standardized tests. They emphasized knowledge and tended to practice one basic method of learning. They believed memorization could foster greater autonomy in thinking. Further, these online instructors tended to favor the lecture method and assigned the same assignment on a given topic. They did not encourage a search for real-life examples, develop assignments related to real-life situations and embed the content of the course in everyday life. In terms of the learning process, Chinese online instructors did not involve their adult students in developing the criteria for evaluating classroom performance. They did not negotiate curricular priorities with students or use learning contracts when assessing students' learning. They never involved students when planning lessons. They did not allow students to participate in making decisions about the topics that would be covered in

class. Above all, these online instructors viewed themselves as providers of knowledge rather than facilitators. They thought a well-disciplined classroom was a stimulus for learning.

Judging from these survey results, one cannot help but conclude that Chinese online instructors do not treat adult students as adults. The methods they use to teach these adult learners are highly pedagogical. These methods should work well with the education and training of children. These survey results confirmed Western scholars' speculation regarding online teaching in that online education in China tends to emphasize knowledge, content, teacher-centered classrooms and exam results. Because of the overemphasis on these teaching methods, Chinese online instructors cannot get out of these teaching modes. From the Chinese adult learners' perceptions regarding their online instructors' teaching strategies, a linear model has emerged from this study which helps our readers see clearly that this pedagogical model is detrimental to adult learning rather than conducive to adult learning in cyberspace.

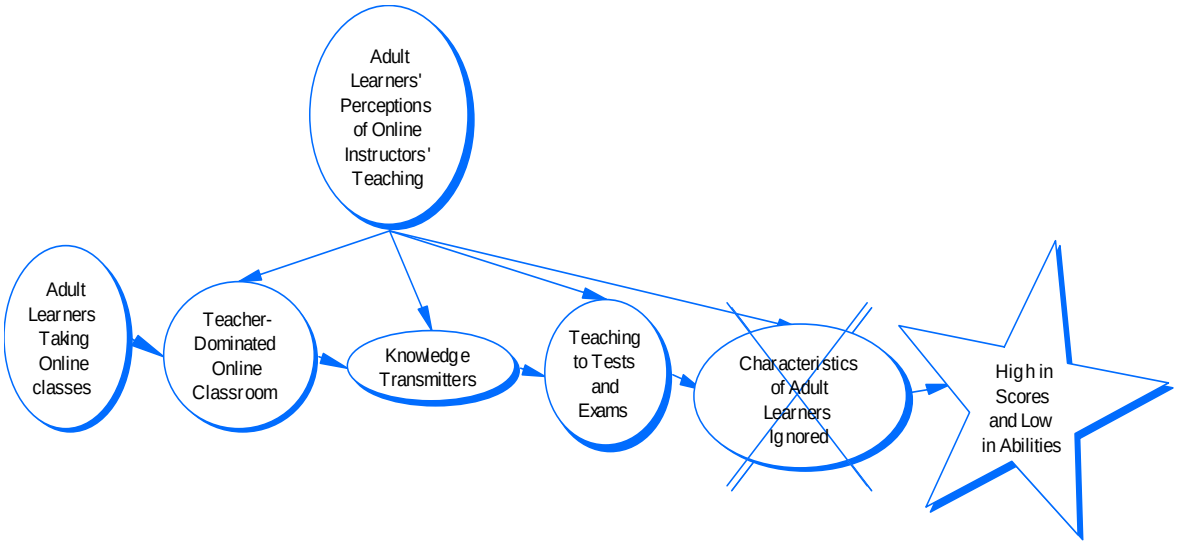

Figure 1. Pedagogical Model

On the other hand, in keeping with the andragogical approach to teaching, Chinese adult students' online instructors applied relating to experience, assessing student needs and climate building approaches to teaching in cyberspace. Specifically, they planned learning activities that took into account their students prior experiences and encouraged students to relate their new learning to prior experience. They attempted to find what each student wanted and needed to know by relying on individual meetings and informal counseling. They also diagnosed gaps between a student's goals and the present levels of performance. They established a friendly and informal climate as the first step in their andragogical model. To be exact, Chinese online instructors eliminated barriers by using numerous competencies that learners already possessed as building blocks for educational objectives. They encouraged risk taking and they accepted errors as a natural part of the learning process. They viewed failures as a feedback device to direct future positive learning.

Compared with their pedagogical approaches to teaching, these andragogical approaches are just small steps in helping adult learners learn. Therefore, these small steps are not powerful enough to override Chinese online instructors' strong preference for their pedagogical approaches to teaching in cyberspace. These pedagogical approaches to teaching are characterized by heavily emphasizing knowledge, content, teacher-centered classrooms and exam results. These methods are believed to result in students' high in scores and low in abilities (Ross, 1992). And of course,

this is in striking contrast to Western andragogical (democratic) approaches to teaching that are characterized by negotiating curricular priorities with adult students, giving out learning contracts, informal evaluation and emphasizing the collaborative learning process etc. These methods are believed to lead to students' autonomy in thinking (Wang, 2005). Numerous studies show that the andragogical model (see andragogical model below) is conducive to adult learning in cyberspace.

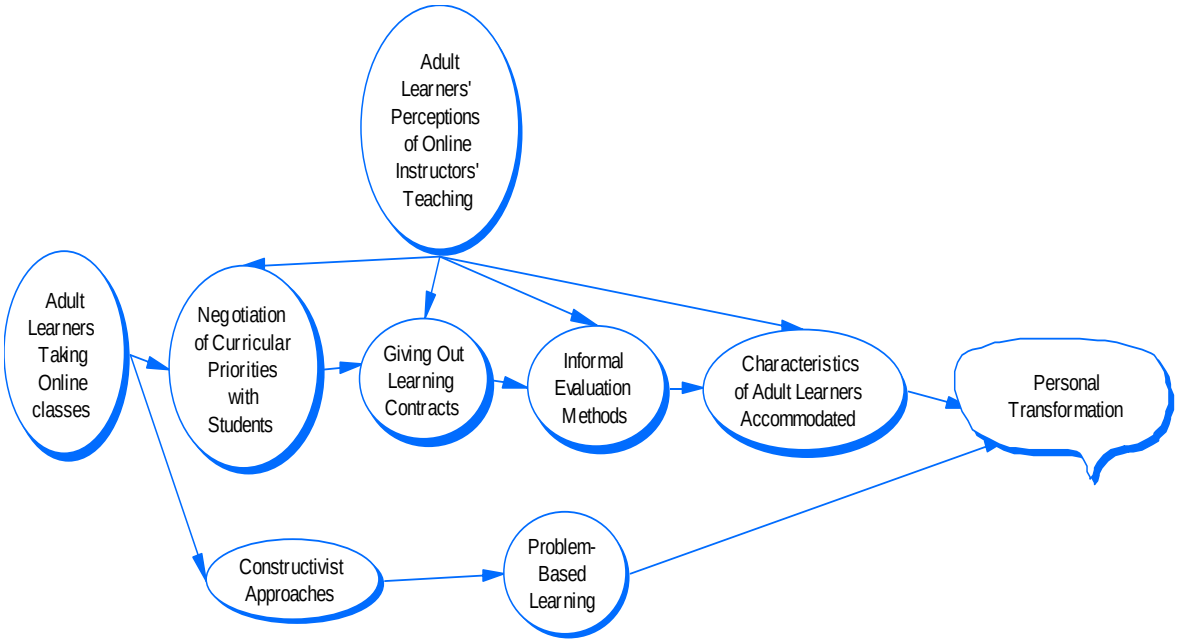

Figure 2. Andragogical Model

This model tells us that teaching andragogically is the way adult learners expect their online instructors to help them learn in the online learning environment. The methods derived from this model are democratic approaches to teaching. More importantly, these methods take into consideration adult learners' interests and experience. In other words, adult learners' characteristics are accommodated and adult learners are treated as adults instead of children. This model is better than the pedagogical model because it is a holistic model instead of a linear model. The end result of this model is that learners are personally transformed and emancipated as a result of online collaborative learning.

In light of these findings, online instructors should be encouraged to learn from this study. Given the nature of adult learners in any society, they should not be taught pedagogically. Although andragogy is not the only way in helping adult learners learn in cyberspace, it has proved to be effective in helping adult learners achieve personal transformation and emancipation. Educators and scholars often talk about different approaches to online education but may fail to incorporate them in their online teaching. This study has clearly shown that in cyberspace there is a pedagogical approach to teaching. There is also andragogical approach to teaching. When it comes to the transformation and emancipation of adult learners, andragogy is the style and method online instructors should employ instead of pedagogy. Pedagogy can be detrimental to adult learners as it does not adequately take into consideration their prior experience, interests and readiness to learn.

Implications for Meaningful Theory and Practice

Since academic courses were put on computer screens, the issue of online teaching has ignited a tremendous amount of research in the 21st century. Adult learners need online transformation and emancipation in order to fulfill their personal dream to obtain a college degree in cyberspace that will enhance their professional development. Therefore, their perceptions of the teaching preferences of their online instructors cannot be ignored. Given the characteristics of adult learners, they wish to be taught in a certain way. A linear model of teaching prescribed by higher authorities or inherited from a certain teaching culture may not be what today's adult learners want. Adult learners are drastically different from children in that they have accumulated a rich reservoir of experience. They have different interests from children. Because of their multiple roles in society, they have a sense of urgency in learning. They bring clear learning objectives to the online classroom. They are more motivated to learn than children. Given these special characteristics of adult learners, the theory of andragogy may be the right model to guide today's online instructors in helping adult learners learn. To adopt a wrong model may be detrimental to learning. However, this is not to say that the theory of pedagogy should be totally ignored in cyberspace learning environment. Wang's (2006) research indicated that educators and practitioners should follow Wang's graph derived from Hersey and Blanchard's (1969) situational leadership style model.

