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First principles of motivation to learn and e^3-learning

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Technology-assisted learning systems are being developed at ever increasing rates, and the labels applied to such systems are growing with them. For example, not only do we have e-learning, but we also have hybrid learning, online learning, and mobile learning (m-learning), to mention only a few. Considering that technology is being incorporated in virtually all courses, this article uses the single term *e^3-learning*, as introduced by Spector and Merrill in this special issue to refer to these systems collectively with the emphasis on effectiveness, efficiency, and engagement. Learning concerns learner motivation. Five first principles of motivation and volition that characterize learning systems that effectively motivate students are introduced in this article.

Keywords: ARCS model; computer-assisted instruction; learning objects; motivation; motivational objects; pedagogical agents; volition

E-learning systems are being adopted and developed at ever increasing rates; they have many potential benefits, but they also have challenges. One paramount challenge is that it is difficult to define what e-learning is and to constrain the definition to a delivery system with clearly delineated characteristics. The growth in types of delivery systems to support the accessibility of instruction in a variety of learning environments and the rapidly expanding universe of electronic applications in support of instruction make it increasingly difficult to develop a classification matrix of modes of instructional delivery. For example, our lexicon contains many overlapping concepts and phrases, such as distance learning, e-learning, distributed learning, blended learning, technology-assisted learning, traditional classroom instruction (whatever that means), hybrid learning, online learning, and mobile learning (m-learning), and people struggle to define the unique characteristics and problems of each of these delivery systems.

In this article no effort is made to solve this problem, because a key assumption is that it is far more productive to define and apply basic principles of learner motivation to all learning environments, just as Merrill (2002) has done with basic principles of instruction, and to examine the specific problems and best practices that can be applied in a given situation. Most learning environments now incorporate technology to assist instruction and learning, and some are more self-directed while others are more instructor-facilitated. Because of this, it is useful in the present context to focus on those that employ varying degrees of distributed learning and incorporate technology assistance. Even though general principles of motivation and learning apply to all learning environments, there are characteristic problems in a given setting requiring analysis and design to create motivational and learning practices that

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exemplify those principles. In referring to the family of technology-supported learning systems this article will use the expression *e³-learning*, as introduced by Spector and Merrill in this special issue to focus on the qualities of effectiveness, efficiency, and engagement. The primary goal of this article is to examine motivational issues in relation to e³-learning settings.

More specifically, the purpose of this article is to describe a set of first principles of learning motivation, similar in concept to Merrill's first principles of instruction (2002); illustrate how the first principles of learning motivation can be incorporated into several examples of e³-learning programs; describe a systematic motivational design process, including its expansion to include volitional, or self-regulatory, strategies; and describe four examples of e-learning programs that can be improved by more systematically including the first principles of learning motivation.

First principles of motivation to learn

The concept of first principles with regard to instruction was introduced by Merrill (2002) to refer to prescriptive principles of learning that are common to all theories of instructional design. Similarly, it is possible to list first principles of motivation that are common to all learning settings. Keller introduced such a set of principles in 1979 and they were later (Keller, 1983) elaborated in the context of a holistic theory of motivation to learn even though they were not called *first principles* in those publications. As Keller (1979) said:

> In brief, we can say that in order to have motivated students, their curiosity must be aroused and sustained; the instruction must be perceived to be relevant to personal values or instrumental to accomplishing desired goals; they must have the personal conviction that they will be able to succeed; and the consequences of the learning experience must be consistent with the personal incentives of the learner. (pp. 6–7)

These four conditions were based on a comprehensive review and synthesis of motivational literature, which resulted in a classification of motivational concepts and theories into four categories depending on whether their primary area of influence is on gaining learner attention, establishing the relevance of the instruction to learner goals and learning styles, building confidence in regard to realistic expectations and personal responsibility for outcomes, or making the instruction satisfying by managing learners' intrinsic and extrinsic outcomes. Keller's theory (1983) is represented by what has become known as the ARCS model (Keller, 1984, 1987a, 1999b) based on the acronym resulting from key words representing the four categories (attention, relevance, confidence, and satisfaction).

Recently, this original synthesis was expanded (Keller, 2008) to include volition (Kuhl, 1987) and self-regulation (Corno, 2001; Zimmerman, 1998). These concepts supplement motivation by explaining attitudes and behaviors that help a person overcome obstacles and persist toward the accomplishment of one's goals.

