Internet and Higher Education 12 (2009) 117–125

Contents lists available at ScienceDirect

Internet and Higher Education

Online learning: Are subjective perceptions of instructional context related to academic success?

Anthony R. Artino, Jr. *

Department of Preventive Medicine & Biometrics, Uniformed Services University of the Health Sciences, 4301 Jones Bridge Road, Bethesda, MD 20814-4712, United States

ARTICLE INFO

Article history:
Accepted 30 July 2009

Keywords:
Distance education
Distributed learning environments
Military training
Academic motivation
Achievement emotions
Self-regulation

ABSTRACT

This study explored the extent to which students' thoughts, feelings, and actions are associated with the nature of an online course and how that course relates to them personally. Following completion of an online course in aviation physiology, service academy undergraduates ($N = 481$) completed a survey that assessed several motivational, emotional, and behavioral outcomes. Consistent with expectations, results from a logistic regression analysis revealed that students who said they were planning to become aviators upon graduation were more likely to report greater perceptions of task value and greater use of metacognitive control strategies than their non-aviator counterparts. On the other hand, after controlling for the other variables in the model, aviators were actually less likely to report being satisfied with the online course, an unexpected finding. Taken together, these results partially substantiate the social cognitive notion that subjective perceptions of the learning environment ultimately shape students' motivational and behavioral engagement in that environment. Implications for the theory and research of online learning are discussed.

Published by Elsevier Inc.

1. Introduction

Institutions worldwide have recognized the Internet's value as an instructional tool and have developed, or are developing, online learning programs (Allen & Seaman, 2008; Larreamendy-Joerns & Leinhardt, 2006). Military organizations are no exception (Curda & Curda, 2003). For example, the U.S. military has acknowledged the utility of online learning and has 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 its training (Fletcher, Tobias, & Wisher, 2007). Known as the Advanced Distributed Learning Initiative, this effort, which began in 1997, is meant to provide cost-effective, high-quality, tailored education and training to the military's more than three million personnel anytime, anywhere (Bonk & Dennen, 2005). As one might expect, online learning is considered a critical component of the Advanced Distributed Learning Initiative (Fletcher et al., 2007).

The growth of online learning has resulted in a plethora of empirical investigations (Sitzmann, Kraiger, Stewart, & Wisher, 2006; Tallent-Runnels et al., 2006). Traditionally, however, research in this area has been dominated by group-comparison studies that assess the attitudes and achievements of online learners versus classroom students (Bernard et al., 2004). With few exceptions, findings have commonly yielded *no significant differences* in various attitude and performance outcomes when similar instructional methods are employed (Bernard et al., 2004; Sitzmann et al., 2006; Zhao, Lei, Yan, Lai, & Tan, 2005). Although important, such group-comparison studies have provided only a modicum of generalizable knowledge for the theory, research, and practice of online learning (Bernard et al., 2004; Gunawardena & McIsaac, 2004). Furthermore, although online learning has been examined extensively in higher education, few studies have explored online instruction in the context of military training (Wisher, 2006; Wisher & Champagne, 2000). And while education and training share many of the same psychological constructs (e.g., learning, motivation, transfer, and memory), the two contexts are distinguished from one another by “fundamental differences in their goals, outcomes, and eventual application of the underlying instruction” (Bonk & Wisher, 2000, p. 3).

The present investigation sought to address these gaps in the online learning literature. In particular, this study tackled recent recommendations to move beyond group-comparison studies (e.g., Abrami & Bernard, 2006; Bernard et al., 2004). Moreover, this study examined online learning in the context of an authentic military training environment (Wisher & Champagne, 2000). In doing so, this investigation was meant to provide insight into how military students actually go about learning in online training contexts.

2. Theoretical framework

Models of self-regulated learning describe a continuous cycle of cognitive, motivational, and behavioral activities that are central to learning and knowledge construction (Azevedo, 2005). Students

* Tel.: +1 301 319 6988; fax: +1 301 295 0933.
E-mail address: anthony.artino@usuhs.mil.

1096-7516/$ – see front matter. Published by Elsevier Inc.
doi:10.1016/j.iheduc.2009.07.003

who are said to be highly self-regulated are active participants who generate the thoughts, feelings, and actions necessary to attain their goals by actively planning, monitoring, and regulating their cognition, motivation, and behavior (Lajoie & Azevedo, 2006). As such, self-regulated learners are thought to be particularly well suited to succeed in autonomous online learning environments (Dabbagh & Kitsantas, 2004; Hartley & Bendixen, 2001). Thus, as a multi-dimensional construct that integrates cognitive, motivational, and behavioral components of learning, self-regulated learning has been adopted by many scholars as a practical theoretical framework for understanding student success in online settings (e.g., Azevedo, 2007; Lynch & Dembo, 2004; Miltiadou & Savenye, 2003; Whipp & Chiarelli, 2004).

The current study employed a conceptual model of self-regulation that is based on several decades of research and theory on self-regulated learning and related motivational and affective constructs (see Fig. 1). This conceptual model, informed by social cognitive theories of self-regulation as formulated by Bandura (1997), Pintrich (2000), and Zimmerman (2000), provides the theoretical foundation upon which the present study is built.

In brief, the conceptual model contains four interacting components: (a) contextual features of the online learning environment, (b) personal factors (motivational beliefs and achievement emotions), (c) personal behaviors (use of cognitive and metacognitive learning strategies), and (d) several additional academic outcomes (achievement, satisfaction, and continuing motivation). According to well-established theory, contextual features of the learning environment are thought to influence motivational beliefs, including students' confidence in their ability to attain designated types of performances (i.e., their self-efficacy beliefs; Bandura, 1997) and the extent to which students find a learning activity interesting, important, and useful (i.e., their task value beliefs; Eccles & Wigfield, 2002). Moreover, these beliefs are assumed to be proximal antecedents of discrete achievement emotions (e.g., enjoyment and anxiety; Pekrun, 2006), which, in turn, influence students' use of various learning strategies, such as elaboration and metacognition (Pekrun, Goetz, Titz, & Perry, 2002; Pintrich, 1999). Finally, students' use of learning strategies is believed to link directly to outcomes such as achievement, satisfaction, and continuing motivation (Pintrich, 2000; Schunk, Pintrich, & Meece, 2008). Thus, the use of learning strategies is posited to mediate the relations between personal and contextual factors and actual learning and performance (Pintrich, 2000); that is, learners with more adaptive beliefs and emotions are also more likely to use cognitive and metacognitive learning strategies (Pintrich, 1999; Pintrich, Smith, Garcia, & McKeachie, 1993; Pekrun et al., 2002). In turn, the use of learning strategies is assumed to result in deeper processing of the material to be learned, which ultimately improves subsequent learning, performance, and motivation (Pintrich, 1995).