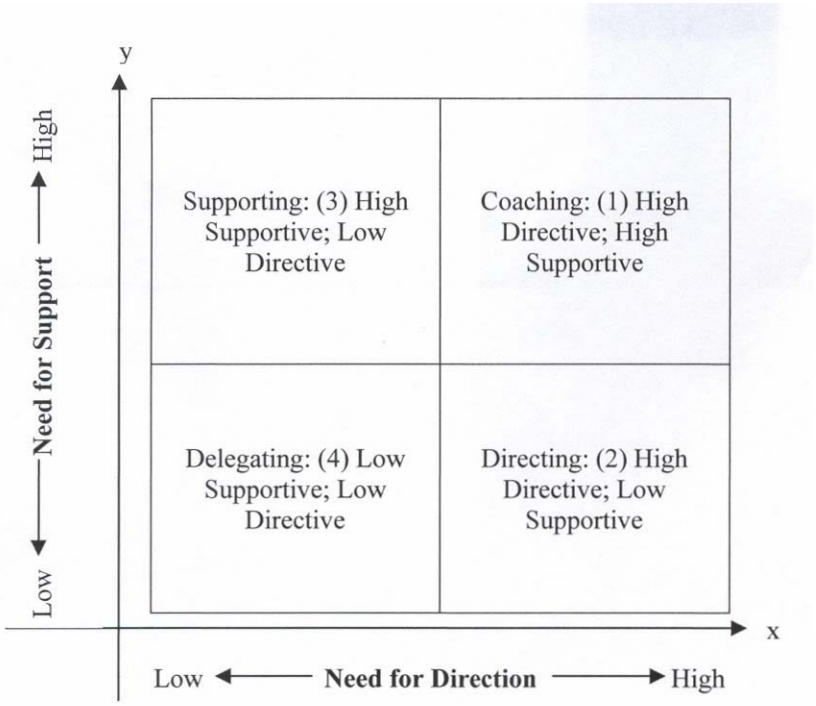

Figure 3. Wang's Graph

Since children have more need for direction and more need to support, their instructors need to be coaches. Since adult learners have less need for direction and less need for support, they expect their instructors to be delegators by using Western democratic approaches to teaching. If their instructors coach by teaching to exams and heavy lecturing, they will frustrate adult learners. On the whole, according to this study, adult learners expect their online instructors to stay in cell 4 (Delegating: Low Supportive; Low Directive) in order to achieve meaningful practice in cyberspace teaching and learning. However, should their online instructors occasionally stay in

other cells because of learning speed, convenience or learning styles, this does not invalidate the requested andragogical model of teaching (Knowles, Holton III & Swanson, 1998, 2005). Rather, this may enhance the andragogical model.

Further research is needed to look in depth into the issue of pedagogy versus andragogy in terms of cyberspace teaching and learning. In-depth interviews and observations are needed to find out why Chinese adult learners perceived online teaching as pedagogical rather than andragogical in the Chinese social context and to what extent andragogy should be applied in the future.

References

Bash, L. (2003). *Adult learners in the academy*. Bolton, MA: Anker Publishing Company, INC.

Boyle, J. (2000). Education for teachers of English in China. *Journal of Education for Teaching*, 26(2), 147-155.

Brookfield, S. D. (2000). The concept of critically reflective practice. In A. L. Wilson & E. R. Hayes (Ed.). *Handbook of Adult and Continuing Education* (pp. 33-49). San Francisco: Jossey-Bass.

Brooks, J., & Brooks, M. (1993). *In search of understanding: the case for constructivist classrooms*. Alexandria, VA: Association for Supervision and Curriculum Development.

Chinese learners in institutions of higher learning: Number one in the world. (2004, December). Retrieved May 23, 2007, from http://news.creaders.net/headline/newsPool/2A223764.html

Conti, G. (1983). *Principles of adult learning scale*. Retrieved March 22, 2007, from http://www.okstate.edu/education/ses/hraepals.html

Conti, G. (2004). Appendix B: principles of adult learning scale. In M. Galbraith (Ed.), *Adult learning methods: A guide for effective instruction* (pp. 87-91). Malabar, Florida: Krieger Publishing Company.

Cranton, P. (1994). *Understanding and promoting transformative learning*. San Francisco: Jossey-Bass.

Creswell, J. W. (2003). *Research design: Qualitative, quantitative, and mixed methods approaches*(2nd ed.). Thousand Oaks, California: Sage Publications, Inc.

Duch, B. (2005). Problem-based learning. Retrieved January 11, 2007, from http://www.udel.edu/pbl/

Freire, P. (1970). *Pedagogy of the oppressed*. New York: Seabury Press.

Freire, P. (1973). *Education for critical consciousness*. New York: Seabury Press.

Hersey, P., & Blanchard, K. (1969). Management of organizational behavior: Utilizing human resources. Englewood Cliffs, NJ: Prentice-Hall.

Hill, R. B. (2001) Survey research. In E. I. Farmer & J. W. Rojewski (Eds.), *Research pathways: Writing professional papers, theses, and dissertations in workforce education* (pp. 201-222). New York: University Press of America, Inc.

Houle, C. O. (1961). *The inquiring mind*. Madison: University of Wisconsin Press.

King, K. P. (2005). *Bringing transformative learning to life.* Krieger: Malabar Fl.

Knowles, M. S. (1970). *The modern practice of adult education: Andragogy versus pedagogy*. New York: Association Press.

Knowles, M. S., & Hulda, F. (1973). *Introduction to group dynamics*. Chicago: Follett.

Knowles, M. S. (1975). *Self-directed learning*. New York: Association Press.

Knowles, M. S. (1984). *Andragogy in action*. San Francisco: Jossey-Bass.

Knowles, M. S. (1986). *Using learning contracts*. San Francisco: Jossey-Bass.

Knowles, M. S., Holton III, E., & Swanson, A. (1998). *The adult learner.* Houston, TX: Gulf Publishing Company.

Knowles, M. S., Holton III, E., & Swanson, A. (2005). *The adult learner* (6th ed.). Boston, MA: Elsevier Butterworth Heinemann.

Mezirow, J. (Ed.). (2000). *Learning as transformation: Critical perspectives on a theory in progress*. San Francisco: Jossey-Bass.

Rhoda, K. I. (2005). The role of distance education in enhancing accessibility for adult learners. In L. Bash (Ed.), *Best practice in adult learning* (pp. 149-172). Bolton, MA: Anker Publishing Company, INC.

Ross, H. (1992). Foreign languages education as a barometer of modernization. In R. Hayhoe (Ed.), *Education and modernization: The Chinese experience* (pp. 239-254). New York: Pergamon Press.

Wang, J. L., & Colletta, N. (1991). Chinese education problems, policies, and prospects. In I. Epstein (Ed.), *Chinese education problems, policies, and prospects* (pp. 145-162). New York: Garland Publishing, INC.

Wang, V., & King, K. P. (2006). Understanding Mezirow's theory of reflectivity from Confucian perspectives: A model and perspective. *Radical Pedagogy*, 8(1), 1-17.

Wang, V. C. X., & King, K. P. (2007). Confucius and Mezirow—Understanding Mezirow's theory of reflectivity from Confucian perspectives: A model and perspective. In K. P. King, & V. C. X. Wang (Eds.), *Comparative adult education around the globe* (pp. 253-275). Hangzhou, China, Zhejiang University Press.

Wang, V. C. X., & Kreysa, P. (2006). Instructional strategies of distance education instructors in China. *The Journal of Educators Online*, 3(1), 1-25.

Wang, V. C. X. (2006). *Essential elements for andragogical styles and methods: How to create andragogical modes in adult education*. Boston, MA: Pearson Education.

Yang, D. P. (2005). China's education in 2003: From growth to reform (J. Eagleton, Trans). *Chinese Education and Society*, 38(4), 11-45. (Original work published in 2003)

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About the Author: This article studies the role of technology in learning English as a Second Language in a new state-of-the-art university in Saudi Arabia. It finds different perceptions of learning technologies as students gain greater proficiency in the English language.

Using English Language Learner Perceptions of Technology to your Advantage

How student perceptions of instructional technology at a new university guide their instruction

Jonathan Jacob Doll

Saudi Arabia

Since the advent of the modern computer, English as a Second Language (ESL) learning has shifted into high gear as the availability for teaching, re-teaching, vocabulary training, grammar building, and many other areas are all at the teacher's fingertips. More importantly, these incredible insights are also at student's fingertips in both learning labs and their usage of instructional technology in and out of the classroom. Still, the question of a students preconceived notions of technology – i.e. their perceptions – can have a lot to do with the eventual success or failures of its use in the classroom (Porter, 1999; Turner & Crews, 2005).