The five principles of motivation may be stated and briefly explained as follows:

(1) Motivation to learn is promoted when a learner's curiosity is aroused due to a perceived gap in current knowledge.

This principle is represented by the first ARCS category, *attention*, which refers to gaining attention, building curiosity, and sustaining active engagement in the learning activity. Research on curiosity, arousal, and boredom (Berlyne, 1965; Kopp, 1982) illustrates the importance of using a variety of approaches to gain learner attention by using such things as interesting graphics, animation, or any kind

of event that introduces incongruity or conflict. A deeper level of attention, or curiosity, is aroused by using mystery, unresolved problems, and other techniques to stimulate a sense of inquiry in the learner. After gaining attention and building curiosity, a challenge is to sustain them, which can be done by applying the principle of variability. People adapt to routine stimuli; no matter how interesting a given technique or strategy is, they will lose interest over time. Thus, it is important to vary one's approaches and introduce changes of pace at a level that is consistent with the optimal arousal levels, which Zuckerman (1971) called *sensation-seeking needs*, of the audience.

(2) Motivation to learn is promoted when the knowledge to be learned is perceived to be meaningfully related to a learner's goals.

This principle, which is represented by the second ARCS category of *relevance*, includes concepts and strategies that establish connections between the instructional environment, which includes content, teaching strategies, and social organization, and the learner's goals, learning styles, and past experiences. Learner goals can be extrinsic to the learning event in that it is necessary to pass a course to be eligible for a desired opportunity, but a stronger level of motivation to learn is achieved when the learner is self-determined (Deci & Ryan, 1985) and experiences intrinsic goal orientation by being engaged in actions that are personally interesting and freely chosen. In recent years it has been popular to refer to learning activities that are highly relevant to a context of application as authentic learning experiences, which is a concept from constructivist literature (Duffy, Lowyck, & Jonassen, 1993). Other motivational concepts that help explain relevance are motives such as the needs for achievement, affiliation, and power (McClelland, 1984), competence (White, 1959), and flow (Csikszentmihalyi, 1990).

(3) Motivation to learn is promoted when learners believe they can succeed in mastering the learning task.

This principle is represented by the third ARCS category, which is *confidence*. It incorporates variables related to students' feelings of personal control and expectancy for success. Confidence is achieved by helping students build positive expectancies for success and then experience success under conditions where they attribute their accomplishments to their own abilities and efforts rather than to external factors such as luck or task difficulty (Weiner, 1974). Successful achievement that is perceived to be a result of good luck or an easy task is not likely to increase students' confidence. This category of confidence includes some of the most currently popular areas of motivational research, such as self-efficacy (Bandura, 1977), attribution theory (Weiner, 1974), self-determination theory, and goal orientation theory, which is explained largely by attribution theory; that is, if people are focused on the task or the process of learning, which are controllable foci of effort, then they are more likely to be less anxious about outcomes and be more productive than if they are focused on outcomes such as people's attitudes about them and their potential success, which can be called a *performance* or *ego orientation* (Dweck & Leggett, 1988; Nicholls, 1984).

(4) Motivation to learn is promoted when learners anticipate and experience satisfying outcomes to a learning task.

The first three principles pertain to conditions that are necessary to establish a student's motivation to learn, and the fourth, which is represented in the ARCS model by the fourth category, *satisfaction*, is necessary for learners to have positive feelings about their learning experiences and to develop continuing motivation to

learn (Maehr, 1976). This means that extrinsic reinforcements, such as rewards and recognition, must be used in accordance with established principles of behavior management (Skinner, 1968), and must not have a detrimental effect on intrinsic motivation (Condry, 1977; Deci & Ryan, 1985). Providing students with opportunities to apply what they have learned, coupled with personal recognition, supports intrinsic feelings of satisfaction. Finally, a sense of equity, or fairness, is important (Adams, 1965). Students must feel that the amount of work required by the course was appropriate; that there was internal consistency between objectives, content, and tests; and that there was no favoritism in grading.

(5) Motivation to learn is promoted and maintained when learners employ volitional (self-regulatory) strategies to protect their intentions.