2.1. The critical role of subjective context

In the classic model of social cognitive theory, as conceptualized by Bandura (1986), contextual features of the learning environment are considered one of three determinants of human behavior. In particular, human functioning purportedly results from the triadic, dynamic, and reciprocal interaction of personal factors, behaviors, and the environment (Bandura, 1986). In short, personal factors (e.g., beliefs, expectations, attitudes, and prior knowledge), behaviors (e.g., individual actions, choices, and verbal statements), and the social and physical environment (e.g., resources, consequences of actions, other people, and physical settings) interact as determinants of one another.

The conceptual model utilized in the current study is based on Bandura's (1986) original framework; however, it differs slightly in that personal factors (beliefs and emotions) and academic behaviors (use of learning strategies) are embedded within, and ultimately influenced by, the learning environment. This difference is meant to highlight the importance of contextual features of the learning environment (classroom, online, or otherwise) and their ultimate affect–for better or worse–on the other learner-centered aspects of academic self-regulation (Boekaerts & Cascallar, 2006). Moreover, consistent with other models of social cognition (Pintrich, 2000; Zimmerman, 2000), the model assumes that instructional contexts are perceived and evaluated by students. In other words, the same *objective* environment (i.e., a self-paced online course in aviation physiology) may be perceived (or appraised) differently by different students. As such, it is the *subjective* environment that ultimately shapes students' beliefs, emotions, and academic behaviors (Roeser, Marachi, & Gehlbach, 2002). This is not to say, however, that subjective perceptions of the environment are fixed. Instead, these

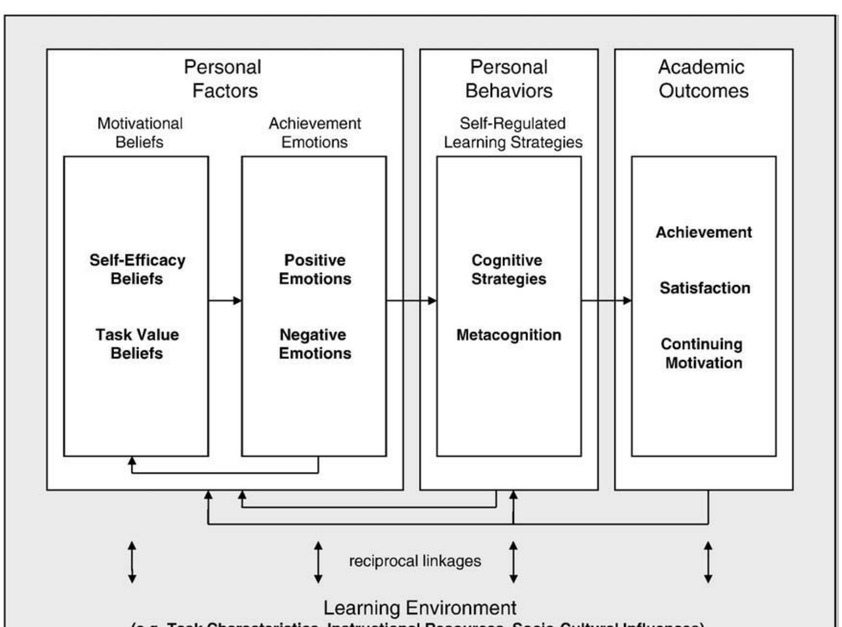

Fig. 1. A social cognitive model of self-regulated learning (adapted from Pekrun, 2006).

perceptions, as well as the objective environment itself, can change as students' thoughts, feelings, and actions vary over time (Bandura, 1997). Thus, self-regulated learning can be thought of as an interactive phenomenon, the product of a dynamic interchange between personal, behavioral, and environmental influences (Pajares, 2002).

The importance of the environment and its influence on the other components of the conceptual model has been described by several motivation researchers (e.g., Pintrich, 1999; Hadwin, Winne, Stockley, Nesbit, & Woszczyna, 2001; Roeser et al., 2002). For instance, in their discussion of an instrument designed to measure various aspects of self-regulated learning, Duncan and McKeachie (2005) proposed that personal components of self-regulation are not static traits of the learner, but rather that "motivation is dynamic and contextually bound and that learning strategies can be learned and brought under the control of the student" (p. 117). That is, students' motivations and emotions change from learning task to learning task (e.g., depending on their self-efficacy for performing the task, interest in the task, etc.). Therefore, the extent to which students use self-regulatory behaviors may vary as well, depending on the nature of the online course and how the learning tasks within that course relate to them personally (Pintrich, 1999; Hadwin et al., 2001). Stated another way, students' subjective perceptions of the environment ultimately "shape their cognitive, emotional, and behavioral engagement or disaffection in that environment" (Roeser et al., 2002, p. 207).

3. Research question and hypothesis

This study represents the second phase of a research program designed to examine how military students function in highly autonomous online learning situations. Using the conceptual model depicted in Fig. 1 and described above, this study examined the relations between service academy undergraduates' subjective perceptions of the learning environment and their thoughts, feelings, and actions in that environment.

One overarching question guided this investigation: Do military students whose future careers are directly related to the content of an online course (aviators) experience greater academic success than their counterparts whose future careers are unrelated to the course (non-aviators)? For the purposes of this study, academic success was operationalized in terms of several outcomes. These include motivational, emotional, and self-regulatory outcomes, as well as students' achievement (final course grade), overall satisfaction with an online course, and continuing motivation to enroll in future online courses. By examining this diverse set of academic outcomes, the present study goes beyond final course grade as the sole indicator of academic success in a training context (see recommendations in Kraiger, Ford, & Salas, 1993).

Based on the theoretical assumptions described above, the nature of the course content in the present study–which was directly applicable to the career aspirations of *some* students (aviators) but not others (non-aviators)–was hypothesized to influence students differentially. Accordingly, aviators were hypothesized to be more likely to report greater task value beliefs, less negative emotions, greater use of learning strategies and, ultimately, higher satisfaction, continuing motivation, and final course grades than their non-aviator counterparts.