That said, a new university named Prince Mohammad Bin Fahd University opened in the eastern province of Saudi Arabia in Fall 2006 and wanted to make the fullest use possible of the instructional technologies that were available. Offering a cadre of engineering, business, and technology related programs to its students, the university had a majority of its students first enroll in a preparatory English program to improve their English skills. Thus, English was offered in a second-language-context by which students took three or more semesters of language-intensive classes before entering the university as a regular student. Also, the university was a picture of Middle Eastern opulence, with marble floors throughout, new classrooms with Smartboards, student labs, and software that make a new university *state-of-the-art*.

With four levels of English students (Beginner, Intermediate, Advanced, and Core), the author constructed a study to ascertain the student perceptions of technology at each English language level, thereby giving a window into the instructional preconceptions and needs of individual students. Coupled with that was a concern, prior to this research study, that teachers might misapply their emphasis on technology or not scaffold sufficiently for students who may not have previous experience or exposure to new forms of instructional technology.

Demographics

Table 1

Approximate Number of Students at PMU

Level	Males	Females
0011/0021	35	35
0031/0041	180	210
0051/0061	50	50
Core	55	55
Total	320	350

PMU is only one of a handful of universities within Saudi Arabia that admit female students. So far, in its inaugural year, there are 670 students: 350 females and 320 males. Table 1 outlines which English programs these students are enrolled in, with the majority being intermediate students. PMU is a private university, but it also offers various scholarships so that its students are from varying socioeconomic groups.

Conceptual Framework

In order to effectively use instructional technology at a new university, a conceptual framework was developed (See Figure 1).

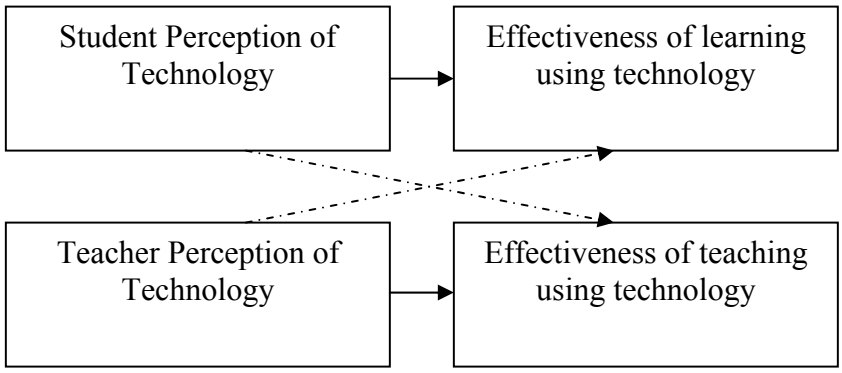

Figure 1: Conceptual framework for instructional technology perceptions

This framework drew upon the effective implementation of instructional technology at other universities and relied upon developing an understanding of the student and faculty perceptions of the various forms of instructional technology that were available to them (Indiana University School of Education, 2002; East Carolina University, 2007; Tuskegee University, 2007). This meant that we wanted to discern how amenable the students were at learning with technology and likewise how agreeable the faculty was in teaching with it. If students wanted to use instructional technology and were prepared for it, they might find greater success in using technology. Conversely, if teachers wanted to use instructional technology and were prepared for it, they might find greater success in using technology. In all, it was reasoned that if we could understand how agreeable students were with the use of technology, we could better inform how teachers used it in the classroom and how effective their implementation was.

Gender also may have played a role in student perceptions of technology. Numerous studies confirm this (Bame, Duger, deVries & McBee, 1993; Boser, Palmer & Daugherty, 1998; Comber, Colley, Hargreaves & Dorn, 1997; Teasedale & Lupart, 2001). Still, not all studies show that gender alone is significant in elucidating differences between student perceptions of technology. Davis and Davis (2007) found in a study of fifty-eight college students that differences in student perceptions were not significant based upon gender, although female students reported being more proficient with it. In order to follow up on these studies, the gender of students was concentrated on during this research study.

Research Questions

Initially, the author felt that university students might have held differing perceptions of technology based upon their culture of origin. Moreover, their English placement level was hypothesized as an indicator of technological preference. Thus, the research questions were as follows:

(1) Do students of varying ethnicities and origins have differing perceptions of the use of instructional technology (IT was defined by the use of computers, laptops, Smartboard, videos, PowerPoint in instruction)?

(2) Do students of varying ESL levels have perceptions of IT that are common to their level?

(3) Could teachers, once made aware of the patterns in student IT perceptions, build on student interest when it is prevalent or be more knowledgeable of where IT implementation was not fully in place so as to scaffold the use of instructional technology as needed.

Methodology

With those questions in mind, a paper and pencil survey was created to determine how Spring 2007 students perceived the role of instructional technology in their learning of English, whether they liked it, and where they felt it could be improved (See Appendix A). In discussing the survey and how it was to be administered, teachers were guided in using the Majlis Method, where a teacher and the students discuss the meanings of each question and come to common meanings (Walters, Walters, Jendli, and Graber). The survey was given to the instructors of 670 students through the use of the inter-university email system. (A similar survey was administered to teachers, but it will not be discussed herein due to the small overall size of the faculty.)

There were fifteen questions on the survey. The first three were demographic, identifying location of origin, culture, and gender of the students. Questions four and five identified the students' English program level. Questions six through ten identified students' computer access at home and preferences regarding computer usage at home and at school. Questions eleven through fourteen were statements that used a Likert scale to rate how strongly students felt about technology being used in the English classroom. Finally, question fifteen was open-ended, and allowed students to identify additional ways that technology impacted them or how the school could improve its use of technology.

Results

After a mass email to all faculty members, surveys were conducted in approximately eighteen classes by a total of 187 (58%) male students and 126 (36%) female students. 310 surveys were received in all. Although the response rate may initially seem low, it was the result of a growing infrastructure for research at the university; as such, it was the first survey of any kind at this new university. Also, the survey was given during an enrollment week when absence levels ran high. Finally, because of the gender segregation of classes in much of the Middle East, the survey was given to male teachers with an orientation, and only sent by email to the women's campus. An additional orientation was not possible although IT people at the school have since been working on ways to allow videos to be made and sent by email to all faculty members.

An analysis was conducted on the results of the 310 surveys using the SPSS statistical program. Each of the variables was looked at individually and some, collectively.

Demographics: origin and culture – The surveyed student body was surprisingly homogenous, with 288 (93%) from Saudi Arabia, 15 (5%) from other Middle Eastern countries, and 7 (3%) from other areas including Europe, Asia, and the United States. Also, 288 (84%) were from cities of 5,000 or more people, while 48 (15%) were from smaller towns. As such, the picture of the students was overwhelmingly of Saudi Arabian descent, thus countering the research question which presumed that students had a significant degree of cultural difference. Also, these survey numbers mirror the demographics for the entire student body, which adds to the statistical validity for this study as will be discussed later.

English program level – As Figure 2 depicts, the number of surveyed Intermediate students swelled for both genders. Males were strongest in their representation as intermediate students, where 100 (54%) of their surveys were completed. Females had their strongest representation as core students, where 61 (48%) of their surveys were completed. Taken as a whole, all of the student English levels were represented by the completed surveys.

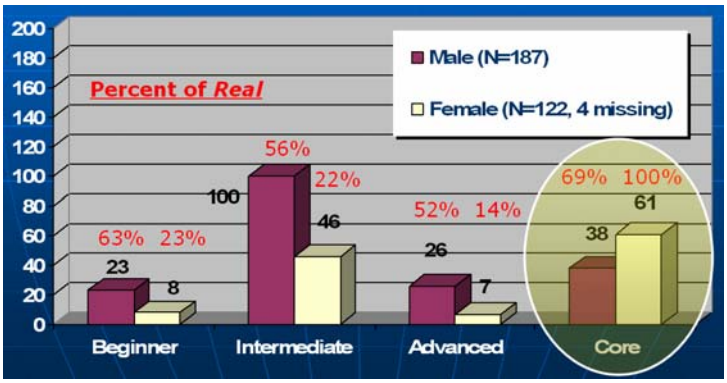

Figure 2: Student Levels Participating in the Study

Computer access at home and preferences therein – A stunning 97% of surveyed students had access to the internet, of which 58% was broadband and 39% was by a dialup service. In addition, over 90% of the students reported having a second computer at home, which strongly suggested that all would have access at home to various forms of instructional technology. 95% of surveyed students reported that they liked the use of Smartboards by their English teachers during instruction while a only 74% reported that they similarly liked to use their laptops as they learned English. Though the university requires students to have and use laptops, this also suggests that more scaffolding and facilitation in this process should be conducted by faculty members. Finally, since computer assisted learning (CAL) labs were still being built, students were asked if they would like to use them in the future to help them learn English. 75% of students who responded affirmed this idea, again suggesting that more scaffolding and facilitation of these labs would be beneficial. Gender did not play a significant role in student responses to these questions.

Technology in the English classroom – Likert scale responses on four survey questions ranged from strongly disagree to strongly agree. These four choices required students to voice their position rather than express no opinion at all. Interestingly, the idea of using such a scale was foreign to some of the students and required teachers to offer additional clarification. One student asked for his survey back after completing it, whereupon he switched all of his responses to the opposite end of the scale. When asked about it, he explained:

> *I change the answers from strongly disagree too strongly agree because I think the strongly disagree is the good and I asked Fawaz and he tell me u ronge [you wrong] and I ask Mr. Doll and I tell them I wont [want] my beber [paper] to change something and I changed these sit. Sorry about thes*
> *(Personal communication, Mohannad Mahrous, February 28, 2007).*

Statement 11: The teacher talking to the class helps me learn English.