After becoming motivated to achieve a goal, it is necessary to persist in one's efforts to achieve it, which is the focus of this fifth principle. Sometimes the driving forces represented in the first four principles are powerful and only minimal volitional strategies of self-control are necessary to stay on task. However, this isn't always true, because various kinds of distractions, obstacles, and competing goals can interfere with persistence. At this point, people who are able to overcome these obstacles and maintain their intentions tend to employ volitional, or self-regulatory, strategies that help them stay on task. Consequently, it is beneficial to make a distinction between *selection motivation* and *realization motivation* (Kuhl, 1987), or volition, which Kuhl (1987) defined as a mediating factor that 'energizes the maintenance and enactment of intended actions' (p. 90). This principle is supported by research and practices on conceptions of volition, such as action control (Kuhl, 1987), implementation intentions (Gollwitzer, 1999), and self-regulation (Corno, 2001; Zimmerman, 1998). All of these pertain to the problem of maintaining goal-oriented behavior and overcoming discouragement and attrition, problems that have been experienced especially in self-directed learning environments including e^3-learning.

Validity of the principles

As can be seen in the literature of motivational design research, these principles have proven to be valid and stable over the years and in virtually all cultures at all levels of education even though there are many differences in the practices used to achieve them (Keller, 1999a, 2008). More specifically, with respect to the validity of the ARCS model, construct validity was established by the way in which the principles were derived from the synthesis of motivational literature and by subsequent tests of their discriminant and predictive validity. Naime-Diffenbach (1991) demonstrated that, if specific attributes of instructional materials related to each of the four principles are manipulated independently, students' motivational reactions vary consistently with the manipulations. Specifically, she enhanced the attention and confidence elements of a lesson that was otherwise rather neutral with regard to the other dimensions of motivation. She found significant results demonstrating that the four components of motivation could be varied independently of one another. Small and Gluck (1994) tested the perceived similarity of elements of the four categories and confirmed their categorizations.

There are many examples of empirical studies that support the validity of this model, and several of them have been done in e^3-learning settings. For example, Chyung, Winiecki, and Fenner (1999) used the ARCS model in combination with a systematic needs assessment process to design and implement interventions that would decrease the dropout rate in a distance learning program. Their results indicated that there were improvements in both

learning and motivational reactions in all four motivational categories (attention, relevance, confidence, and satisfaction). Also, there was a significant reduction in the dropout rate, from 44 to 22%.

A study of motivation and performance in a distance learning class, by Chang and Lehman (2002), provides another example from an e^3-learning environment. They used the ARCS model to guide the development of a set of tactics designed to facilitate easy scanning of online text, reduce the word count on a screen compared to the original word count in a printed text, improve the quality of quizzes as a motivational tool, and incorporate more interactive features. The investigators found a significant improvement in learner perceptions of motivation and in scores on a comprehension test.

The motivational and volitional concepts represented by the five principles define the conditions under which students are likely to have high levels of motivation and persistence in their immediate environments and also have positive levels of continuing motivation (Maehr, 1976) to learn more about the given topic. However, a limitation of these categories is that they do not, in and of themselves, explain what motivational tactics to use or when to use them. The solution to this problem is illustrated by the two preceding studies (Chang & Lehman, 2002; Chyung et al., 1999) that incorporated the ARCS model, which includes a systematic motivational design process. They used the design process as a basis for analyzing their audiences and prescribing strategies for the motivational issues they identified.

Designing motivational practices

The motivational design process that is a key component of the ARCS model, like all systematic design processes, includes pre-intervention, or in the present case pre-instructional, analysis and design steps, implementation steps, and post-instructional steps such as evaluation (Keller, 1987b, 1999a). For example, sometimes an instructional event will have a high level of perceived relevance on the part of the students and sometimes it won't. The same is true for the other categories. Thus, to maximize the motivational qualities of a learning environment it is desirable to determine what the motivational characteristics of the students are and how to strengthen the areas that are weak. For this, it is helpful to use a systematic motivational design process, such as the one represented by the ARCS model, which provides guidance in creating motivational tactics that match student characteristics and needs (Keller, 1987b). This process includes pre-intervention steps, implementation steps, and post-instructional steps such as evaluation (Keller, 1987b, 1999a).

In its most complete formulation the process has 10 steps (Keller, 1999a). Steps 1 and 2 consist of gathering information about the learners and the learning environment. This information provides a basis for step 3, audience analysis, to determine what kinds of motivational problems, if any, to address in the subsequent design steps.

Next, step 4 consists of an environmental analysis, which can include critiques of existing instructional materials, the delivery system, learning conditions, or other pertinent parts of the setting. Based on these analyses, step 5 consists of formulating a set of project objectives that describe the motivational goals to be accomplished and ways of assessing whether the goals are accomplished.