4. Materials and methods

Using survey methodology (DeVellis, 2003), this cross-sectional study employed a non-experimental, posttest-only, correlational design (Shadish, Cook, & Campbell, 2002). In particular, a survey instrument, the Online Learning Beliefs, Emotions, and Behaviors Survey (OLBEBS), was developed to measure students' motivational beliefs (self-efficacy and task value), negative achievement emotions (boredom and frustration), self-regulated learning behaviors (elaboration and metacognition), prior knowledge of the online course material, and two additional academic outcomes (satisfaction and continuing motivation).

4.1. Participants

A convenience sample of 481 undergraduates (sophomores and juniors) from the U.S. Naval Academy was invited to participate in this study; 100% of the students completed the survey. The sample included 398 men (83%) and 83 women (17%). The mean age of the participants was 20.5 years (SD = 1.0, range 19–24). Of the 481 participants, 356 (74%) identified themselves as intending to pursue aviation careers after graduation from the academy (hereafter referred to as aviators). The remainder of the students ($n = 124$, 26%) identified themselves as non-aviators. Table 1 provides a summary of participant demography.

4.2. Learning materials

The instructional materials used in this study consisted of a self-paced online course developed by the U.S. Navy for an education and training program. The mission of this particular program is to prepare all prospective flight personnel for the physiological aspects of flight and survival aboard Navy and Marine Corps aircraft. The online course was the first part of a two-stage training program in aviation physiology required for all service academy undergraduates. The course was designed to be taken prior to students' completion of the second stage of their training, which consisted of traditional, face-to-face instruction at a local training center.

The online course was composed of four, 40-minute lessons. Each lesson included text, graphics, and video, as well as end-of-lesson quizzes that consisted of 12 to 15 multiple-choice and true/false, declarative knowledge-type questions. The entire course was designed as a mastery learning experience; as such, students had to score 80% or higher on each of the four end-of-lesson quizzes to successfully "pass" the training. While working through the course, students who did not score at least 80% on any given quiz were required to return to the lesson, review the material, and then retake the quiz. Quiz items were drawn from a pool of questions, and thus each time an end-of-lesson quiz was attempted, the items were slightly different than the previous assessment. A student's final course grade was computed as the average of the four end-of-lesson quizzes. It is worth noting, however, that item-specific data for the end-of-lesson quizzes were not collected by the course management system. As a result, reliability and validity evidence for the quizzes could not be collected and analyzed as part of this study.

4.3. Procedures

Students were contacted via email by their academy advisor and were provided with directions for accessing the course management system and completing the self-paced online course. Once logged into

Table 1
Demographic information for the total sample and the two career groups (aviators and non-aviators).

Participants			Demographics					
			Gender				Age	
			Male		Female			
	N	%	*n*	%	*n*	%	*M*	SD
Total sample	481	100	398	83	83	17	20.5	1.0
Aviators	356	74	295	83	61	17	20.6	1.0
Non-aviators	124	26	103	83	21	17	20.3	1.1

the system, students had the ability to proceed through the course at their own pace, logging in and out of the lessons as needed.

Due to procedural limitations set forth by the Navy, students were surveyed approximately three weeks after completing the online course, instead of directly following instruction. Specifically, upon arrival at the local training center for the face-to-face portion of their training, students were invited to complete an anonymous, self-report survey. Participation in the survey was completely voluntary.

4.4. Instrumentation

The instrument used in this study, the OLBEBS, was composed of 50 items divided into two sections. The first section included 41 Likert-type items with a response scale ranging from 1 (*completely disagree*) to 7 (*completely agree*). The items in this section were further subdivided into eight subscales (see Appendix A for a list of the survey items).

4.4.1. Motivational beliefs

Two subscales from Artino and McCoach (2008) were used to assess students' personal motivational beliefs: (a) a five-item *self-efficacy* subscale designed to assess students' confidence in their ability to learn the material presented in a self-paced online format; and (b) a six-item *task value* subscale designed to assess students' judgments of how interesting, important, and useful the online course was to them.

4.4.2. Negative achievement emotions

Two subscales adapted from the Achievement Emotions Questionnaire (AEQ; Pekrun, Goetz, & Perry, 2005) were used to assess students' negative achievement emotions: (a) a five-item *boredom* subscale intended to assess students' course-related boredom; and (b) a four-item *frustration* subscale designed to assess students' course-related frustration, annoyance, and irritation. This study assessed negative emotions because previous work with a similar sample indicated that a large proportion of the students were bored and frustrated with online training (Artino, 2008).

4.4.3. Self-regulated learning strategies

Students' self-reported use of cognitive and metacognitive learning strategies was assessed with items derived from the Motivated Strategies for Learning Questionnaire (MSLQ; Pintrich et al., 1993): (a) a four-item *elaboration* subscale designed to assess students' use of elaboration strategies (e.g., paraphrasing and summarizing); and (b) a nine-item *metacognition* subscale intended to assess students' use of metacognitive control strategies (e.g., planning, setting goals, monitoring one's comprehension, and regulating performance). Although the two learning strategies variables were self-reported strategies, for brevity, they are referred to as *elaboration* and *metacognition* in the remainder of this article.

4.4.4. Satisfaction

Students' overall satisfaction with the online course was assessed with a three-item *satisfaction* subscale adapted from Artino (2008).

4.4.5. Prior knowledge

Due to procedural limitations imposed by the Navy, a true measure of prior knowledge (i.e., a pretest) could not be collected in this study. Instead, students' prior knowledge of the online course material was measured with a five-item *prior knowledge* subscale. This subscale was designed to assess students' familiarity with the course's four terminal learning objectives (i.e., students' appraisal of how much they knew prior to completing the online course). Although the prior knowledge variable was self-reported, for brevity, it is referred to as *prior knowledge* in the remainder of this article.

Section two of the survey was composed of nine items, including background and demographic questions and three individual items used as variables in this study.

4.4.6. Online technologies experience

Online technologies experience was assessed with a single self-report item: “Compared to other academy undergraduates, how experienced are you with online computer technologies (for example, using a web browser, surfing the Internet, etc.)?” The response scale ranged from 1 (*extremely inexperienced*) to 7 (*extremely experienced*).