On the teacher version of the survey, "talk to the class" was termed as the teacher "lecturing the class". However, since the students represented several levels in an ESL environment and many would not understand the meaning and nuances of the term "lecture", this word was broken down into simpler English. Here 92% of students affirmed the use of lecturing in a classroom context and male and female students showed agreement.

Statement 12: Discussion-style teaching class helps me learn English.

In contrast to the previous questions, the difference between lecturing and discussion was explained by the those administering the survey. This time, there was an even larger amount of agreement from students, with 94% of students affirming the use of classroom discussion.

Statement 13: The Smartboard helps me learn English.

Statements thirteen and fourteen were the most integral research questions set forth in this study. Interesting insights included differences between male and female responses. In statement thirteen, an average of 83% of students, 79% of males and 87% of females, responded that the Smartboard was helpful in their language instruction. There was also a further differentiation of student responses according to their English levels which will be discussed in the next section.

Statement 14: Other forms of technology (radio, CD, video, PowerPoint) help me learn English.

As with statement thirteen, male-female differences were also more pronounced, although the overall sense of agreement was stronger than in the previous question. An average of 91% of students, 86% of males and 95% of females, responded that other forms of technology were useful in their language instruction. This was particularly interesting because it gave a window to what things students wanted t at this new university.

Question 15: Open-ended response

In the short-answer responses, students shared the new forms of technology that they wanted to see. Among the lop-of-the-list items were movies, videos, and even some form of educational television. As has been noted elsewhere, students wanted to see teachers using technology more – a thing one might term as "speaking *their* language" (Prensky, 2001; Haynes, 2006).

Discussion

There was a widespread desire of students to see and use various forms of instructional technology in the classroom, as evidenced by responses to statements thirteen and fourteen as well as the open-ended responses in question fifteen. This inspired an extended Chi square analysis of questions thirteen and fourteen (the two Likert-scale questions created directly from the research questions) in order to further understand how students had responded.

Question number 13 dealt with the level to which students felt that the use of Smartboard technology helped them in learning English. In order to understand student responses, the data was analyzed to determine which students agreed with this question. In all, 253 (82%) of the students either agreed or strongly agreed with question 13 (See Table 2).

Table 2

Question 13 - Preference for Smartboard – those who agreed or strongly agreed

Question 13	Beginners	Intermediates	Advanced	Core
Number of students	25	118	21	85
Percent of their level	81%	82%	66%	81%

From crosstabs in SPSS, these students were found to be of a largely homogenous (by percentage) distribution of English levels, including 25 Beginners (81% of Beginners surveyed), 118 Intermediates (82% of Intermediates surveyed), 21 Advanced students (66% of Advanced

students surveyed), and 85 Core students (81% of Core students surveyed). This led to the question about who were the concurring students, what characteristics did they have in common and how did they differ. For students who strongly agreed, the level of English was of interest (See Table 3).

Table 3

Question 13 - Preference for the Smartboard – those who strongly agreed only

Question 13	Beginners	Intermediates	Advanced	Core
Number of students	14	43	5	19
Percent of their level	45%	30%	16%	19%

The largest number of students who strongly advocated the use of the Smartboard were Beginners, with 45% of students in their level, followed by Intermediates, with 30% of students in their level. A chi square significance value of .013 was found for this variable when students expressed strong agreement. Then, the lowest scores for Smartboard use came from the Core students (19%) and lastly the Advanced students (16%). These results suggest that lower level English learners learn best from a visual, multimedia environment that the teacher as the ultimate manipulator and information-giver. Conversely, the higher level students were not as appreciative or not as dependent on a teacher-led multimedia environment. Surprisingly, this suggests that beginning and intermediate learners are closest in their preferred type of instruction to the teacher-led behaviorist style classes that are the norm in Saudi Arabian high schools.

Next to be studied was student preferences for other forms of technology, such as for radios, CDs, video and PowerPoint. More students responded in agreement or strong agreement than was observed in question 13. Table 4 records student responses that were in agreement or strong agreement. On question 14, the responses were even more homogenous (by percentage) in distribution of English levels, ranging from only 93% for beginners to 84% for advanced classes.

Table 4

Question 14 - Preference for other technology –agreed or strongly agreed

Question 14	Beginners	Intermediates	Advanced	Core
Number of students	27	131	27	88
Percent of their level	93%	90%	84%	89%

This showed that nearly all students, regardless of level, were in agreement to a large extent with the use of other forms of technology. A further look at these students selected only ones who had shown strong agreement (See Table 5). A chi square significance value of .021 was found for this variable when students expressed strong agreement. The largest group showing strong agreement was Core students at 46% of their cohort, closely followed by 40% of Intermediate students. Advanced and Beginning students trailed behind at 28% and 17% of their cohorts, respectively.

Table 5

Question 14 - Preference for other technology – those who strongly agreed only

Question 14	Beginners	Intermediates	Advanced	Core
Number of students	5	58	9	46
Percent of their level	17%	40%	28%	46%

These results taken individually might seem unimpressive, but taken together they show some common themes for each level of English language learners. In addition, themes can be drawn up for individual preferences for instructional technology shown by students at each level. Surveys by level for Question 13 suggest that Beginners and Intermediates most appreciate use of the Smartboard in their education while Advanced and Core students do not rely as heavily on it. One explanation for this is that these groups, who speak English at the most basic levels, appreciate a teacher-led multimedia curriculum the more than Advanced and Core students

Secondly, the breakdown from Question 14 suggests that Beginners and Advanced students may not be ready for new or alternative forms of instructional technology, whereas Intermediates are quite interested and Core students are the most interested in these options. The significant lack of interest by Beginners in new forms of technology might in-part be from their inexperience with such applications or in-part from lack of English skills. The lower interest from advanced students might be because these students are more focused on getting into the Core.

Conclusion

The first research questions for this study proposed that ethnicity would affect student perceptions of instructional technology. This proved to be false due to the student population being much more homogenous by ethnicity than anticipated. However, this research question deserves the accolade of having inspired the study. The second and third research questions turned out to be true. Thus, students of varying levels of English proficiency in English do have differing perceptions of the use of technology, and as a result teachers can redirect their focus in line with student needs when using various forms of instructional technology.

According to these findings, faculty at our university can begin to streamline their education of students learning English and more appropriately respond to their English-level preferences for the use of Smartboards and other forms of technology. As a result, the Smartboard is used primarily with Beginner and Intermediate level students and can be tapered off or supplemented with PowerPoint and other types of instructional technology in the Advanced and Core levels. Similarly, other technology can be used with Intermediate and Core level students – those who are either insulated from the need to make a large step in their English level – while additional scaffolding and modeling can be used with Beginner and Core level students.

A secondary result of these findings could be that other universities in the Middle East and beyond can evaluate their uses of instructional technology based on the level of English of their students. Findings from other schools and universities might corroborate those at our university or challenge them. In either case, instructors have more definitive data on technologies to deliver educational programs for which students are ready and they perceive as effective.

References

Bame, A., Dugger, W. Jr., de Vries, M., & McBee, J. (1993). Pupils' attitudes toward technology–PATT-USA. The Journal of Technology Studies, 19(1), pp. 40-48.

Boser, R. A., Palmer, J. D., & Daugherty, M. K. (1998, Fall). Students' attitudes toward technology in selected technology education programs. *Journal of Technology Education, 10*(1), 4–18. Retrieved September 12, 2003, from http://scholar.lib.vt.edu/ejournals/JTE/.

Comber, C., Colley, A., Hargreaves, D. J., & Dorn, L. (1997, Summer). The effects of age, gender, and computer experiences upon computer attitudes. *Education Research*, *39*(2), pp. 123–133.

Davis, J. & Davis, H. (2007). Perceptions of career and technology and training and development students regarding personal computer knowledge and skills. *College Student Journal,* 41(1), pp. 1-6.

East Carolina University. (2007). Conceptual framework for preparing education professionals. Retrieved on July 7, 2007 from the Internet at: http://www.ecu.edu/cs-educ/admin/ConceptualFramework.cfm.

Haynes, J. (December 2006). Circle time: DSL – Digital as a second language. *The Essential Teacher*, 3(4),pp. 6-7.

Indiana University School of Education. (2002). Conceptual framework: Commitment to technology. Retrieved on July 7, 2007 from the Internet at: www.indiana.edu/~iubncate/framework/technology.html.

Porter, S. (1999). Technology in teaching literature and culture: some reflections. University of Oxford. Retrieved on May 21, 2007 from the Internet at: http://users.ox.ac.uk/~ctitext2/publish/occas/eurolit/porter.html.

Prensky, M. (October 2001). Digital natives, digital immigrants. *On the horizon*. NCB University Press, 9(5), pp. 1-6. Retrieved on February 25, 2007 from the Internet at: http://www.marcprensky.com/writing/.

Teasdale, S., & Lupart, J. L. (2001). Gender differences in computer attitudes, skills, and perceived ability. Paper presented at the Canadian Society for Studies in Education, Quebec, Canada. Retrieved January 19, 2004, from http://www.geomatics.ucalgary.ca/cwse/CompAtt.pdf.

Turner, F. & Crews, J. (2005) Bricks and clicks: A comparative analysis of online and traditional education settings. *International Journal of Instructional Technology and Distance Learning*. 2(4), pp. 3-8.