Then, there are three design steps: step 6 – brainstorming within each motivational category to generate a rich list of potential solutions; step 7 – selecting the final tactics, a more critical and analytical process for choosing tactics that best fit the time, resources, and other constraining factors in the situation; step 8 – integrating the motivational tactics into the instructional plan.

The final two steps consist of development (step 9) and evaluation (step 10), and are similar to any other development model.

Numerous reports and studies have described and confirmed the validity of this model with respect to its conceptual foundation (for example, Means, Jonassen, & Dwyer, 1997; Small & Gluck, 1994; Visser & Keller, 1990). Also, a simplified approach that retains the essential elements of analysis and design was developed and validated by Suzuki (Suzuki & Keller, 1996) and cross-validated by Song (Song & Keller, 2001), who applied it to the development of motivationally adaptive computer-assisted instruction (CAI). In summary, the purpose of the systematic design process is to support a problem-solving approach to determining what motivational gaps exist in a given situation and then prescribing appropriate strategies rather than prescribing selected motivational tactics to improve instruction without regard to the situational characteristics.

Integrating motivational practices into e^3-learning programs

In addition to the validation studies described above, there are several recent developments that illustrate new directions in research on motivation and e^3-learning and demonstrate how these first principles of learning motivation combined with the systematic design process can be used to improve learning environments. In keeping with the classifications introduced by Merrill (2002), these systems can be considered to be programs containing prescribed practices in support of the first principles. A complete description of a program would include discussions of principles and practices associated with instruction as well as motivation, but in this article the focus is on motivation and volition. The four programs to be discussed are (a) motivationally adaptive CAI, (b) reusable motivational objects, (c) animated pedagogical agents, and (d) blended learning.

Motivationally adaptive CAI

One area of research and development in e^3-learning, especially self-directed learning programs such as CAI, addresses the challenge of how to anticipate and match the expected motivation levels of the students while the program is being designed. It would be much better to have the program respond in real time to differences in learner motivation. There has been a persistent, even though not voluminous, series of studies of motivationally adaptive CAI (Astleitner & Keller, 1995; del Soldato & du Boulay, 1995; Rezabek, 1994). Although Rezabek discussed the use of intrinsic motivational strategies for the development of a motivationally adaptive instructional system, none of these studies provided an adaptive approach based on an ongoing assessment of learner motivation. In contrast, Song and Keller (2001) developed an approach that assessed learners' motivational states and then increased or decreased the amount and type of motivational tactics. They embedded three motivational diagnostic surveys of self-reported levels of attention (curiosity), relevance, and confidence in a CAI program on genetics for tenth-grade students. Each survey was followed by a check quiz. The number and type of motivational tactics in the lesson were automatically increased or decreased depending on the students' responses. Compared to the control group, which studied the well-designed but motivationally unenhanced version, and the saturated group, which received all 24 tactics that had been placed in a tactic folder, the motivationally adaptive CAI showed higher effectiveness, motivation, and attention. This study demonstrated that CAI can be designed to respond to changes in learner motivation. It also illustrated that incorporating practices consistent with the first principles of motivation can be useful for designing the appropriate motivational tactics to use in response to changes.

Reusable motivational objects

The second new area of development in regard to motivational design and e^3-learning pertains to the design of reusable *motivational* objects (RMOs). For years there has been a focus on the concept of reusable *learning* objects (RLOs) that integrate database, Internet, and other digital technologies to store learning content as discrete small 'chunks' that can be used alone or assembled with others to form a lesson or course (Masie, 2002). Typically, RLOs consist, at a minimum, of an objective, content, practice, and assessment. But, a limitation of RLO-based design is that there has been no provision for incorporating motivational tactics into the learning objects or into programs of instruction that are constructed from learning objects. However, Oh (2006) developed and tested a prototype of the concept of RMOs. Graduate students in mathematics education who were subject matter experts and had training in lesson planning were provided with stimulus materials that enabled them to build lessons incorporating both RLOs and RMOs. They were compared to groups that had RLOs only and RLOs plus RMOs and a motivational design job aid. Performance was an efficiency score based on the ratio of time spent on task to a product's score as determined by evaluators using a checklist. Attitudes toward the RMOs and motivational design job aid were measured with an instructional material motivation survey. Oh (2006) found that the RMO significantly affected motivational design performance but the motivational design job aid did not add to the effect. There were no differences in attitudes toward the design process, but this may have been due in part to the fact that the performance time of approximately one hour was relatively short and participants did not have experience with instructional design methods other than the one used in their assigned groups. However, based on their positive effect on the quality of the finished products, it can be concluded that the concept of RMOs is feasible with regard to developing meaningful motivational objects, that RMOs can be used effectively even by teachers with minimal instructional design skills, and that they provide a means of representing the motivational first principles in this type of learning environment.