4.4.7. Online learning experience

Online learning experience was assessed with a single self-report item: “Compared to other academy undergraduates, how experienced are you with self-paced online learning (for example, courses like the online portion of this Navy course)?” Again, the response scale ranged from 1 (*extremely inexperienced*) to 7 (*extremely experienced*).

4.4.8. Continuing motivation

Continuing motivation (Maehr, 1976) to enroll in future online courses was assessed with a single self-report item: “Considering your experience with this online course, would you choose to enroll in another self-paced online Navy course in the future? Please answer this question as if the choice were completely up to you.” The response scale ranged from 1 (*definitely will not enroll*) to 6 (*definitely will enroll*).

4.5. Data screening and statistical analyses

Before addressing the research question, data were screened for accuracy and missing values. Following data screening, a confirmatory factor analysis (CFA) was completed on the 41 items included in the first part of the OLBEBS. Factors identified in the CFA were then subjected to a reliability analysis, and the final subscales were identified based on this analysis. The variables used in all subsequent analyses were created by computing a mean score for the items associated with a particular subscale.

To answer the research question, logistic regression was used to predict group membership (aviators = 1; non-aviators = 0). Logistic regression was chosen primarily because of its inherent flexibility as an analysis technique. Specifically, logistic regression lends itself well to the development of a reliable prediction model when the outcome of interest is dichotomous (Cohen, Cohen, West, & Aiken, 2003). Moreover, logistic regression allows one to examine the unique contribution of the independent variables in predicting group membership, while accounting for the other variables in the model.

5. Results

Results are divided into three main sections: (a) CFA aimed at validating the hypothesized survey structure, (b) descriptive statistics, and (c) logistic regression.

5.1. Confirmatory factor analysis

Using AMOS 7.0 (Arbuckle, 2006), a CFA was conducted to examine the convergent and discriminant validity of the eight-factor, 41-item survey. Maximum likelihood estimation was used to estimate the parameters, and a chi-square test was conducted to assess model fit. Generally, a non-significant chi-square result indicates a good model fit (Kline, 2005). However, because the chi-square test is affected by, among other things, the sample size and the size of the correlations in the model, researchers do not normally rely on the chi-square test as the sole measure of model fit. Therefore, several additional fit indices were considered together with the chi-square test. These indices included the chi square/degrees of freedom ratio

Table 2
Descriptive statistics for the total sample and the two career groups (aviators and non-aviators).

Variable	Number of survey items	Cronbach's alphas	Total sample ($N=481$)		Aviators ($n=356$)		Non-aviators ($n=124$)	
			M	SD	*M*	SD	*M*	SD
Age	1	–	20.50	1.00	20.57	0.97	20.31	1.05
Online technologies experience	1	–	4.98	1.28	5.06	1.25	4.74	1.33
Online learning experience	1	–	4.45	1.08	4.51	1.07	4.28	1.09
Prior knowledge	4	.86	3.60	1.30	3.78	1.30	3.07	1.17
Self-efficacy	4	.91	5.32	1.12	5.38	1.13	5.18	1.08
Task value	5	.88	4.87	1.09	4.98	1.07	4.55	1.07
Boredom	3	.84	4.02	1.32	3.99	1.32	4.11	1.32
Frustration	3	.89	3.36	1.45	3.31	1.43	3.49	1.46
Elaboration	3	.82	4.81	1.08	4.85	1.08	4.70	1.05
Metacognition	7	.89	4.12	1.11	4.42	1.04	3.85	1.23
Satisfaction	3	.92	4.77	1.20	4.79	1.22	4.74	1.45
Continuing motivation	1	–	3.93	1.17	3.93	1.13	3.92	1.27
Course grade	–	–	89.10	3.66	89.17	3.68	88.88	3.58

Note. Continuing motivation was measured on a 6-point Likert-type response scale from 1 (*definitely will not enroll*) to 6 (*definitely will enroll*). All other Likert-type variables were measured on a 7-point agreement response scale. Course grade ranged from 80 to 100.

(also referred to as the normed chi square), the comparative fit index (CFI), and the root-mean-square error of approximation (RMSEA).

Taken together, the results from the CFA substantiated the hypothesized eight-factor structure of the survey. In particular, all model fit statistics fell within recommended standards (Hu & Bentler, 1999): the chi square was statistically significant, χ^2 (436, $N=471$)= 860.333, $p<.001$; however, the normed chi square (1.97) was less than 2.00, the CFI (.955) was slightly greater than .95, and the RMSEA (.046) was less than .06.

Based on these results, Cronbach's alpha coefficients were calculated for the eight subscales to assess the internal consistency reliability of the scores. As indicated in Table 2, all alpha coefficients were well within the recommended range, with actual values of .82–.92 (see guidelines in Gable & Wolfe, 1993).

5.2. Descriptive statistics

Descriptive statistics for the total sample and the two career groups (aviators and non-aviators) are provided in Table 2. As indicated, for the total sample, eight of the 10 variables measured on a 7-point Likert-type scale had means at or above the midpoint of the response scale; while two variables (prior knowledge and frustration) had means slightly below the midpoint. Means for the two career groups were similar. The mean scores for continuing motivation (measured on a 6-point Likert-type scale) were also above the midpoint of the response scale for the total sample and the two career groups. Standard deviations for these 11 variables ranged from 1.04 to 1.46, and visual inspection of the associated histograms showed that nine variables were negatively skewed (online technologies experience, online learning experience, self-efficacy, task value, boredom, elaboration, metacognition, satisfaction, and continuing motivation). On the other hand, distributions for prior knowledge and frustration showed a slightly positive skew. Finally, course grades for the total sample and two career groups had means from 88.88 to 89.17 and standard deviations ranging from 3.58 to 3.68; these distributions were also positively skewed.

5.3. Logistic regression

Logistic regression results are presented in Table 3. As indicated, the addition of the 14 predictors to the model resulted in improvements in all measures of model fit (Menard, 2000). For example, the likelihood ratio chi-square test was used to assess the contribution of the 14 variables to the prediction of group membership. Results

Table 3
Model summary for the logistic regression analysis of group membership (aviators = 1; non-aviators = 0).