Tuskegee University. (2007). The conceptual framework: Commitment to technology. Retrieved on July 7, 2007 from the Internet at: www.tuskegee.edu/global/story.asp?s=1211394&ClientType=Print

Walters, T. Walters, L., Jendli, A., Graber, G. (2006). Pain and delight: Social consequences of internet use in the United Arab Emirates. *A podcast of a written presentation.* Retrieved on May 9, 2007 from http://www.zu.ac.ae/podcast/mp3only.html.

About the Author

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APPENDIX A: STUDENT LEVEL SURVEY

Official Use

1. _____

1. Gender □ Male □ Female

2. _____

2. Culture
□ From Saudi Arabia
□ From Oman, Yemen, Bahrain, Qatar, or UAE
□ From another country in the Middle East or Africa
□ Other

3. What type of town or city are you from?
□ Small: 100 – 500 persons
3. _____ □ Medium: 500 – 5,000 persons
□ Large: 5,000 or more people

4. Academic Level *(Check only one)* □ Preparation Year □ Core Curriculum

5. If Preparation Year: □ PRP 0011 □ PRP 0031 □ PRP 0051

6. Do you have a computer at home in addition to your school laptop? □ No □Yes
4. _____

7. What level of access to the Internet do you have?
□ No internet access □ Dialup access □ High speed access
5. _____

8. Do you like the use of the Smartboard as you learn English? □ No □Yes

6. _____

9. Do you like to use your laptop in the classroom as you learn English?
□ No □Yes

7. _____

10. Would you like to use computers in a computer lab as you learn English?
□ No □Yes

Tell whether you strongly agree, agree, disagree, or strongly disagree.

8. _____

11. The teacher talking to the class helps me to learn English.
□ Strongly Disagree □ Disagree □ Agree □ Strongly agree

9. _____

12. Classroom discussion between the teacher and students helps me learn English.
□ Strongly Disagree □ Disagree □ Agree □ Strongly agree

13. The use of the Smartboard helps me learn English.
10. _____ □ Strongly Disagree □ Disagree □ Agree □ Strongly agree

14. The use of other technology (radio, cd, video, or Powerpoint) helps me learn English.
□ Strongly Disagree □ Disagree □ Agree □ Strongly agree

15. Do you have any additional thoughts about using technology in English classes?

_____

Editor's Note: This study is the planning phase of a project to reduce the discrepancy between university training and real-world needs in the software development industry.

An Active Student Centered Learning (ASCL) Approach to Instruct and Assess a Software Engineering Course

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Abstract

Software Engineering is quite different from traditional engineering because of the intangible nature of software. While software engineering does focus on rigorous methods for designing and building software, more recently, the focus has shifted to building "real-world" large software systems with increased attention to safety-critical applications. A large disconnect is perceived to exist between the skills required by a software industry and the skills acquired by students in an academic setting. In this paper we strive to design a software engineering course (for juniors and seniors in an undergraduate degree program), that will enable students to tackle these challenges. Curriculum development methodologies for teaching software engineering courses range from simulation games to experiential learning methods based on reflective practices. This paper presents a novel innovative methodology based on Active Student Centered Learning (ASCL) to instruct and assess a Software Engineering course.

Keywords: Active Student Centered Learning, ASCL, instruction, assessment, software engineering, computer assisted learning, online instruction, web-based instruction, e-learning, computer science, distance learning, effective learning environment, innovative curriculum development methodology.

Introduction

Software Engineering (SE), is generally defined as "the discipline of developing and maintaining software systems that behave reliably and efficiently, are affordable to develop and maintain, and satisfy all the requirements that customers have defined for them" [1]. Software engineering was originally introduced to reflect application of traditional ideas from engineering to the problems of building software. Hence software engineering, like other engineering disciplines, has to date tended to focus on rigorous methods for designing and building software. To some extent this parallel continues to hold even as the focus has recently shifted to building "real-world" large software systems with increased attention to safety-critical applications. It is being realized that software engineering is quite different from traditional engineering because of the intangible nature of software. A large disconnect is perceived to exist between the software engineering skills required by a software industry and the skills acquired by students in an academic setting [2]. In order to narrow this divide, many professional societies have helped to define a Software Engineering Body of Knowledge (SWEBOK) [3] that is intended as a guide to the pertinent subset of generally accepted software engineering knowledge and can assist in the development of a software engineering course curriculum.

In this paper we strive to design a software engineering course for juniors and seniors in an undergraduate degree program based on the above guidelines, that will enable our students to successfully participate in and contribute to a "real-world" software industry.

Current literature includes many curriculum development methodologies for teaching software engineering courses, ranging from simulation games [4] to experiential learning methods based on reflective practices [5]. Curriculum development methodology in this paper is based on an

Active Student Centered Learning (ASCL) paradigm with novel ways to instruct and assess a Software Engineering course. This methodology is explained in detail in the following sections.

Active Student Centered Learning (ASCL)

As pointed out by Svinicki [6], the idea of teaching using learner-centered models is not new and has been around since the 1980's. In 1987, Chickering and Gamson [7] also emphasized active or collaborative learning in their "Seven Principles of Good Practice" for undergraduate education. Later, Bender [8] illustrated how technology can be used in various courses to de-center the classroom and facilitate more active student-centered learning. Recently, Boettcher [9] reported on the Ten Core Principles for Designing Effective Learning Environments, whereby she elaborates on the fundamental design framework for structured learning experience having four elements with the learner at the center. Thus, respecting this shift from teaching to student-centered learning where students are in constant engagement with the context, we decided to align our Software Engineering course with this methodology. To begin with we took a close look at the ten core principles outlined by Boettcher and adopted these in the ASCL framework as elaborated below:

1) *Core Learning Principle #1: Every structured learning experience has four elements - the learner (at the center), the mentor/faculty member, the knowledge, and the environment.* In the ASCL classroom, we focus on the first element, not only as a single student, but also as a team of students working together, since in the "real-world" students will be expected to work both individually and as part of a team on a large software project. Several group learning activities will be part of the assigned projects with students playing different roles of customer, architect, software developer, system integrator, system tester, etc. The other elements of ASCL classroom would be the faculty member as a designer of the group learning activity, the knowledge being the course content of software engineering skills, and the environment would be the resources our students would be needing such as a computer laboratory, object-oriented design and other SE tools, multimedia resources, etc.
2) *Core Learning Principle #2: Every learning experience includes the environment in which the learner interacts.* In conformance with this principle, in the ASCL classroom our goal is to accommodate a full range of student needs and learning styles and offer various levels of interactions: between faculty and student, between students, and between student and resources; and offer a range of activities from individual activities and small group activities to large group activities. Examples of such a learning environment include a group SE project whereby each team member participates in the project in several different roles (analyst, developer, tester, etc.) and at several different phases (requirements, design, development, testing, deployment, etc.) of the project.
3) *Core Learning Principle #3: We shape our tools and our tools shape us.* A corollary of this principle is that as our students become more engaged and active in their learning, we notice a dynamic shift in their learning process; we as faculty are moving towards the periphery while students take center-stage. In the ASCL classroom it is priority to facilitate this shift towards the students taking the center-stage rapidly with the help of various tools such as discussion boards, online forums, blogs, etc.
4) *Core Learning Principle #4: Faculty members are the directors of the learning experience.* In the ASCL classroom even though our students assume center-stage quickly, we as faculty members continue to play a very crucial role in their learning process. We are responsible for structuring the course by directing and supporting our students through various instructional events, designing effective and efficient learning

environments, and, finally assessing the learner outcomes. We are now directing their learning experience, not being the "sage on the stage" simply transmitting knowledge. It is important to note that to assist us in this new role as “director” we have modern technology such as electronic discussion boards and virtual black boards which can be individualized for each student based on their needs.

5) *Core Learning Principle #5: Learners bring their own personalized knowledge, skills, and attitudes to the learning experience.* This learning principle focuses on the learner as an individual trying to foster individual creativity. We can therefore design a more effective learning experience for our students if we can assess their existing knowledge at the beginning of the course. Again, modern technology provides us with a range of tools for obtaining this information about our students. In the ASCL classroom this pre-assessment is initiated in many different ways – ranging from the traditional in-class discussion to the more private (one-on-one) discussion boards via online forums. In the first meeting we also ask the student to submit a writing sample, which is analyzed to determine if students are placed appropriately and if any referrals need to be made to an Academic Support Center for additional support and help with the writing in the course.

6) *Core Learning Principle #6: Every learner has a zone of proximal development that defines the space that a learner is ready to develop into useful knowledge.* According to Vygotsky [10][11], a student's zone of proximal development (ZPD) is “the distance between the actual developmental level as determined by independent problem solving and the level of potential development as determined through problem solving under adult guidance or in collaboration with more capable peers.” In an ASCL classroom this ZPD principle further reinforces the core learning principle #5 above, and emphasizes the importance of preliminary assessments of student knowledge for effective learning. We need to constantly monitor our students' state of understanding and capabilities by embedding feedback from students throughout our course from the very beginning once again; using modern technology. This is further elaborated in the Assessment section.

