The Effects of ARCS-based Confidence Strategies on Learner Confidence and Performance in Distance Education

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Abstract

The purpose of this research was to manipulate the component of confidence found in Keller’s ARCS Model to enhance the confidence and performance of undergraduate students enrolled in an online course at a Texas University. This study also tested whether the confidence tactics had any unintentional effect on the remaining attention, relevance, and satisfaction subscales of the ARCS model and learners’ overall motivation for the class and the instructional materials. The results indicated that the treatment group showed statistically greater gains than the control group in terms of learner confidence on the CIS but not the IMMS. The treatment group outperformed the control group on all of the individual posttest measures and on the overall mean performance score. The results showed no statistically significant difference on the attention subsection. However, statistically significant differences were noted for the relevance and satisfaction subscales. There was also a statistically significant difference in overall learner motivation as measured on both surveys.

Introduction

Motivation is a highly important yet under-researched aspect of learning. Means, Jonassen, and Dwyer (1997) cited studies showing that motivation accounted for 16% to 38% of the variations in overall student achievement. However, an extensive review of the literature leads one to concur that there is a noted lack of research concerning the motivational needs of learners (Astleitner & Keller, 1995; Gabrielle, 2003; Means, Jonassen & Dwyer, 1997; Shellnut, Knowlton & Savage, 1999; Visser & Keller, 1990).

This is particularly true in terms of computer and web-based instruction. Keller (1999a) noted that self-directed learning environments, like distance education classes, posed greater challenges to learner motivation than their face-to-face counterparts. Song and Keller (2001) advised that continued problems with learner motivation in web or site-based Computer Assisted Instruction (CAI) were often the result of incorrect assumptions on the part of instructional designers that motivation, if taken into account at all, was assumed to be already present in the
CAI. They also noted that with the widespread use of computers in education, one could no longer depend on the “novelty effect” of technology to stimulate learner motivation.

Distance education environments provide unique challenges for instructors and designers who wish to motivate students. Traditional distance learning models stress the independence of the learner (Downs & Moller, 1999; Moore, 1989) and the privatization of the learning environment (Keegan, 1986; Moller, et. al. 2005). Such student-centered, independent learning requires a strong sense of motivation and confidence. Researchers may not be paying enough attention to the motivational requirements of online learners.

For example, in an in-depth study of the proceedings of the World Conferences of the International Council for Distance Education from 1988 to 1995, Visser, Plomp, Amirault, and Kuiper (2002) found that only six of 801 studies addressed motivational concerns of online learners. They also noted that a disturbing “trend in the lack of attention paid to motivation in distance education is present in some of the recently published specialized handbooks in the field of distance education” (p. 95).

Keller’s ARCS Model and Previous Studies

To stimulate and manage student motivation to learn, Keller (1987a, 1987b, 1987c) created the ARCS Model of Motivation. ARCS stands for Attention, Relevance, Confidence and Satisfaction and serves as the framework for the motivational and confidence-enhancing tactics found in this study.

Keller’s ARCS model enjoys wide support in the literature, and a number of researchers attest to its reliability and validity in many different learning and design environments. For example, ARCS research can be found concerning the traditional classroom (Bickford, 1989; Klein & Freitag, 1992; Means, Jonassen & Dwyer, 1997; Moller, 1993; Naime-Diefenbach, 1991; Small & Gluck, 1994; Visser & Keller, 1990), Computer Assisted Instruction (Asteitner & Keller, 1995; Bohlin & Milheim, 1994; ChanLin, 1994; Lee & Boling, 1996; Shelnut, Knowlton & Savage, 1999; Song, 1998; Song & Keller, 1999; Suzuki & Keller, 1996), blended learning environments (Gabrielle, 2003), and online, distant, and web-based classrooms (Chyung, 2001; Huett, 2006; Song, 2000; Visser, 1998). In fact, Means, Jonassen, and Dwyer (1997) called Keller’s ARCS model the “only coherent and comprehensive instructional design model accommodating motivation” (p. 5).

The ARCS model was initially predicated on the Expectancy Value Theory based on the work of Tolman (1932) and Lewin (1938). The Expectancy Value Theory essentially states that learners pursue activities they value and in which they expect to succeed (Keller, 1987c). The ARCS model is an attempt to synthesize behavioral, cognitive, and affective learning theories and demonstrate that learner motivation can be influenced through external conditions such as instructional materials (Moller, 1993).

To quote Keller (1987a), “motivational interventions can be focused within a general category, or specific subcategory of the model” (p. 6). However, there is insufficient evidence to support such claims that learner motivation can be isolated or compartmentalized into separate categories. Studies of ARCS-enhanced instructional materials have returned inconsistent results on the individual subsections as well as on the overall measure of learner motivation. Means, Jonassen, and Dwyer (1997) found that “there is inconsistent evidence that each of the factors operates independently, that learners’ motivations can be decomposed and isolated, or that
changes in one motivational state have an inconsequential effect on others” (p.6). For example, Naime-Diefenbach (1991) specifically targeted increases in learner attention and confidence and claims her study “validated the attention component of the ARCS model under controlled conditions” (p.50). However, she was not successful in isolating and validating confidence.

Also, Moller (1993) was unsuccessful in isolating and validating increases in confidence for the treatment group in a study specifically designed to do so. Though overall motivation, performance, and self-directed learning were the targets of Gabrielle’s (2003) study, she found mixed returns on the confidence subsection. Her results indicated a significant difference between groups as regards confidence on one survey measure but not the other. In a study designed only to enhance the relevance subsection of the ARCS model, Babe (1995) also found statistically significant differences between groups for all subsections (attention, relevance, confidence, and satisfaction).

The results of this study (and those mentioned above) continue to challenge researchers’ assumptions (Keller, 1987a; Naime-Diefenbach, 1991) that individual components of the ARCS model can be isolated for improvement.