Variable	*b*	*SE b*	OR	Model fit statistics			
				−2 Log likelihood	Likelihood ratio χ^2	Likelihood ratio R^2	% Correctly classified
Gender	0.08	0.31	1.08	475.02	56.26**	0.11	75.7
Age	0.25*	0.12	1.28				
Online technologies experience	0.07	0.11	1.07				
Online learning experience	0.03	0.13	1.03				
Prior knowledge	0.40**	0.10	1.49				
Self-efficacy	0.11	0.12	1.11				
Task value	0.56**	0.17	1.75				
Boredom	−0.02	0.12	0.98				
Frustration	−0.06	0.11	0.94				
Elaboration	−0.28	0.15	0.76				
Metacognition	0.29*	0.15	1.34				
Satisfaction	−0.33*	0.17	0.72				
Continuing motivation	−0.13	0.13	0.88				
Course grade	0.00	0.03	1.00				

Note. *b* = unstandardized regression coefficient; OR = odds ratio. −2 Log Likelihood for the null model = 531.27; percent correctly classified in the null model = 74.6.
* $p<.05$.
** $p<.001$.

indicated that the 14 variables statistically significantly improved model prediction, χ^2 (14, N = 469) = 56.26, p < .001. Similarly, the likelihood ratio R-square test was used to assess the proportional reduction in deviance produced by the final model (i.e., the model with 14 predictors) when compared to the null model. Results revealed an 11.0% reduction in deviance. Additionally, the classification characteristics of the final model were slightly improved over the null model: the final model correctly classified 75.7% of students as either aviators or non-aviators, while the null model correctly classified 74.6% of students.

As shown in Table 3, age (b = .25, p < .05), prior knowledge (b = .40, p < .001), task value (b = .56, p < .001), metacognition (b = .29, p < .05), and satisfaction (b = −.33, p < .05) were all statistically significant predictors of group membership. For age, holding all other variables constant, the odds of being an aviator increased by almost 30% (odds ratio [OR] = 1.28) for every one year of age increase. That is, aviators were more likely to be slightly older than non-aviators. For prior knowledge, the odds of being an aviator increased by approximately 50% (OR = 1.49) for every one unit increase in a respondent's prior knowledge score. Stated another way, the odds of aviator membership were higher as one's self-reported prior knowledge increased. Similarly, for task value and metacognition, the odds of being an aviator increased by a factor of 1.75 and 1.34, respectively, for every one unit increase in a student's score on each subscale. In other words, aviators were more likely to report greater perceptions of the importance, utility, and interest of the course material. Likewise, aviators were more likely to report greater use of metacognitive control strategies while learning online. On the other hand, for satisfaction, the odds of aviator membership decreased by almost 30% (OR = .72) for every one unit increase in a respondent's satisfaction score. That is, aviators were less likely to report being satisfied with the online course, a somewhat unexpected finding. Taken together, results from the logistic regression analysis suggested that the odds of aviator membership were higher as one's age, self-reported prior knowledge, task value, and metacognition increased and lower as one's overall satisfaction with the online course increased.

6. Discussion

The present study examined service academy undergraduates' thoughts, feelings, and actions in the context of a self-paced online course in the military. In particular, this study employed a conceptual model of social cognitive self-regulation to examine the importance of subjective perceptions of instructional context (i.e., the extent to which students' beliefs, emotions, and behaviors are associated with the nature of the online course and how that course relates to them personally).

As a whole, findings from this study were partially congruent with prior theory and research in the fields of academic motivation and self-regulation (e.g., Pekrun et al., 2002; Pintrich, 1999; Zusho, Pintrich, & Coppola, 2003). Specifically, the results reported here suggest that students' motivational beliefs and self-regulatory behaviors are related, in part, to the nature of the online course and how that course relates to them personally. The following sections describe, in more detail, the extent to which these findings support the concepts and relationships described in the conceptual model.

6.1. Motivational beliefs and learning strategies use

The importance of the environment, and its influence on the other variables and processes in the conceptual model, is based on the social cognitive view that self-regulated learning is not a static trait, but rather that beliefs and emotions–as well as the adaptive behaviors and positive academic outcomes that follow–are dynamic and contextually bound (Duncan & McKeachie, 2005; Pekrun, 2006). Findings from this study partially support the hypothesis that students with career aspirations directly related to the course content (aviators) would be more likely to report adaptive motivation-emotion profiles and would experience greater academic success than their counterparts whose future careers were indirectly related to the course (non-aviators). Specifically, aviators were more likely to report greater perceptions of task value and greater use of metacognitive control strategies than non-aviators. This finding is compelling if one considers how similar aviators and non-aviators are to one another, aside from one important difference: their anticipated career paths. Thus, it seems that because aviators found the course more interesting, important, and useful, they chose to employ more metacognitive control strategies. Although this suggestion is far from definitive, due to the correlational nature of this study, it is consistent with the social cognitive position that knowledge of learning strategies is not enough; instead, "students also must be motivated to use the strategies as well as regulate their cognition and effort" (Pintrich & De Groot, 1990, p. 33). Furthermore, the finding that the odds of aviator membership were higher as an individual's task value and metacognition increased is consistent with the assumption that motivational and behavioral engagement are largely shaped by subjective perceptions of the learning environment (Roeser et al., 2002).

6.2. Achievement emotions

Based on the content of the course, which was directly related to the career aspirations of some students (aviators) and not others (non-aviators), it was hypothesized that aviators would also be more likely to report less boredom and frustration than non-aviators. Results from the present study failed to support this hypothesis. Although it is unclear exactly why *any* student reported being bored and/or frustrated, the failure to find group differences in achievement emotions suggests that these emotions may have been directed toward aspects of the course *other* than course content. For example, Pekrun (2006) indicated that if a learning activity "is not sufficiently controllable, *frustration* will be experienced" (p. 323). In the current study, students participated in a course that was largely linear and which offered only a modicum of learner control. Furthermore, previous work with a similar sample (Artino, 2008) revealed that many students experienced technical problems when attempting to access the online course through the course management system. Finally, the course format, being largely text-based and including just a few interactive learning activities, may have been minimally engaging for students. Therefore, taken together, it seems plausible that students' negative emotions may have been directed more toward course design and delivery and less toward course content. Such an explanation might account for why aviators and non-aviators reported similar levels of boredom and frustration, since both groups, regardless of career aspirations, would likely have experienced these same issues and perceived them in a similar way. Nonetheless, follow-on research using qualitative methods would help clarify this finding.