7) *Core Principle #7: Concepts are not words; concepts are organized and intricate knowledge clusters.* This is again based on Vygotsky’s [10][11] idea that concept formation is a series of operations instead of a one-time event or as described by Freeman [12] "a process of successive approximations" to assimilate meaning. In the ASCL classroom we design assignments which build-on progressively, taking the students through all the steps in a Software Engineering process. We start with having our students conduct feasibility studies for their assigned project and generating appropriate requirements based on these studies. Next, we progress them into a design phase whereby they architect the system along with various subsystems and start the modeling and coding phase. Then, they move onto the validation phase whereby they actually conduct tests in the laboratory to determine if their system meets the customer requirements. Finally their system is ready for the evolution phase, where they are able to accommodate any changes and extra features requested by the customers.

8) *Core Learning Principle #8: All learners do not need to learn all course content; although all learners do need to learn the core concepts.* This learning principle focuses on the knowledge element in the core learning principle #1 above. Software Engineering has a set of basic skills or concepts which every student needs to understand thoroughly. Further, based on the students’ motivation, creativity, and priorities, additional concepts can be developed by the students. To incorporate this principle in the ASCL classroom we provide our students with a database of external web-based links, whereby they can acquire additional knowledge, for example, we provide links for online tutorials [13] on The Unified Modeling Language™ (UML™) [14] by Object Management Group (OMG)

which is the industry-standard language for specifying, visualizing, constructing, and documenting the artifacts of software systems. This language simplifies the complex process of software design, creating a "blueprint" for construction.

9) *Core Learning Principle #9: Different instruction is required for different learning outcomes* (Gagne, 1965 [15]). In 2002, Merrill [16] combined a broad range of instructional theories into a framework for design known as the First Principles of Instruction, which is shown below in Figure 1 as four instructional phases revolving around a problem.

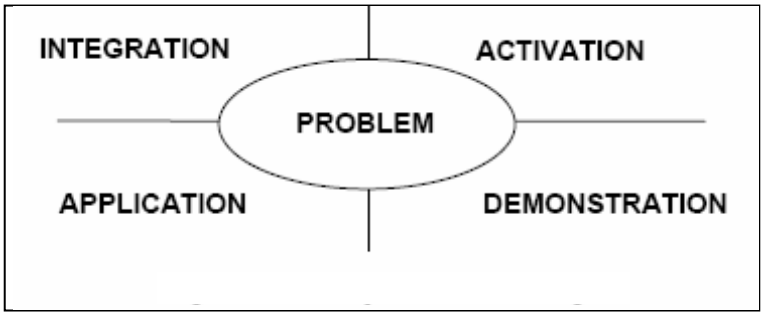

Figure 1 First Principles of Instructional Design

He stressed that learning is facilitated when learners are engaged in solving "real-world" problems and when existing knowledge is activated as a foundation for new knowledge. The ASCL classroom adaptation of core learning principle #5 above already reflects this in part, whereby we included an assessment of existing knowledge at the beginning of our course. Merrill's first principle of instruction further asserts that learning is facilitated when new knowledge is demonstrated to the learner, which is then applied by the learner. Lastly, learning is facilitated when new knowledge is integrated into the learner's world. In the ASCL classroom, we demonstrate to our students what needs to be learned, rather than merely telling them about what needs to be learned. We do this by sharing object models, behavior models, use-case scenarios, etc. for a real-world system. We also require our students to use their new knowledge to solve a variety of problems thereby providing multiple opportunities for them to use this new knowledge. Lastly, we encourage our students to transfer this newly acquired knowledge into their everyday life by giving them practical real-world problems which they can relate to within their community. This paves a way for students to make a difference in their communities as part of a relevant and meaningful class experience. This principle also promotes diversity and recognizes and respects the individual differences amongst learners, based on their background and cultural perspectives.

10) *Core Learning Principle #10: Everything else being equal, more time-on-task equals more learning.* This in a way follows from the above principle whereby learning is facilitated if students interact actively with the course material. In the ASCL classroom we use simulated software games and role-playing to offer a more dynamic and interactive learning experience to our students. These experiential learning processes permit students to invest greater amounts of time in their learning development and eventually they are ready to apply and integrate this new knowledge into the real-world.

ASCL Conceptual Context

The encapsulation of above ten core principles in the ASCL framework is best reflected in Figure 2 below in the form of a conceptual context. This may be viewed as a relational model with the Student or Learner in the center, supported by Faculty as well as the environment, resources, and,

tools. Background knowledge pre-assessment helps develop an individualized and more effective learning environment, further allowing us to focus on core concepts and any additional specialized concepts needed by the learner. This relational model also stresses on Assessment in ASCL which is an integral part of any learning process and is described in the next section.

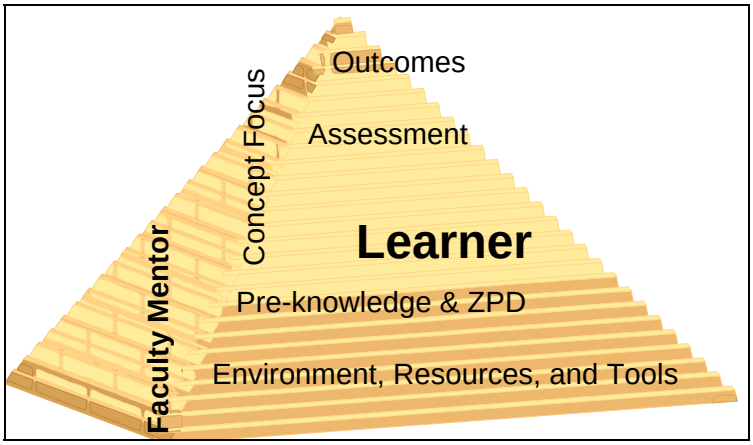

Figure 2: ASCL Conceptual Context

Assessment in ASCL

Assessment plays an important role both in teaching and learning and is an integral component of any learning process. Almost 30 years ago, Derek Rowntree [17] expressed an important aspect of assessment to enhance the learning experience of students – "*If we wish to discover the truth about an educational system we must look into its assessment procedures*." In their handbook for teachers, Angelo and Cross [18] report the central purpose of Classroom Assessment is to empower both teachers and their students to improve the quality of learning in the classroom. They further assert how classroom assessment can help teachers refocus their teaching to help students make their learning more efficient and more effective.

We teachers often assume that our students are indeed learning what we intend to teach them. However, often while grading the final exam, we notice huge gaps between what we intended our students to learn and what they have actually learned! In order to avoid such "end-of-the-semester" disappointments, we need effective ways to monitor our students on a constant basis throughout the semester.

According to Atherton [19], assessment is viewed as integral to every stage of teaching, from minute to minute as much as module to module, rather than as a discrete process. Further, the Committee on Classroom Assessment and the National Science Education Standards [20] promotes a balanced and integrated system of assessment. This is where different assessment techniques come in handy.

Wright [21] appropriately describes Assessment as "…a learner-centered, teacher-directed approach designed to improve student learning in the individual classroom." Also, in [22], she describes many effective assessment methods. Even though assessment has been defined differently by many authors, there is a common thread in all the definitions - gathering of feedback on the learning process, understanding the meaning of this feedback, and using the feedback to improve the teaching-learning process [23][24]. Boston [25] reports that historically most classroom assessment has been summative and often implemented in the form of end-of-term assessments by using final grades and some form of student evaluation.

It should be noted that this summative approach allows for improvement only in subsequent teaching of the course and not the current one. In contrast, formative assessment, defined by Black and William [24] as, "all those activities undertaken by teachers and by their students [that] provide information to be used as feedback to modify the teaching and learning activities in which they are engaged" would seem to impact the current course by using feedback to adapt teaching to meet student needs. Therefore, our strategy would be to use a combination of summative and formative approaches to make course adjustments during the duration of our Software Engineering course.

Assessment Techniques for our Software Engineering Course

After surveying the literature on a variety of assessment techniques, we decided to use the techniques listed below.

1) Background Knowledge Pre-assessment: This directly follows from the Core Learning Principles #s 5 and 6 we outlined in Section 2 above and is a rather common practice in most courses. We use written questionnaires, in-class discussions, and online private discussion boards to pre-assess a students' knowledge and abilities and come up with an initial estimate for each students' ZPD. We also take an initial writing sample (as shown in Section 0) from each student in order to determine the level of assistance a student would need with the writing in the course. This background knowledge assessment is repeated at the beginning of each new module in order to fabricate appropriate lesson plans.

2) **Goal Ranking and Syllabus Adjustment:** In the first meeting we share a preliminary syllabus for the course with several course goals. We then encourage students to rank these goals in a relative order of importance to them. After analyzing this data, we can help students achieve many of the course goals and connect some of these to our course syllabus in the form of special projects. Also there may be some goals which just cannot be accommodated, in which case, we give our students an honest response and prevent future disappointments.

3) **The Minute Paper:** At the end of each class, we ask our students to answer two questions as in the form shown in Figure 3 below. Firstly, this provides us with a rapid feedback as to whether our main idea coincides with what the students perceived as the main idea. Additionally, students are forced to organize their thinking to rank the two most significant points and then to decide upon a significant question.

1. What are the two most significant things you have learned during this lecture?

_____

_____

2. What is the most important question you have related to this lecture?

_____

_____

Figure 3: Sample Form for the Minute Paper

4) **The Muddiest Point:** At the end of a new module or topic, we ask our students to write down what was least clear to them in that module. This forces the students to rate their own understanding of the module and will help us decide whether to distribute an additional explanatory handout clarifying the issues, or, initiate a discussion forum, or, eventually organize a tutorial session. This technique of identifying the least understood point is an interesting exercise and there is always room for improving classroom explanations, no matter how experienced a teacher is.