The major focus of this study was to determine whether confidence could be specifically targeted for improvement and whether improvements in confidence would translate into overall motivation and performance gains. The underlying assumptions are that confidence is a highly important aspect of motivation, that it can be manipulated through external factors, and that it has an effect on learner performance.

Confidence

Confidence has been described in the literature as a personality trait (McKinney, 1960). However, confidence is more universally accepted as situation-specific, and it can therefore be manipulated by internal and external factors (Keller, 1979; Moller 1993).

In his development of Social Learning Theory, Rotter (1954) argued that people have a tendency to ascribe their failures or successes to internal or external factors: he found that people tend to pursue that which brings about the most rewarding consequence, which he called expectancy. Bandura (1977; 1986) elaborated on this concept when he explained that individuals’ expectancy is related to their estimate of the outcome of a given behavior. He used the term self-efficacy to describe the belief that one’s abilities and knowledge are sufficient to be successful at a given task: learners who expect to succeed demonstrate more confidence than learners who expect to fail. However, a learner may still possess confidence without the guarantee of success, as long as the challenge is “within acceptable boundaries” (Naime-Diefenbach, 1991, p. 12).

Building on the work of Rotter, Bandura, and others, Keller defines confidence as “helping the learners believe/feel that they will succeed and control their success” (Keller, 1987a, p. 2). Confidence is the interplay between desire for success and fear of failure. These opposing forces vie for control over the learning experience. To better understand the role of confidence, Keller and Suzuki (1988) characterize its three most important dimensions: perceived competence, perceived control, and expectancy for success.

Perceived Competence

Confidence is about self-perception: of one’s abilities and control within the learning context. Learners who believe in their potential success are more likely to exert the effort
required to be successful. Despite the fact that learner expectations are not always realistically
aligned with learner abilities, expectations can still positively influence outcomes (Bickford,
1989).

Students with a poor perception of their abilities may become anxious and perform less
well than their counterparts with higher confidence in their abilities (Naime-Diefenbach, 1991).
Moller (1993) describes learners with high anxiety as often “misdirecting effort from learning to
task-irrelevant concerns. Learners high in anxiety are often low in self-esteem and, as such,
avoid evaluative situations” (p. 7). In contrast, learners with normal anxiety levels feel more
confident and motivated in situations where they must be evaluated.

Perceived Control

When learners believe their efforts and decisions have real consequences, they feel more
confident (Bandura, 1977; Keller & Suzuki, 1988). This fosters a higher internal locus of control
and a greater sense of self-pride and accomplishment (Moller, 1993). In contrast, learners who
believe luck or other uncontrollable outside forces are in charge of their successes or failures
tend to feel more helpless and unconfident, and perform at lower levels. Keller (1979) finds that
locus of control is more closely related to “attitudes toward performance than to actual
performance” (p. 31).

According to Keller and Suzuki (1988), “features in the instruction that promote feelings
of personal control over outcomes will help develop confidence and persistence” (p. 405). This is
supported by researchers such as Carroll (1963), Bloom (1976), and Kinzie and Sullivan (1989)
who recommend allowing learners to control the pace of instruction. However, research is
mixed about how much control is actually beneficial to learners (Klein & Keller, 1990).
Steinberg (1989) cited numerous studies that showed that learners with little prior knowledge of
the subject matter were likely to perform poorly with increased learner control.

Keller (1987a) suggests one strategy for fostering control is to give students knowledge
of what is expected of them. However, this is not enough to guarantee confidence: while learners
may understand what steps are necessary to complete an assigned task, without the confidence in
their ability to successfully complete those tasks, they may not perform as well as they should
(Moller, 1993). The concept of control may be particularly relevant to distance learning
environments. Roblyer (1999) found that students who chose distance education classes over
face-to-face classes often did so out of a greater desire or need for control over their own
learning outcomes.

Expectancy for Success

Learners’ expectations or beliefs can influence outcomes. For example, if the learner
believes he will be successful at a given task, such belief may result in greater effort expended
and improve success. Learners with such expectancy for success also possess higher motivation
than learners who expect failure (Naime-Diefenbach, 1991).

The learner who expects failure may also evince learned helplessness (Keller, 1979;
Seligman, 1975). According to Keller (1979), learned helplessness may be “established by
inability, impossibility of the task, or a negative set” (p. 31). Regardless of its origins, once taken
hold, learned helplessness can be a powerful impediment to success.

In order to help learners overcome learned helplessness and other self-fulfilling
prophecies, it is necessary that instructional designers consider learner anxiety and provide for
instruction that helps boost learner confidence, making them feel competent, in control, and successful. In general, Keller (1987a, 1987b) calls for increasing confidence by providing for success opportunities that are meaningful, provide adequate challenge, bolster achievement, and avoid boredom.

It is important to note that while fear of failure can strongly affect motivation in traditional learning environments, it may be an even greater factor in distance education (Visser, 1998). Even with highly-motivated students, the isolation of the learner, an unfamiliar distance environment, the technology required in distance courses, the distance separating learner and instructor, and other mitigating factors have an effect on learner confidence. Studies have shown that technology brings with it new attitudes and anxiety levels that can have a direct effect on confidence (Yaghi & Ghaith, 2002). The instructor of the distant course must be especially concerned with increasing and maintaining learner confidence.

Method

The purposes of this research were to: (a) determine if there were statistically significant differences in confidence levels of online learners using systematically designed confidence tactics based on Keller’s ARCS model; (b) determine if the tactics also produced a statistically significant difference in academic performance; (c) determine if the tactics also produced a statistically significant difference in the remaining ARCS subsections of attention, relevance, and satisfaction; and (d) determine if the tactics also produced a statistically significant difference in overall learner motivation as measured by the total ARCS score.