6.3. Satisfaction

Another noteworthy result was that, after accounting for the other variables in the logistic regression model, the odds of aviator membership decreased by almost 30% (OR = .72) for every one unit increase in a respondent's satisfaction score. That is, aviators were actually less likely to report being satisfied with the online course. Although unexpected, this result may indicate that aviators, who valued the course more, also had greater expectations with respect to what they hoped to learn in the course. According to Keller (1999), students are much more likely to be satisfied with instruction when the learning outcomes they experience are consistent with their initial expectations. Thus, as a group, if what aviators actually learned by taking the course did not match what they expected to learn, then it follows that they might be somewhat less satisfied at the end of the course. On the other hand, non-aviators, who likely had fewer expectations going into the course, could have obtained similar learning outcomes yet not have been as dissatisfied as their aviator counterparts. Although speculative, this scenario provides at least one explanation for the unanticipated finding that aviators were less likely to be satisfied with the online course. It is worth nothing, however, that the mean satisfaction score across both groups was above the midpoint of the 7-point agreement response scale ($M=4.77$, SD = 1.2), and the distribution of satisfaction scores was severely negatively skewed. Both of these descriptive statistics indicate that *all* students were generally quite satisfied with the course.

6.4. Achievement

Contrary to expectations, aviators did not achieve significantly higher final course grades than non-aviators. There are several conceivable explanations for this result. First and foremost, the mastery nature of the online course resulted in range restriction in the course grade outcome. Range restriction has the effect of downwardly biasing effect sizes (Cohen et al., 2003), thereby making it more difficult to find statistically significant relationships between course grade and the group membership variable. A second account for the failure to find a statistically significant relationship between group membership and achievement is also worth considering: namely, limitations in the nature of the course assessment. In particular, final course grade was determined by averaging students' performance on four multiple-choice tests. Such select-response tests are best suited for assessing the recall of knowledge, but they may not be the most effective method for assessing deep understanding, higher-order thinking, and transfer of learning (Haladyna, Downing, & Rodriguez, 2002). Moreover, multiple-choice tests are "limited in their ability to represent the substance of knowledge such as cognitive structure and misconceptions" (Nesbit & Hadwin, 2006, p. 832). Therefore, it is possible that aviators, who reporter greater levels of task value and metacognitive processing while learning online, did in fact gain greater understanding of the course material. However, because of the limitations inherent to the assessment used in this study, these learning differences may have been missed. Accordingly, future research in online settings would benefit from the use of validated assessments that are sensitive enough to capture subtle differences in student understanding (see, for example, Azevedo & Cromley, 2004; Mayer & Chandler, 2001).

6.5. Limitations of the study

This study has several important limitations that should be considered when interpreting the results. First, the sample was exceptionally homogeneous and may not represent the "typical" college undergraduate. For example, the majority of students were men and, by virtue of their acceptance into a military academy, none was physically disabled. Moreover, Naval Academy undergraduates are generally considered high-ability students. For example, standardized test scores for the class of 2011 were well above the national average: 69% and 84% of students scored above 600 on the verbal and math components of the SAT, respectively (U.S. Naval Academy, 2007). National SAT statistics for 2007 college-bound seniors were much lower: only 21% and 25% of students scored above 600 on the verbal and math components, respectively (College Board, 2007). Therefore, the findings reported here have limited generalizability beyond the present sample (Shadish et al., 2002). Nonetheless, the students who participated in this study are relevant members of the higher education community. As such, these results are applicable for researchers and practitioners considering similar, high-ability students learning in comparable online learning contexts.

Second, students were surveyed approximately three weeks after completing the online course, and the validity and reliability of these delayed measures of students' thoughts, feelings, and actions are somewhat uncertain (Thorndike, 2005). Accordingly, future work should consider the use of embedded, web-based surveys that can more effectively measure students' beliefs, emotions, and behaviors as they unfold during online learning.

Finally, the variables used in the present study were created primarily from self-report measures. Like all self-reports, the survey used in this study has reliability and validity limitations (e.g., social desirability bias and response sets; Thorndike, 2005). Of particular consequence are the threats to construct validity that are inherent to measuring self-regulatory behaviors with a self-report questionnaire (Hadwin, Nesbit, Jamieson-Noel, Code, & Winne, 2007). Altogether, these measurement limitations suggest that future work should include alternative techniques for assessing self-regulation, such as think-aloud protocols and audit trails (Nesbit & Hadwin, 2006).

7. Conclusions

Taken together, results from this study shed some additional light on the complex relations between personal, behavioral, and environmental influences on self-regulated learning and overall academic success in online learning. Notwithstanding methodological limitations, these findings provide further evidence for the social cognitive view that subjective perceptions of the learning environment may ultimately shape students' motivational and behavioral engagement in that environment (Pintrich, 1999; Hadwin et al., 2001; Roeser et al., 2002). Furthermore, these results offer important theoretical and empirical extensions of academic self-regulation by illustrating that several associations are equally robust in the context of an authentic online training environment in the military.

Results from this study also suggest that social cognitive theories of self-regulation may provide a useful framework for understanding how military students go about learning in online training situations. In particular, the findings reported here provide researchers and practitioners with some important insights into how students' perceptions of course context may influence their motivational beliefs and use of self-regulated learning strategies. From a practical standpoint, this information may be valuable for military and higher education leaders who are trying to determine if and how to employ online learning for different student populations. Accordingly, future studies would do well to consider applying such multidimensional models of learning to further inform our understanding of the complex interplay between students' thoughts, feelings, and actions while learning online. Ultimately, pursuing such work has the potential to move the field forward by providing additional guidance for the theory, research, and practice of online learning.

Acknowledgements

An earlier version of this manuscript was presented at the 2008 annual meeting of the American Psychological Association, Boston, MA.

The author is a military service member. The views expressed in this article are those of the author and do not necessarily reflect the official policy or position of the Department of the Navy, Department of Defense, nor the U.S. Government.

Appendix A. Survey instrument

All subscales utilized the following response scale.

Completely disagree	Mostly disagree	Tend to disagree	Neutral	Tend to agree	Mostly agree	Completely agree
1	2	3	4	5	6	7

Motivational beliefs (adapted from Artino & McCoach, 2008).