5) **Documented Problems:** After each module, we assign problems (from that module) to be done outside the class and request our students to clearly document all the steps involved in coming up with a solution. This includes not only writing down the answers, but also providing the reasoning behind their answers as well, which in fact is another way of expressing the "Show all your work" philosophy. This documentation can vary from a simple paragraph of what was done and why, to a detailed explanation of a formal mathematical proof. Sadly, today many students are still focused around getting the correct answer rather than focusing on the process of problem solving. This kind of assignment will force our students to focus on the process irrespective of the answer. We also stress that in most SE problems there is no "right" or "wrong" answer. For example, when we assign a problem whereby students have to select a particular software process model for a system, students may pick any model as long as they can support that selection with valid reasons for choosing that model.

Curriculum Improvements to Overcome Problems with Instruction and Assessment in a Software Engineering Course

Assessment plays an important and integral component of the learning process in ASCL. This section explores curriculum improvements for the SE course to overcome problems outlined earlier. Begin by developing assessment activities that can facilitate and improve student learning. Course goals, objectives and content specify the extent of the learning that must takeplace within the classroom environment. This assessment is designed to offer benefits to students and instructors as it facilitates improved student learning. It helps students to be self-reflective, clarifies the link between learning and course content, and helps learners to understand their strengths and weaknesses. Student's focus is better when they understand their instructors' expectations. Assessment produces data to enable instructors to adjust teaching methods, reduce gaps and facilitate student learning, and provide a student-centered and student-responsive classroom. Results are enhanced by involving students, encouraging active participation in the learning process, and providing consistent and constructive feedback. Begin by establishing goals and learning objectives, and at the end; measure how well these goals have been met and use the results to revise the course to further improve the teaching and learning.

Setting Student Learning Goals and Objectives for SE course

Start by defining general goals based on the skills and broad concepts students will develop in this SE course. Refine these goals and develop specific observable and measurable learning objectives that can be used as performance indicators. Using Bloom's Taxonomy [26], a well-known description of levels of educational objectives, and ideas from Angelo and Cross [18], generate a snapshot of this goal and objective setting activity as shown in Figure 4. Base each objective on the various levels of knowledge, comprehension, application, analysis, synthesis and evaluation as identified by Bloom [26].

Goals	Objectives	Assess					
		Knowledge	Comprehension	Application	Analysis	Synthesis	Evaluation
Goal 1: The student will know the fundamentals of **Software Engineering** Processes (ch1)	1-1 Define Software (SW) and SW Engineering (SE)	■			■		
	1-2 Differentiate - SE and Computer Science				■		
	1-3 Differentiate - SW process and SW process model				■		
	1-4 List various costs associated with SE	■					
	1-5 Discuss various SE methods with their components		■				■
	1-6 List attributes of good SW	■					
	1-7 Discuss key challenges in SE		■		■		■
	1-8 Explain CASE with examples			■		■	
Goal 2: The student will know the fundamentals of **System Engineering** Processes (ch2&3)	2-1 Define system	■					
	2-2 Differentiate – Technical and Socio-technical systems				■		
	2-3 What are the essential characteristics of Socio-technical systems		■				
	2-4 Give examples of Emergent system properties			■			
	2-5 What is System Engineering? List the different phases in a system engineering process.	■	■				
	2-6 Detail the different phases in a systems engineering process along with their problems.				■	■	
	2-7 Explain why a Legacy system may be critical to a business		■				■
	2-8 Draw a System Block Diagram identifying the various subsystems and the links between them			■	■	■	
	2-9 List the dimensions of Dependability.	■					
	2-10 Suggest which Dependability attributes are likely to be most critical for following systems and why	■	■	■	■	■	■
Goal 3: The student will use the concepts of SW processes and SW process models (ch4&5)	3-1 Explain the process activities common to all processes		■	■			
	3-2 Detail the differences in the 3 generic SW process models				■	■	
	3-3 Suggest some variants to the above generic SW process models	■	■	■	■	■	■
	3-4 Order the following tasks in a Waterfall Model					■	■
	3-5 Compare and Contrast - Incremental Delivery and Spiral Development	■			■		
	3-6 Discuss the various Design process activities		■		■		
	3-7 Suggest (with reasons) the most appropriate SW process model for the following systems	■	■	■	■	■	■
	3-8 What are the advantages of using the Rational Unified Process (RUP) model	■	■				
	3-9 List some of the SW management activities	■					

Figure 4: Sample Course Goals and Objectives.

Measuring and Assessing the Goals and Objectives

After setting goals and learning objectives for our course, we measure whether these have been met and further analyze how they can be met. We begin by reflecting on what we want to achieve in this course and then identify the information we want to collect about student progress, eventually linking them to our intended learning goals and objectives. We first review our existing techniques to identify any gaps in our assessment techniques, and then append with additional assessment techniques, if needed. Also, we critically review our current course syllabus to include all the learning objectives and link them to course content. Figure 5 shows a sample assignment we generated for one of the learning objectives of our first goal.

Goal #1: The student will know the fundamentals of Software Engineering Processes

Objective #1-7: Discuss key challenges in SE

Assignment that demonstrates accomplishment of this objective:

1) Document all the possible challenges in SE
2) From these, identify at least three challenges which you think are critical.
3) Giving different examples discuss (with analysis and your eventual evaluation) the three key challenges you identified in 2 above.
4) Submit a write-up along with any tables you generated.

Figure 5: Sample Assignment

Collecting Assessment Data

After defining assessment metrics for our course, we need to decide when and how often to assess. We can collect the data (using varied techniques) at several different points – at the beginning of the semester, at the end of every class, at the beginning of a new topic, at the end of the semester etc. For example, the Background Knowledge Pre-Assessment listed in Section 0 can be conducted at the beginning of the semester by requesting students for an Initial Writing Sample in order to asses their writing skills and to determine the level of assistance a student would need with the writing in the course. This would also reveal if students are placed appropriately in the course and if any referrals need to be made to the Academic Support Center for additional support and help with the writing in the course. Figure 6 below shows a sample.

Description	You are required to write a page: First introduce yourself, then explain the reasons for your participation in this Software Engineering course.
Purpose	To determine you are placed appropriately. Referrals need to be made to the Academic Support Center for support and help with writing in this course.
Audience:	Course Instructor, Academic Support Center, Other Faculty Members
Mode of writing	Expressive – focus on your personal motives and experiences
Length	One page (Max)
Grading Criteria	None. ***This assignment is not graded.***
Deadline	In Class Writing Assignment – ***Due today*** by end of class

Figure 6: Sample Background Knowledge Pre-Assessment Assignment

In addition to knowing a student's background, it is equally important to know what kind of learning is occurring at a specific moment in time. We identify our fundamental course concepts, and then assess whether our students fully grasp these, or are simply going on without any solid understanding of these basic concepts. This information also helps to alter the pace of the course and make any adjustments to our syllabus in order to solidify these concepts. Examples of assessment methods which help us gauge the understanding of such concepts can include the minute paper and the muddiest point assessment techniques introduced in Section 0.

Assessment Data Analysis

Our eventual aim in collecting assessment data is to improve teaching and learning. In order to this, we begin by organizing the data (both quantitative and qualitative) we have collected in Section 0 above. We base our analysis on the guidelines provided in [27][28] and Figure 7 below shows a way to organize some of this data. Once the data is organized it is easy to see what action we need to take based on this. Based on this data organization we formulate an action plan [28] and Figure 8 shows a sample of one such plan. Such a plan can be very useful at the beginning of the semester, or even during the middle of the semester, when we can actually try to correct our instruction method.

Assessment Entity	Assessment Method	Data Collected	Interpretation of data	Action	Comments
Student prior knowledge of SE	Background Knowledge Pre-assessment	Initial writing sample discussion board forum ZPD	15% - some pre-knowledge of SE 35% - writing skills inadequate	Cover background and basics of SE Organize writing and tutorial session with Academic Learning Center support	Surprised about the writing skills Limited SE pre-knowledge

Figure 7: Sample Data Analysis – Organization

Reporting the Results

After implementing the various items in our action plan, we may use the results in several different ways. First of all, we use these results to direct our instruction method towards our students learning needs. Additionally, we may use this assessment information for improving our department's curriculum and syllabus for this course. This assessment information may also be useful to other faculty members in our department who may be responsible for teaching either a pre-requisite to this SE course, or, simply, a more advanced 2nd level SE course. In order to communicate these results effectively, we link them to our course goals and learning objectives, as shown in a sample matrix [27] in Figure 9 below.

Action Item	Action	Steps to be taken
1	*INCREASE BASIC KNOWLEDGE OF SE*	- Motivate students about SE using real-world examples - Share interesting anecdotes about the pitfalls of not applying SE principles - Demonstrate that they have been using SE principles in prior courses, although did not classify them as such - Ask students with adequate background to share their knowledge with other sin the class
2	*IMPROVE WRITING SKILLS*	- Share writing samples from prior classes showing both good and inadequate samples - Share writing guidelines in Computer Science based on the standards from the Computer Society - Explain the importance of writing skills in Computer Science, especially in SE - Assign simple and progressive assignments to improve writing - Offer tutorial and help sessions in writing for all

Figure 9: Steps to achieve student learning needs.