The design of the instructional materials and treatment in this study was the result of analysis of Keller’s work on the ARCS model as well as that of numerous other researchers. After reviewing the literature, tactics that could be applied to improve learner confidence and performance began to emerge. Following Keller’s (1999a, b) advice, the confidence-enhancing tactics were designed to be appropriate for the audience, the delivery system and the course, to be in-line with course objectives and assessments, to be integrated with instruction (provide a minimal level of disruption to the learning process), to be cost-effective, and to fit within the time restraints of the class.

Participants

The subjects in this study were undergraduate students enrolled in a for-credit course at a Texas university rated Carnegie Doctoral/Research Universities—Extensive. Subjects were selected from participants in a freshman-level computer course and were randomly assigned to either the treatment or the control group.

This study was conducted over a period of approximately five and one-half weeks. The initial sample consisted of 81 (treatment n=41; control n=40) total students and included 37 males (treatment n=18; control n=19) and 44 females (treatment n=23; control n=21). Ages ranged from 18 to 31. Student-reported ethnicities were in-line with university-reported demographics concerning the campus undergraduate population as a whole.

A majority of subjects (67) reported full-time enrollment at the university. For the semester in which this study was conducted, 35 subjects reported this section as their first attempt at an online class, while 44 reported having taken at least one online course in the past.
In addition, 5 subjects rated their experience and proficiency with computers as “beginning user.” Fifty-seven students ranked themselves as an “intermediate user.” Lastly, 15 rated themselves as an “advanced user” with 2 self-reporting as an “expert user.”

Research Design

This study used a true experimental, posttest-only, control-group design, and was undertaken using quantitative methods (Gall, Gall, & Borg, 2003). Two quantitative surveys were used to measure confidence and motivation: (a) the Course Interest Survey (CIS), and (b) the Instructional Materials Motivation Survey (IMMS). These two surveys were delivered in web-based format. Performance was also measured based on the differences between posttest scores automatically generated in SAM Office 2003.

This experiment used SAM Office 2003 and WebCT for the delivery and presentation of the tactics, strategies, confidence-enhancing e-mails (CEE), and instructional course content. SAM (Skill Assessment Manager) provides training scenarios for Microsoft Office in a lifelike, simulated environment designed to replicate Microsoft Office 2003. SAM Office 2003 was chosen as the delivery platform based on the prior experience of the researchers that this platform did an effective job of advancing student skills in Microsoft Office 2003. In the case of this study, the students were trained to use the Access database program. Three semesters of prior surveys indicated that Access was the Microsoft Office program students were least familiar with. Therefore, Access was chosen to help control for any variance in student ability.

The SAM software is widely distributed to universities across the country and claims to have served hundreds of thousands of students and educators since its inception in 1998 (Course Technology Website, 2005). WebCT, along with SAM, is another widely used distance learning application.

The attention, relevance, and satisfaction components of the ARCS model were not intentionally incorporated into the design of this study in order to better isolate the variable of confidence in question.

Variables

The independent variable (treatment) consisted of ARCS confidence tactics (see Table 1) distributed through SAM Office 2003 and through confidence-enhancing e-mail messages in the WebCT environment (see Figure 1).

The two main dependent variables under investigation were confidence and academic performance. In addition, scores for the remaining ARCS components of attention, relevance, and satisfaction as well as an overall motivation score (ARCS total score) were calculated for comparison purposes.
Table 1