Self-efficacy

1. Even in the face of technical difficulties, I am certain I can learn the material presented in an online course.
2. I am confident I can learn without the presence of an instructor to assist me.
3. I am confident I can do an outstanding job on the activities in a self-paced online course.
4. I am certain I can understand the most difficult material presented in a self-paced online course.
5. Even with distractions, I am confident I can learn material presented online.

Task value

1. It was personally important for me to perform well in this course.
2. This course provided a great deal of practical information.
3. I was very interested in the content of this course.
4. Completing this course moved me closer to attaining my career goals.
5. It was important for me to learn the material in this course.
6. The knowledge I gained by taking this course can be applied in many different situations.

Negative achievement emotions (adapted from the AEQ; Pekrun et al., 2005).

Boredom

While completing this online course…

1. I was bored.
2. I felt the course was fairly dull.
3. My mind wandered.
4. I was uninterested in the course material.
5. I thought about what else I would rather be doing.

Frustration

While completing this online course…

1. I felt frustrated.
2. I was angry.
3. I felt as though I was wasting my time.
4. I was irritated.

Self-regulated learning strategies (adapted from the MSLQ; Pintrich et al., 1993).

Elaboration

While working through this online course…

1. I tried to relate what I was learning to what I already know.
2. I tried to make all the different ideas fit together and make sense to me.
3. I made up my own examples to help me understand the important concepts.
4. I tried to connect what I was learning with my own experiences.

Metacognition

While working through this online course…

1. If I became confused about something I read, I went back and tried to figure it out.
2. If course material was difficult to understand, I changed the way I studied it.
3. I asked myself questions to make sure I understood the material I was studying.
4. I tried to think through each topic and decide what I was supposed to learn from it, rather than just reading it over.
5. I tried to determine which concepts I didn't understand well.
6. I set goals for myself in order to direct my activities.
7. If I got confused during online activities, I made sure I sorted it out before proceeding on to the next section of the course.
8. I kept track of how much I understood, not just if I was getting through the material.
9. I stopped once in a while and went over what I had learned.

Satisfaction (adapted from Artino, 2008)

1. Overall, I was satisfied with my online learning experience.
2. This online course met my needs as a learner.
3. I would recommend this online course to a friend who needed to learn the material.

Prior knowledge

1. I knew the steps necessary to prevent adverse phenomena that result from exposure to altitude.
2. I could identify the methods used to prevent motion sickness in flight.
3. I was familiar with how the different sensory systems function in flight.
4. I could describe the aviation life support equipment used by personnel flying in naval aircraft.
5. I could describe the emergency egress procedures used for ejection seat-equipped aircraft.

References

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

Allen, I. E., & Seaman, J. (2008). *Staying the course: Online education in the United States, 2008.* Retrieved November 20, 2008, from http://www.sloan-c.org/publications/survey/pdf/staying_the_course.pdf

Arbuckle, J. L. (2006). *Amos 7.0 user's guide.* Chicago, IL: SPSS, Inc.

Artino, A. R. (2008). Motivational beliefs and perceptions of instructional quality: Predicting satisfaction with online training. *Journal of Computer Assisted Learning*, *24*, 260−270.

Artino, A. R., & McCoach, D. B. (2008). Development and initial validation of the online learning value and self-efficacy scale. *Journal of Educational Computing Research*, *38*, 379−403.

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

Azevedo (2007). Understanding the complex nature of self-regulatory processes in learning with computer-based learning environments: An introduction. *Metacognition and Learning*, *2*, 7−65.

Azevedo, R., & Cromley, J. G. (2004). Does training on self-regulated learning facilitate students' learning with hypermedia? *Journal of Educational Psychology*, *96*, 523−535.

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.