Engaging Students in Assessment

One of the main benefits of our assessment techniques is that they provide an opportunity to openly communicate with our students. To ensure this, we need to engage them in the assessment process. We need to help them understand why assessment is important, how it can help us become more effective teachers, and eventually how this assessment can help them become more efficient learners. According to [18], we can maximize the positive impact of classroom assessment by sharing the assessment results with our students, showing them how we interpret the results, and letting them know what we intend to do with them. Also, Wright [21] asserts that as students become more involved, self-reflective learners; classroom assessment increases their interest in learning and changes their attitudes and behaviors. We use an innovative way of engaging our students in assessment by letting them design their own Midterm exam based on the course goals and learning objectives we initially set. We set up a discussion board forum and sought responses from our students in preparing this exam. Each student carefully thought about the learning objectives and came up with some real thought provoking questions. There were some questions which we had to modify based on our perception of a student's interpretation of a particular learning objective, although overall the questions were meaningful. We will be reporting on the results of such exam preparation ideas in a subsequent paper with further analysis of our results. Another experiment we tried was to let students prepare a grading rubrics for a written assignment and then do a peer evaluation by grading at least 2 other student papers. We introduced rubrics [29] to our students and demonstrated how to generate a rubric using the Rubistar website [30]. A sample of such grading rubrics (prepared by students with some minimal assistance from us) is shown in Figure 10 below.

CATEGORY	SCORE			
	4	3	2	1
Organization	Information is very organized with well-constructed paragraphs and subheadings.	Information is organized with well-constructed paragraphs.	Information is organized, but paragraphs are not well-constructed.	The information appears to be disorganized.
Quality of Information	Information clearly relates to the main topic. It includes several supporting details and/or examples.	Information clearly relates to the main topic. It provides 1-2 supporting details and/or examples.	Information clearly relates to the main topic. No details and/or examples are given.	Information has little or nothing to do with the main topic.
First Draft	Detailed draft is neatly presented and includes all required information.	Draft includes all required information and is legible.	Draft includes most required information and is legible.	Draft is missing required information and is difficult to read.
Mechanics	No grammatical, spelling or punctuation errors.	Almost no grammatical, spelling or punctuation errors	A few grammatical, spelling, or punctuation errors.	Many grammatical, spelling, or punctuation errors.
Sources	All sources (information and graphics) are accurately documented in the desired format.	All sources (information and graphics) are accurately documented, but a few are not in the desired format.	All sources (information and graphics) are accurately documented, but many are not in the desired format.	Some sources are not accurately documented.

Figure 10: Sample Grading Rubrics for a Writing Assignment in SE

Conclusions

In this paper we report on an innovative curriculum development methodology based on Active Student Centered Learning (ASCL) with novel ways to instruct and assess a Software Engineering course. We perceive an emergent need to develop such a Software Engineering course whereby we prepare our students to successfully participate in and contribute to a "real-world" software industry. We have tried to encompass many "real-world" and "large-scale" SE problems focused on safety-critical systems. Based on the ASCL methodology along with the assessment techniques discussed here, we are confident that our students will meet the growing demand to narrow the divide between the software engineering skills required by a software industry and the skills acquired by our students in an academic setting. We still have to assess the learning impact of this methodology and hope to publish this shortly after the course is successfully delivered. Meanwhile, we have to focus on the future course offerings whereby we may use this methodology for other courses within the Computer Science department. Also, we need to understand the applications (along with any limitations) of this technique in case we have to scale it for a large class. We also need to explore ways to mechanize many aspects of the course development in order to standardize the use of these methods across several different courses, different faculty members within the department, different departments (for example, Electrical and Computer Engineering, Mathematics, etc.) and eventually university wide.

References

1. [IE2005] *The IEEE Computer Society/ACM Joint Task Force for Computing Curricula 2005*. "The Overview Report," available at: http://www.computer.org/portal/cms_docs_ieeecs/ieeecs/education/cc2001/CC2005-March06Final.pdf

2. Ludi, S. and Collofello, J. S., "An Analysis of the Gap Between the Knowledge and Skills Learned in Academic Software Engineering Course Projects and Those Required in Real Projects." In Proceedings of the *31st ASEE/IEEE Frontiers in Education Conference*, Oct 2001.

3. The IEEE Computer Society Guide to the Software Engineering Body of Knowledge SWEBOK, 2004 Version, available at: http://www.swebok.org/htmlformat.html.

4. Navarro, E. O., Baker, A. and Hoek, A., "Teaching Software Engineering using Simulation Games," *In Proceedings of the 2004 International Conference on Simulation in Education*, San Diego, California, January 2003.

5. Socha, D., "Teaching Software Engineering the Experiential Way," keynote presentation at the first *New Zealand Software Engineering Subject Conference* in Auckland, New Zealand, December 2003.

6. Svinicki, M., "New Directions in Learning and Motivation", in *Teaching and Learning on the edge of the Millenium: Building on What We Have Learned*, M. D. Svinicki, ed. (San Francisco: Jossey-Bass, 1999) pp. 13-16. Available at: http://education.gsu.edu/ctl/FLC/Foundations/Overview.pdf

7. Chickering, A., and Gamson, Z., "Seven principles of good practice in undergraduate education", *American Association of Higher Education Bulletin*, 39, 3-7. Available at: http://aahebulletin.com/public/archive/sevenprinciples1987.asp

8. Bender, B., "Student Centered Learning: A Personal Journal", *EDUCAUSE Center for Applied Research, Research Bulletin*, Vol. 2003, Issue 11, May 2003. Available at: http://www.educause.edu/ir/library/pdf/ERB0311.pdf

9. Boettcher, J., "Ten Core Principles for Designing Effective Learning Environments: Insights from Brain Research and Pedagogical Theory", *Innovate – Journal of Online Education*, Vol. 3, Issue 3, Feb/Mar 2007. Available at: http://www.innovateonline.info/index.php?view=article&id=54

10. Vygotsky, L. S., "Thought and language," E. Hanfmann & G. Vakar, Eds. & Trans. (Cambridge, MA: MIT Press) 1962.

11. Vygotsky, L. S., "Mind in society: The development of higher psychological processes," M. Cole, V. John-Steiner, S. Scribner, & E. Souberman, Eds. & Trans (Cambridge, MA: Harvard University Press) 1978.

12. Freeman, W. J., "How brains make up their mind." (New York: Columbia University Press) 2000.

13. Miller, R., "Practical UML: A Hands-On Introduction for Developers," CodeGear from Borland Developer Network, available at http://dn.codegear.com/article/31863.

14. The Unified Modeling Language™ (UML™) by Object Management Group (OMG) available at http://www.uml.org.

15. Gagne, R. M., "The conditions of learning." (New York: Holt, Rinehart and Winston), 1965.

16. Merrill, M. D., "First principles of instruction," *Educational Technology Research* and Development, 50 (3), 43-59, 2002.

17. Rowntree, D., "Assessing students: How shall we know them." (London: Harper and Row), 1977.

18. Angelo, T.A. and Cross, K.P., "Classroom Assessment Techniques: A Handbook for College Teachers," Second edition (San Francisco: Jossey-Bass) 1993.

19. Atherton, J. S., "Learning and Teaching: Assessment," 2003 [On-line] UK: Available: http://146.227.1.20/~jamesa//teaching/assessment.htm Accessed: 15 February 2007

20. J. Myron Atkin, Paul Black, and Janet Coffey (Eds.), "Classroom assessment and the National Science Education Standards," Committee on Classroom Assessment and the National Science Education Standards. National Research Council, Center for Education, Division of Behavioral and Social Sciences and Education. (Washington, DC: National Academy Press) 2001.

21. Wright, B. D., "Discipline-based assessment: The case of sociology," AAHE Bulletin, pp. 14-16, 1991.

22. Wright, B. D., "Evaluating Learning in Individual Courses," Handbook of the Undergraduate Curriculum, J. Gaff and J Ratcliff, eds., (SanFrancisco: Jossey-Bass), 1997, pp. 571-590.

23. Huba, M. E. and Freed, J. E. "Learner-centered assessment on college campuses: Shifting the focus from teaching to learning," (Boston, MA: Allyn & Bacon), 2000.

24. Black, P., & Wiliam, D., "Assessment and classroom learning," Assessment in Education, 5(1), 7-74, 1998.

25. Boston, C., "The concept of formative assessment," Practical Assessment, Research & Evaluation 8(9), 2002.

26. Krathwohl, D. R., Bloom, B. S., and Masia, B. B., "Taxonomy of Educational Objectives: The Classification of Educational Goals, Handbook II: The Affective Domain," (New York: McKay), 1964.

27. Palomba, C. A. and Banta, T. W., "Assessment essentials," (San Francisco: Jossey-Bass), 1999.

28. Stassen, M., Doherty, K., Poe, M., "COURSE-Based Review and Assessment Methods for Understanding Student Learning," Handbook from the Office of Academy Planning and Assessment, University of Massachusetts Amherst, 2001.

29. Ronkowitz, K. and Mullinix, B. "Rubrics in the Age of Accountability: Transparent Assessment in Support of Learning," An NJEDge Collaborative Faculty Development Initiative (CFDI) Video Conference, February 16, 2005.

30. Rubistar: Create rubrics for your Project-Based-Learning-Activities at http://rubistar.4teachers.org/index.php

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