*Confidence Tactics (CT)*

<table>
<thead>
<tr>
<th>CT Components</th>
<th>Treatment Group</th>
<th>Control</th>
</tr>
</thead>
<tbody>
<tr>
<td>LR1: Are there clear statements, in terms of observable behaviors, of what is expected of the learners?</td>
<td>Objectives were stated in <em>SAM</em> at the beginning of each lesson and restated on guide-sheets. Reminders were stated in the confidence-enhancing e-mails (CEE). In addition, a pretest (see SO1) served to familiarize learners with what was expected of them.</td>
<td>Objectives were not stated, and a pretest was not provided.</td>
</tr>
<tr>
<td>LR2: Is there a means for learners to write their own goals or objectives?</td>
<td>SAM 2003 is a self-contained simulation environment, so this was not an option.</td>
<td>SAM 2003 is a self-contained simulation environment, so this was not an option.</td>
</tr>
<tr>
<td>SO1: Multiple entry points: Provide a pretest and multiple entry points into the instructional material.</td>
<td>The treatment group received a pretest/performance exercise that determined the level of expertise the learner brought to each exercise, and this allowed for the learner to enter the training/instructional material at differing points. Each learner received training/instructional materials only in areas of demonstrated deficiency. Learners were reminded of this in the CEEs.</td>
<td>The control group received no such pretest/performance exercise and was required to take all of the training/instructional material regardless of previous knowledge, experience or expertise.</td>
</tr>
<tr>
<td>SO2: Is the content organized in a clear, easy-to-follow sequence?</td>
<td>The content was organized in a pretest-training-posttest sequence. The treatment group received a statement with each lesson assuring them the material was clear and easy-to-follow along with directions highlighting how to proceed through the pretest-training-posttest sequence. Learners were reminded of this in the CEEs.</td>
<td>This group received no such explanation.</td>
</tr>
<tr>
<td>CT Components</td>
<td>Treatment Group</td>
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<tr>
<td>SO3: Are the tasks sequenced from simple to difficult within the material?</td>
<td>Materials in SAM 2003 follow a logical sequence and are generally sequenced from easy to more difficult in each lesson. However, only the treatment group received a statement assuring them of this fact. Learners were reminded of this in the CEEs.</td>
<td>The tasks were sequenced from simple to difficult; however, the control group received no statement.</td>
</tr>
<tr>
<td>SO4: Is the overall challenge level appropriate for this audience?</td>
<td>Yes, but only in the treatment group was this stated to the learner. Learners were reminded of this in the CEEs.</td>
<td>Yes, but not stated.</td>
</tr>
<tr>
<td>SO5: Are the materials free of “trick” or excessively difficult questions or exercises?</td>
<td>Yes, but only this version stated this fact to the learner, and learners were reminded of this in the CEEs. It should be noted, however, that each student came to the program with differing levels of expertise, so it was impossible to gauge the difficulty level for everyone. To control for this variable, a pretest was made available to the treatment group to assess initial ability and allow for multiple entry points into the instruction. Also, SAM 2003’s simulation of Microsoft Access was used for the duration of this experiment, since three past surveys of students have indicated that Access was the program with which they were the least familiar.</td>
<td>Yes, but no pretest was administered, and this fact was not stated.</td>
</tr>
<tr>
<td>SO6: Are the exercises consistent with the objectives?</td>
<td>Yes, however, only this version stated the objectives to the learner before beginning. Learners were also reminded of this in the CEEs.</td>
<td>Yes, but objectives were not stated.</td>
</tr>
<tr>
<td>SO7: Are there methods for self-evaluation?</td>
<td>Yes, SAM 2003 was set to display simple feedback for each task (e.g., correct or incorrect). Results were also displayed at the end of each exam as a percentage (e.g., 90% correct). Learners were reminded of this in the CEEs.</td>
<td>No feedback was provided, and no results were displayed.</td>
</tr>
<tr>
<td>CT Components</td>
<td>Treatment Group</td>
<td>Control</td>
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<tr>
<td>PC1: Are learners given choices in sequencing? Can they sequence their study of different parts of the material?</td>
<td>All exercises in each module were presented at once, and learners were able to approach the lessons in any order they chose. Learners were reminded of this in the CEEs.</td>
<td>Learners were given the lessons in a particular sequence, one-at-a-time, with a specific due date.</td>
</tr>
<tr>
<td>PC2: Are learners allowed to go at their own pace?</td>
<td>Self-pacing was allowed with a due date established clearly up front, and all assignments were opened at the same time and stayed open until the due date with no time-limits for self-pacing. Learners were reminded of this in the CEEs.</td>
<td>Each exercise was timed. The time-limit was decided as follows: (a) examine the time it took for the students in the previous semester to complete exercises, (b) select the longest time for completion, and (c) add thirty minutes. The control group had ample time to complete the exercises but was not informed of this. Every control group subject finished each exercise before time had expired.</td>
</tr>
<tr>
<td>PC3: Are learners given opportunities to create their own exercises or methods of demonstrating competency?</td>
<td>Learners were given the opportunity for demonstrating further competency by creating their own exercises (such as an Access database) for extra credit or to take the place of a low test score. Learners were reminded of this in the CEEs.</td>
<td>Learners were given no such opportunity.</td>
</tr>
<tr>
<td>PC4: Are learners given choice over study location?</td>
<td>Yes—this was an internet-based class. Learners were reminded of this in the CEEs.</td>
<td>Yes—this was an internet-based class.</td>
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</table>

*(table continues)*
<table>
<thead>
<tr>
<th>CT Components</th>
<th>Treatment Group</th>
<th>Control</th>
</tr>
</thead>
<tbody>
<tr>
<td>PC5: Are learners given the opportunity to record comments on how the materials could be made more interesting?</td>
<td>A blog and threaded discussion concerning the materials was set up to allow for comments. Learners were encouraged to participate in the CEEs.</td>
<td>There was no access to a blog or threaded discussion about materials.</td>
</tr>
<tr>
<td>PC6: Are learners given the opportunity for feedback and practice in a “low risk” environment where it is acceptable to make mistakes and learn from them?</td>
<td>On the pretest, training, and posttest, learners were given feedback regarding performance and were allowed multiple attempts at the posttest. They were reminded about these multiple attempts at the beginning of each exercise and in the CEEs.</td>
<td>The control group received no pretest, one timed attempt at the training with minimal computer-generated feedback, and one attempt at the posttest with no feedback concerning final performance.</td>
</tr>
</tbody>
</table>

*Note: Adapted from Moller (1993) and Moller and Russell (1994). LR=Learning Requirements, SO=Success Opportunities, PC=Personal Control, CEE=Confidence-Enhancing Emails.*
Dear CECS 1100 Students,

It is my privilege to welcome you to the fall semester of CECS 1100. This letter serves to introduce myself and to offer you some advice and recommendations about the course and the assignments you will be completing for this class. I want you to enjoy and learn from this class, and I have no doubt that you will be successful!

First, let me give you a brief personal introduction. My name is Jason Huett. I have taught this online section of CECS 1100 for two years now. In addition, I have taught numerous different university courses for the last 13 years. I am in the process of completing my PhD in Educational Computing. If you would like to learn more about me, please feel free to access my personal website at http://webpages.charter.net/xxxxxxx/

Second, I would like to offer some suggestions regarding how to proceed with the class.

1. Make sure you have logged in to the correct SAM Office 2003 section. Your section is _____
2. Make sure you read and follow all the directions on your assignment sheets for each pathway.
3. Remember, SAM Office 2003 pathways are numbered from one to eight in a clear and easy to follow sequence. While the assignments are available for you to complete in any order, they are generally sequenced from simple to more difficult.
4. Pay attention to due dates. You have one due date for all eight Access pathways. Set a schedule for completion of the assignments and stick to it. Please do not procrastinate.
5. Do as well as you can on the pretest but don’t worry if you don’t know all the answers. Feel free to skip any question you don’t know how to do.
6. You can take the posttest up to six times if you desire. I will only count your highest grade.