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

Boekaerts, M., & Cascallar, E. (2006). How far have we moved toward the integration of theory and practice in self-regulation? *Educational Psychology Review*, *18*, 199−210.
Bonk, C. J., & Dennen, V. P. (2005). *Massive multiplayer online gaming: A research framework for military training and education.* Retrieved December 4, 2008, from http://blogoehlert.typepad.com/eclippings/files/GameReport_Bonk_final.pdf
Bonk, C. J., & Wisher, R. A. (2000). *Applying collaborative and e-learning tool to military distance learning: A research framework (United States Army Research Institute for the Behavioral and Social Sciences).* Alexandria, VA: Author.
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.
College Board. (2007). *2007 college-bound seniors: Total group profile report.* Retrieved January 18, 2008, from http://www.collegeboard.com/prod_downloads/about/news_info/cbsenior/yr2007/national-report.pdf
Curda, S. K., & Curda, L. K. (2003). Advanced distributed learning: A paradigm shift for military education. *Quarterly Review of Distance Education*, *4*, 1−14.
Dabbagh, N., & Kitsantas, A. (2004). Supporting self-regulation in student-centered Web-based learning environments. *International Journal on E-Learning*, *3*(1), 40−47.
DeVellis, R. F. (2003). *Scale development: Theory and applications*, 2nd Ed. Thousand Oaks, CA: Sage Publications.
Duncan, T. G., & McKeachie, W. J. (2005). The making of the Motivated Strategies for Learning Questionnaire. *Educational Psychologist*, *40*, 117−128.
Eccles, J. S., & Wigfield, A. (2002). Motivational beliefs, values, and goals. *Annual Review of Psychology*, *53*, 109−132.
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.
Gable, R. K., & Wolfe, M. B. (1993). *Instrument development in the affective domain: Measuring attitudes and values in corporate and school settings.* Boston: Kluwer Academic Publishers.
Gunawardena, C. N., & McIsaac, M. S. (2004). Distance education. In D. H. Jonassen (Ed.), *Handbook of research for educational communications and technology* (pp. 355−396)., 2nd ed. Mahwah, NJ: Erlbaum.
Hadwin, A. F., Winne, P. H., Stockley, D. B., Nesbit, J. C., & Woszczyna, C. (2001). Context moderates students' self-reports about how they study. *Journal of Educational Psychology*, *93*, 477−487.
Hadwin, A. F., Nesbit, J. C., Jamieson-Noel, D., Code, J., & Winne, P. H. (2007). Examining trace data to explore self-regulated learning. *Metacognition and Learning*, *2*, 107−124.
Haladyna, T. M., Downing, S. M., & Rodriguez, M. C. (2002). A review of multiple-choice item-writing guidelines for classroom assessment. *Applied Measurement in Education*, *15*, 309−334.
Hartley, K., & Bendixen, L. D. (2001). Educational research in the Internet age: Examining the role of individual characteristics. *Educational Researcher*, *30*(9), 22−26.
Hu, L., & Bentler, P. M. (1999). Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. *Structural Equation Modeling*, *6*, 1−55.
Keller, J. M. (1999). Using the ARCS motivational process in computer-based instruction and distance education. *New Directions in Teaching and Learning*, *78*, 39−47.
Kline, R. B. (2005). *Principles and practice of structural equation modeling*, 2nd ed. New York: The Guilford Press.
Kraiger, K., Ford, J. K., & Salas, E. (1993). Application of cognitive, skill-based, and affective theories of learning outcomes to new methods of training evaluation. *Journal of Applied Psychology*, *78*, 311−328.
Lajoie, S. P., & Azevedo, R. (2006). Teaching and learning in technology-rich environments. In P. A. Alexander, & P. H. Winne (Eds.), *Handbook of educational psychology* (pp. 803−821)., 2nd ed. Mahwah, NJ: Lawrence Erlbaum Associates.
Larreamendy-Joerns, J., & Leinhardt, G. (2006). Going the distance with online education. *Review of Educational Research*, *76*, 567−605.
Lynch, R., & Dembo, M. (2004). The relationship between self-regulation and online learning in a blended learning context. *International Review of Research in Open and Distance Learning*, *5*(2), 1−16.
Maehr, M. (1976). Continuing motivation: An analysis of a seldom considered educational outcome. *Review of Educational Research*, *46*, 443−462.
Mayer, R. E., & Chandler, P. (2001). When learning is just a click away: Does simple user interaction foster deeper understanding of multimedia messages? *Journal of Educational Psychology*, *93*, 390−397.
Menard, S. (2000). Coefficients of determination for multiple logistic regression analysis. *The American Statistician*, *54*(1), 17−24.
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.
Nesbit, J. C., & Hadwin, A. F. (2006). Methodological issues in educational psychology. In P. A. Alexander, & P. H. Winne (Eds.), *Handbook of educational psychology* (pp. 825−847)., 2nd ed. Mahwah, NJ: Lawrence Erlbaum Associates.
Pajares, F. (2002). *Overview of social cognitive theory and of self-efficacy.* Retrieved April 10, 2006, from http://www.emory.edu/EDUCATION/mfp/eff.html
Pekrun, R. (2006). The control-value theory of achievement emotions: Assumptions, corollaries, and implications for educational research and practice. *Educational Psychology Review*, *18*, 315−341.
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.
Pekrun, R., Goetz, T., & Perry, R. P. (2005). *Achievement emotions questionnaire (AEQ): User's manual.* Munich, Germany: University of Munich, Department of Psychology.
Pintrich, P. R. (1995). Understanding self-regulated learning. In P. R. Pintrich (Ed.), *Understanding self-regulated learning* (pp. 3−12). San Francisco: Jossey-Bass.
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, & M. Zeidner (Eds.), *Handbook of self-regulation* (pp. 451−502). San Diego, CA: Academic Press.
Pintrich, P. R., & De Groot, E. V. (1990). Motivational and self-regulated learning component of classroom academic performance. *Journal of Educational Psychology*, *82*, 33−40.
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.
Roeser, R. W., Marachi, R., & Gehlbach, H. (2002). A goal theory perspective on teachers' professional identities and the contexts of teaching. In C. Midgley (Ed.), *Goals, goal structures, and patterns of adaptive learning* (pp. 205−241). Mahwah, NJ: Lawrence Erlbaum Associates.
Schunk, D. H., Pintrich, P. R., & Meece, J. L. (2008). *Motivation in education: Theory, research, and applications*, 3rd ed. Upper Saddle River, NJ: Pearson Education.
Shadish, W. R., Cook, T. D., & Campbell, D. T. (2002). *Experimental and quasi-experimental designs for generalized causal inference.* Boston: Houghton-Mifflin.
Sitzmann, T., Kraiger, K., Stewart, D., & Wisher, R. (2006). The comparative effectiveness of Web-based and classroom instruction: A meta-analysis. *Personnel Psychology*, *59*, 623−664.
Tallent-Runnels, M. K., Thomas, J. A., Lan, W. Y., Cooper, S., Ahern, T. C., Shaw, S. M., et al. (2006). Teaching courses online: A review of the research. *Review of Educational Research*, *76*, 93−135.
Thorndike, R. M. (2005). *Measurement and evaluation in psychology and education*, 7th ed. Upper Saddle River, NJ: Pearson Education, Inc.
United States Naval Academy. (2007). *Class of 2011 profile.* Retrieved January 18, 2008, from http://www.usna.edu/Admissions/documents/Classof2011Profile.pdf
Whipp, J. L., & Chiarelli, S. (2004). Self-regulation in a Web-based course: A case study. *Educational Technology Research and Development*, *52*(4), 5−22.
Wisher, R. A. (2006). Blended learning in military training. In C. J. Bonk, & C. R. Graham (Eds.), *Handbook of blended learning: Global perspectives, local designs* (pp. 519−532). San Francisco: Pfeiffer Publishing.
Wisher, R. A., & Champagne, M. V. (2000). Distance learning and training: An evaluation perspective. In S. Tobius, & J. D. Fletcher (Eds.), *Training and retraining: A handbook for business, industry, government, and the military* (pp. 385−409). Detroit, MI: Macmillan Reference USA.
Zhao, Y., Lei, J., Yan, B., Lai, C., & Tan, H. S. (2005). What makes the difference? A practical analysis of research on the effectiveness of distance education. *Teachers College Record*, *107*, 1836−1884.
Zimmerman, B. J. (2000). Attaining self-regulation: A social cognitive perspective. In M. Boekaerts, P. R. Pintrich, & M. Zeidner (Eds.), *Handbook of self-regulation* (pp. 13−39). San Diego, CA: Academic.
Zusho, A., Pintrich, P. R., & Coppola, B. (2003). Skill and will: The role of motivation and cognition in the learning of college chemistry. *International Journal of Science Education*, *25*, 1081−1094.