In these assignments, you have complete control of your pacing, your sequencing, your place of study, and you can have multiple attempts at the graded portion of the pathway. You will be given feedback regarding your performance in terms of a percent grade (e.g. 84% correct) on each exam by SAM Office 2003. You can also access your progress report at any time by clicking on the reports button in SAM Office 2003.

Lastly, I also encourage you to submit any comments you have concerning these assignments and how they can be improved to the ____ section of the discussion board in WebCT. I have also set up a blog (short for web-log) where you can record your thoughts, comments, and ideas at http://xxxxx.blogspot.com Give it a try!

Your success in this class depends entirely on you, and you will be successful! If you ever need my help or have any questions, please do not hesitate to contact me via e-mail at jxxxx@xxxxxxedu. If it is an emergency, I can be reached on my cell at 940-395-3460.

I look forward to working with you this semester.

Sincerely, XXXXX

Figure 1. Example of confidence-enhancing email (CEE) with comments.
Instruments

The instruments used in the study were two surveys and series of posttests, and all were delivered in a web-based format at a distance. The Course Interest Survey (CIS) was designed to assess the four components of the ARCS model (attention, relevance, confidence, and satisfaction), and to provide an overall motivation score in relation to the class (Keller & Subhiyah, 1993). In this study, an individual measure of learner confidence was highlighted. Prior scores obtained with this instrument have resulted in a Cronbach’s alpha for all five components (attention, relevance, confidence, satisfaction and total ARCS score) in excess of .80 (Gabrielle, 2003). For this study, scores on the web-based CIS were found to have a total reliability alpha of .93 based on obtained scores. The reliability alphas for the computed scores of the individual subsections in this study were as follows: attention (.80), relevance (.83), confidence (.80), and satisfaction (.83).

Also created by Keller (1993), the Instructional Materials Motivation Survey (IMMS) was used to gauge the motivational effect of instructional materials. In relationship to the instructional material, it was designed to assess the four components of the ARCS model (attention, relevance, confidence, and satisfaction), as well as an overall motivation score. Again, an individual measure of learner confidence was highlighted. Prior scores obtained with this instrument (A, R, C, S, and total ARCS score) have resulted in an overall Cronbach’s alpha in excess of .80 (Gabrielle, 2003). The confidence subscale has previously shown a Cronbach’s alpha of .90 (Keller, 1993; Moller, 1993). For this study, the web-based IMMS was found to have a total reliability alpha of .93 based on the obtained scores. The reliability alphas for computed scores of the individual subsections in this study were as follows: attention (.86), relevance (.80), confidence (.85), and satisfaction (.86).

Academic performance was measured using posttests automatically generated by SAM Office 2003 after students completed the training/instructional materials. For this study, the posttest was found to have a total reliability alpha of .86 based on obtained scores.

Results

An independent samples t-test was chosen to compare the survey responses. The treatment group showed statistically significant gains over the control group in terms of learner confidence on the Course Interest Survey (CIS) (p=.004) but not the Instructional Materials Motivation Survey (IMMS) (p=.080). Again, an independent samples t-test was chosen to compare posttest performance. In this case, the treatment group outperformed the control group on all of the individual posttest measures and, most importantly, on the overall aggregate mean performance score (p<.001; d=1).

The results showed no statistically significant difference on the attention subsection of the ARCS model between the groups for either the CIS or IMMS using a conservative alpha measure of p=.01.

Statistically significant differences were noted for the relevance and satisfaction subscales of the model even though no intentional effort was made to enhance any variable except confidence. There was also a statistically significant difference in overall learner motivation as measured on both the CIS and IMMS.
Confidence and CIS and IMMS Results

Given the design of the study, it does not unreasonable to assume the subjects receiving the confidence-enhancing tactics would perceive an increase in personal confidence and motivation for the class and the instructional materials. This assumption was only partially correct. While the learners in the treatment group did have higher confidence and motivation scores as regards the class (CIS), they did not show similar confidence gains as regards the instructional materials (IMMS). Quantitative results indicated there was a statistically significant difference between the treatment and control groups for confidence as measured by the CIS (p=.004). This finding was further supported by the relatively impressive effect size (d=.65) and estimated power (.65) at alpha .01 for the confidence subsection of the CIS.

In addition, results indicated there was not a statistically significant difference between the treatment and control groups for confidence as measured by the IMMS (p=.080). However, the reported effect size (d=.41) and estimated power (.27) at alpha .01 cannot be dismissed as insignificant. Further study is warranted before a definitive conclusion can be drawn. The means, standard deviations, skewness and kurtosis values, effect size, and approximate power for the confidence variable for both measures is reported in Table 2.

Table 2
Results for the Confidence Subsection of the CIS and IMMS

<table>
<thead>
<tr>
<th>Subsection</th>
<th>Section</th>
<th>N</th>
<th>Mean</th>
<th>Std. Dev</th>
<th>Skewness</th>
<th>Kurtosis</th>
<th>p</th>
<th>Effect Size (d)</th>
<th>Approx. Power (p=.05)</th>
<th>Approx. Power (p=.01)</th>
</tr>
</thead>
<tbody>
<tr>
<td>CIS Confidence</td>
<td>Treatment</td>
<td>38</td>
<td>34.79</td>
<td>4.916</td>
<td>-1.010</td>
<td>.583</td>
<td>.004</td>
<td>.65</td>
<td>.87</td>
<td>.65</td>
</tr>
<tr>
<td></td>
<td>Control</td>
<td>37</td>
<td>31.46</td>
<td>4.857</td>
<td>-1.269</td>
<td>.759</td>
<td></td>
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<td></td>
<td>Total</td>
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<td>-.928</td>
<td>.863</td>
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<td>IMMS Confidence</td>
<td>Treatment</td>
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<td>31.77</td>
<td>7.276</td>
<td>-.607</td>
<td>-.207</td>
<td>.080</td>
<td>.41</td>
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<td>Control</td>
<td>37</td>
<td>28.70</td>
<td>7.356</td>
<td>-.159</td>
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<td></td>
<td>Total</td>
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<td>30.19</td>
<td>7.428</td>
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Performance Results

Differences in academic performance were measured between the control group and the treatment group using automatically generated test scores in *SAM Office 2003*. There were eight posttest subsections delivered over the treatment period. The results examined each of these posttest subsections individually and then as an aggregate mean score for those completing all eight tests. Only those completing all eight exams were included in the aggregate mean score. The overall average showed a statistically significant difference in performance between the treatment and control groups (p<.001).

Worthy of note was the effect size of 1 for the average mean score. This can be interpreted to mean that the treatment group (n=30), on average, scored approximately one standard deviation above the average mean of the control group (n=26). Another way of looking at this would be to say that the mean of the treatment group was at approximately the 84th percentile of the control group. Though Cohen (1988) does caution against applying his guideline too rigidly, this most likely can be interpreted as a large effect size with substantial power (.91). This supports the contention that the students in the treatment group, on average, outperformed the control group on the posttest measures.

Attention, Relevance, Satisfaction and Overall Motivation

Regarding attention, at alpha .01 (p≤.01) there was no statistically significant difference (p=.014) between the control (n=37) and treatment (n=38) groups for the attention subscale on the CIS. In addition, there was no statistically significant difference (p=.015) between the control (n=37) and treatment (n=35) groups for the attention subscale on the IMMS survey measure. However, the medium effect sizes (CIS d=.56; IMMS d=.57), moderate power ratings (CIS=.49; IMMS =.48), and the relative consistency of findings across the other subsections warrant further study (perhaps with larger sample sizes) before a definitive conclusion can be drawn about the statistical and practical implications of the applied treatment on the participants’ levels of attention.

Regarding relevance, at alpha .01 (p≤.01), *unexpectedly*, there was a statistically significant difference (p<.001) between the control (n=37) and treatment (n=38) groups for the relevance subscale on the CIS. In addition, there was a statistically significant difference (p=.001) between the control (n=37) and treatment (n=35) groups on the IMMS survey measure. The impressive effect sizes (CIS d=.85; IMMS d=.75) and considerable power ratings (CIS=.88; IMMS =.80) lend credence to the claim that the treatment produced unintended effects on the participants’ perception of relevance for both the course (CIS) and the instructional materials (IMMS).

Regarding satisfaction, *unexpectedly*, there was a statistically significant difference (p=.001) between the control (n=37) and treatment (n=38) groups for the satisfaction subscale on the CIS. In addition, there was a statistically significant difference (p=.002) between the control (n=37) and treatment (n=35) groups on the IMMS survey measure. Similar to relevance, the impressive effect sizes (CIS d=.78; IMMS d=.72) and considerable power ratings (CIS=.83; IMMS =.73) lend credence to the claim that the treatment produced unintended effects on the participants’ perception of satisfaction for both the course (CIS) and the instructional materials (IMMS).
Discussion

Based on the study’s design, one could potentially expect the results to reflect an increase in learner confidence on both the IMMS and CIS measures. In fact, given that many of the confidence tactics used in this study were specifically designed to enhance the instructional materials, one would expect the IMMS to show a noticeable increase in learner confidence even if the CIS did not. However, quite the opposite was the case: the students in the treatment group found the tactics confidence-enhancing as regards the class as a whole but not the instructional materials. In a similar study, Moller (1993) failed to obtain changes in confidence as regards instructional materials and listed three possible explanations:

1) The ARCS model is insufficient for improving learner confidence; 2) the resulting tactics and methods used in the research were inappropriate for these subjects or implemented improperly; and 3) the differences were too small to measure using the selected empirical research methods. (p. 89)

To this and echoing Babe (1995), the researchers would add: 4) perhaps the role of the confidence variable, as one of the four main subsections of motivation, needs to be reexamined.

Taking each of these possible explanations in turn, there is insufficient data to suggest that the ARCS model is somehow flawed or incomplete when it comes to addressing learner confidence. The model has shown an ability to increase learner confidence even when confidence was not the focus of the researchers’ investigations. The fact that the model, as a whole, can produce increases in confidence is not really in question. The question is more whether the individual subsection of confidence can be targeted as a valid, independent construct that produces consistent results.

Along with other research, this study’s rather mixed results suggest that confidence may indeed be a more abstract and complicated dimension in the overall realm of motivation than the ARCS model would lead one to believe. Researchers who have specifically targeted confidence for enhancement have been unable to validate the independence nature of the confidence component under controlled conditions (Moller, 1993; Naime-Diefenbach, 1991). As mentioned earlier, researchers such as Gabrielle (2003) and Babe (1995) found mixed returns for confidence even when confidence was not the focus of the study.

Given the complexity of isolating confidence and of dealing with the cognitive and affective domains of the individual as well as concepts such as anxiety, locus of control, and fear of failure, it appears one weakness of the ARCS model may be its oversimplification of the abstract and highly complex concept of confidence. In order to obtain an increase in confidence, it may be necessary to take a more comprehensive approach to motivating students and include enhancements to the other ARCS components even if the desire is to focus on confidence alone. This is supported by researchers such as Marovitz and Buckley (1987), who felt the results of their experiments indicated “that the four factors of Keller’s ARCS model are intricately bound together” (p. 12). This would require a rethinking of the ARCS model as a series of related and not independent constructs for improving motivation (Babe, 1995).

The second possible explanation for the lack of a statistically significant difference in confidence regarding the instructional materials is that the confidence tactics and confidence-enhancing e-mails used in this study were ineffective or implemented improperly. This is always a possibility. A few strategies that may have had an effect on confidence were “built-in” to the
SAM Office 2003 software (such as any novelty effects generated through the simulation program or student choice over study location) and could not be removed. This may have impacted the confidence levels of participants in unforeseeable ways. In addition, treatment group subjects indicated that they found some of the confidence tactics used in this study more effective than others.

For example, informal surveys of participants indicated they found the guide-sheets for each Access assignment and the e-mail messages, which incorporated all of the tactics (see Table 1) under Component I: Learning Requirements and most of those under Component II: Success Opportunities, as confidence-boosting. However, only two students took advantage of the opportunity, under Component III: Personal Control, to create their own exercises or methods of demonstrating competency. Also, under the same component of personal control, only two students accessed the blog and threaded discussion on how to make the materials more interesting. Finally, even though students were given a choice to control their own sequencing, almost all chose to complete the assignments in the same order.

Researchers have linked increases in learner control to increases in confidence (and positive attitudes of learners) as well as decreases in learner anxiety (Bandura, 1977; Keller & Suzuki, 1988; Kinzie, 1990; Kinzie & Sullivan, 1989; Moller & Russell, 1994). However, in this study, some members of the control group indicated an appreciation for the strict structure, deadlines and pacing. A majority of treatment group students (64%), who were given personal control to complete the assignments at any time during a five-and-one-half-week window, waited until the last 72 hours to “cram in” most of the assignments before they were due. Only 24% of the treatment group finished the required assignments before the last week. This is not altogether surprising since, according to Ferrari, Keane, Wolfe, and Beck (1998), “as many as 70% of American college students engage in frequent academic procrastination” (p. 199).

There is no real way of knowing how such procrastination affected the confidence levels of the treatment group, but one can imagine that procrastination brings with it an increase in learner anxiety. Anxiety has an inverse relationship to confidence, so the effect on confidence levels was probably not a positive one. Wolters (2003) cited more than a dozen studies linking procrastination to higher levels of anxiety and lower levels of self-esteem. Milgram, Marshavsky, and Sadeh (1995) found that students with fewer abilities to manage their own learning requirements tended to procrastinate more when given a choice over when to begin their own tasks. This could account for the lack of difference in confidence as measured on the IMMS. If students are waiting to the last minute to complete the materials, the treatment does not have very long to take effect.

One may need to reexamine certain aspects of personal control (including the tactics used in this study) to determine if they are indeed confidence-enhancing for subjects similar to those in this experiment. One may also want to examine in more detail how personal control issues affect distance learning environments in particular. What seems clear is that the students in this study did not use some of the tactics as intended. In fact, some of the tactics used in this study (mostly those under Personal Control) may have had the opposite effect of what was intended. Even Keller admits that allowing learners “to control the instructional strategy of a lesson may not be beneficial” (Klein and Keller, 1990, p. 145). Such findings further the idea that trying to isolate confidence when dealing with diverse groups of individuals, with differing levels of maturity, may be a more difficult process than first envisioned.
Third, another way of stating differences may be too small to measure is to say perhaps the IMMS survey is not sensitive enough to detect short-term changes. While no current research indicates that the IMMS survey is a poor or weak measure of learner confidence, it seems possible that this survey may not be sensitive enough to detect short-term changes. Perhaps the confidence enhancements are producing a desired effect, but the survey cannot consistently detect the changes over the short-term. Given the protean motivational nature of learners over time, the survey would need to be highly sensitive and/or delivered at precisely the right time to accurately reflect learner changes in confidence in the short-term. Over a brief period, learners may not even be aware enough of a change to report it accurately.

The question of study duration brings up other issues. Moller (1993) writes “assuming the longer an attitude is held the stronger it becomes, it may be unrealistic to assume that a measurable change [in confidence] can be detected using a short-term experimental design” (p. 92). The meaning of “short-term” is unclear. A wider review of the literature does little to clarify exactly how much time it takes for the ARCS model effect a statistically significant difference in learner confidence.

Looking at previous studies, one finds a diverse spectrum of study durations resulting in different assessments of subjects’ confidence on the IMMS. For example, Moller (1993) and Naime-Diefenbach (1991) studied confidence using written instructional materials in one short, self-instructional lesson and showed no noticeable changes in confidence as measured on the IMMS. Babe (1995) used a longer instructional lesson with relevance-enhancing strategies and showed an increase in learner confidence on IMMS. This study used a five-and-one-half-week treatment period with no confidence changes on the IMMS but notable changes on the CIS. Gabrielle (2003) applied her treatments to a highly homogenous group of military cadets over one long semester and showed increases in confidence on the IMMS but not the CIS. In short, there is no clear picture of how much time is necessary to identify noticeable confidence changes for either the instructional materials or the class as a whole.

Lastly, there is the idea that the confidence subsection should be reexamined as one of the four main constructs of the ARCS model of motivation. With such issues as maturity, anxiety, locus of control, and fear of failure, confidence may not lend itself to easy encapsulation inside of a model. There is no doubt that confidence is a part of motivation, but the ARCS model implies that there are specific strategies and variables related only to confidence. These strategies for improving confidence are independent of the other ARCS components and, hence, can be individually targeted and manipulated (Keller, 1987a).

Naime-Diefenbach (1991) claimed to have validated the independent attention component of the ARCS model. Babe (1995), Nwagbara (1993), and Chang (2001) validated the usefulness of targeting the relevance component, but Babe questioned its independent nature. The researchers could locate no studies specifically targeting the satisfaction component, but one can speculate that targeting instruction for increases in student satisfaction would not possess the same degree of complexity as enhancing learner confidence.

To the researchers’ knowledge, all studies to date, including this one, that have used the ARCS model to specifically target confidence have failed to achieve statistically significant results as reported by the IMMS. Possibly, placing the more abstract and difficult dimension of confidence on equal footing with the other components of the model diminishes the conceptual validity of the model.
Performance

The data showed that the students in the treatment group, on average, outperformed the control group on the posttest measures. This is in-line with previous research findings that suggest increases in motivation can translate into increases in performance or achievement (Bickford, 1989; Gabrielle, 2003; Song & Keller, 2001).

Since the treatment group was exposed to a pretest exercise as a confidence tactic, some of the difference in scores may have been attributable to a “practice effect.” However, it is the researchers’ contention that this effect would not account for all the variance in scores.

A, R, S and Overall Motivation

For this study, there were clear differences noted for relevance, satisfaction and overall motivation. By way of comparison to other studies, Möller (1993) showed no changes in any of the ARCS subsections using the IMMS. Targeting overall motivation, Gabrielle (2003) found statistically significant differences only for attention with a moderate difference for satisfaction (p=.076) and no difference on the relevance and confidence subsections of the CIS. Regarding the IMMS, she found statistically significant differences on all subsections. In a study that specifically manipulated the attention and confidence subsections, Naime-Diefenbach (1991) showed a statistically significant increase in attention but no increases in confidence or the remaining ARCS subsections of the IMMS. As one can see, consistency of findings is an issue across studies.

One particular reason for the mixed findings in this study may be an overlap of the confidence tactics (see Table 1) and confidence-enhancing e-mails (see Figure 1) into the attention, relevance and satisfaction components. For instance, providing the treatment group the opportunity to create their own exercises or methods of demonstrating competency (PC3) and allowing the treatment group access to a blog and threaded discussion for comments (PC5) may have enhanced attention or even relevance. Tactics such as these might stimulate the learner’s curiosity to think of ideas for improvement that increase feelings of “connectedness,” or relevance, to the material. Allowing learners multiple entry points into the instruction (SO1), which catered to individual skills and avoided wasting time, might have increased the learner’s sense of satisfaction as well as confidence.

Although the confidence-enhancing e-mails used in this study were designed to stress only the confidence tactics and strategies, it is possible that they had an indirect effect on the treatment group’s sense of attention, relevance, and satisfaction. Simply receiving the e-mails might serve to gain learner attention. The concern, verbal praise, and goal reminders expressed in the messages may have served to increase learner satisfaction and improved their sense of connectedness (relevance) to the subject matter. Also, SAM Office 2003 is a simulation program, and simulations and real-world settings are suggested by Keller for enhancing both satisfaction and relevance (Babe, 1995). However, this study’s findings still call into question the discriminate validity of the separate categories of the ARCS model. At the very least, this study highlights the challenges faced in isolating confidence for independent enhancement.

Perhaps the most important finding is that overall motivation can be enhanced in learners through the application of external factors. That was the belief which initially guided this study and, despite any disagreement about the validity of the independent components of the ARCS model, the model, as a whole, proves to be an effective design tool for increasing overall learner
motivation. The findings of this study confirm decades of previous research that motivation is a critical component to learning (Keller, 1979, 1987a, 1987b, 1987c; Means, Jonassen & Dwyer, 1997; Song & Keller, 2001). This study also furthers the body of research by affirming the ARCS model as a viable model for increasing motivation and performance in distance education settings.

Implications for Instructional Design

The results of this study offer several suggestions for future researchers and instructional designers. First, overall motivation can be enhanced in distance learners through the application of carefully crafted external factors such as confidence tactics and confidence-enhancing e-mails. Second, the performance results of this study show that motivation is a powerful force in learning. This study confirms that systematically designed and carefully applied tactics can improve performance. Third, Keller’s ARCS model is an effective design tool for building motivational enhancements and e-mails into distance education environments, and one should not shy away from using Keller’s ARCS model as a conceptual framework for new and emerging technologies. If one believes that distance learning environments pose greater challenges to learner motivation than their face-to-face counterparts, then a well-thought-out systematic approach to manipulating distance learner motivation is an important design consideration.

While the study did not support the discriminate validity of the separate category of confidence, it does provide future designers with material proven useful for increasing overall motivation and performance. One implication future designers may wish to take from this study is to focus less on individual aspects of the ARCS model and more on a learner’s overall sense of motivation. To this end, confidence is a powerful variable that needs to be included in instructional design.

Further Research

The results of this study have spawned several ongoing research projects. Many of the confidence-enhancing tactics used in this study were delivered through e-mail. This has led to follow-up studies focusing on motivational messages similar to the one illustrated in Figure 1. Following the work of researchers who found positive outcomes in learner motivation and/or retention using motivational messages (Gabrielle, 2003; Huett, 2006; J. Visser, 1990; Visser and Keller, 1990; Visser, Plomp, and Kuiper, 1999; 2002), the ARCS model is being used as a guide for developing motivational communications with distance education students. In one ongoing study conducted by the authors, the initial results look promising. Though data analysis is still underway, in two large distance education computer classes (where the only difference is the presence of ARCS-based motivational e-mail messages delivered at roughly 10-day intervals for the treatment), preliminary results show significant increases in student motivation, satisfaction, relevance, and attention. Similar to this study, no significant differences have been noted for confidence. Also, the treatment group shows a 6.35% failure rate compared to that of 19% for the control. In addition, the treatment group has an average drop-out (non-completer) rate of 4.76% compared to 15.5% for the control.

Other studies using similar messages are currently in the early stages of replication with distant students, from undergraduates to graduate, in online classes dealing with a variety of subject matters. It seems feasible that the social aspect or sense of community created through
motivational communications may be part of the necessary support structure distance learners need (Cathcart, Samovar, & Henman, 1996; Kember, Lai, Murphy, Shaw & Yuen, 1994; Moller, 1998).

While additional research is needed to validate the effects of these motivational communications, ongoing research suggests that efforts to improve motivational communications in distance learning situations could have significant returns.
References