Animated pedagogical agents

The third example of motivational design is in relation to the recent and growing trend of using animated pedagogical agents in e^3-learning. These agents can be used in many ways to facilitate learning and motivation. A motivational problem that frequently occurs in e^3-learning is frustration (Baylor, 1999): computer-based learning environments may be prone to annoying glitches, and the learning tasks may contain various kinds of challenges and require student effort to interpret ambiguously described tasks and solve difficult problems. This can result in violations of several first principles, especially attention and confidence. For example, one of the most common causes of frustration in the areas of mathematics, science, and engineering may be presumed to be due to the complexity of the learning tasks, which can translate into confidence problems in the learners (Baylor, 1999). Moderate levels of frustration, in the form of difficult or challenging tasks, can facilitate motivation and achievement (Keller, 1999a), but if the perceived or actual challenge is too great, the learner will give up due to feelings of helplessness. A motivational practice that has proven to be helpful in supporting the first principles consists of cognitively and affectively focused motivational messages (Kim & Keller, 2008; Song & Keller, 2001; Visser & Keller, 1990), and they can be delivered by an agent. The use of agents in CAI in the areas of mathematics, science, and engineering can have a positive effect on learner affect and persistence before frustration becomes debilitating. For example, in previous agent-based implementations, Mori, Prendinger, and Ishizuka (2003) evaluated an affective agent that was designed to

alleviate frustration during a mathematics quiz game by delivering empathetic *happy for* or *sorry for* responses; however, results were limited by a small sample size. While Wang, Johnson, Rizzo, Shaw, and Mayer (2005) have found that agent *politeness* is valuable in a tutoring environment, they have not focused on learner frustration. Baylor (1999) investigated the role of interface agent message (presence/absence of motivation) and affective state (positive vs. evasive) on student attitude for mathematically anxious students. Her results supported the value of cognitively focused motivational messages (e.g., Bandura, 1997; Visser & Keller, 1990) on student confidence whereas agent affective state played a lesser role.

Learner motivation in blended learning

The fourth example of motivational design research and application in e^3-learning is in the context of blended learning environments. Combining technology-based delivery systems with classroom delivery offers opportunities to integrate motivational support strategies in novel ways. A paradigm that has been applied in two different blended settings (Keller, Deimann, & Liu, 2005; Kim & Keller, 2008) is to distribute motivational and volitional messages to students. This paradigm builds upon a method established by Visser and Keller (1990) called the *clinical use of motivational messages*. The method was created in an instructor-led setting but its features make it feasible to adapt and test in a blended learning setting. In this approach messages are prepared to provide motivational support at times in the course when, based on past experience, predictable motivational problems may occur. In the two recent studies outlined below (Keller et al., 2005; Kim & Keller, 2008) this process was changed in several ways: it was expanded to include volitional strategies; it was implemented in large undergraduate classes; the messages were created and distributed by the researchers not the instructor; and diagnostic questionnaires were sent to the students each week to identify their motivational attitudes and amount of effort as measured by time spent studying. Also, in these classes, in contrast to the one taught by Visser, as described in Visser and Keller (1990), the instructors had a general knowledge of the motivational challenges faced by the students, but did not have a close working relationship with them or personal knowledge of events in their lives that might adversely affect their studies. Also, the instructors were not able to personally distribute messages to class participants outside of class in an unobtrusive manner as Visser had done. This was important to avoid undue attention to the messages when only one or a selected group of participants were considered to be in need of a particular motivational message. An additional change was that the messages distributed via email were somewhat less personal compared to the previous study, because the instructor did not have the same level of familiarity with the students as Visser had. However, considering the widespread use of this medium, it was assumed that students might view such messages as a type of personal attention (Woods, 2002).

In the first study (Keller et al., 2005), a set of motivational messages based on characteristic motivational problems as identified by the instructor and her graduate teaching assistant was prepared. One group received the entire set of messages at the beginning of a four-week test period so that the students could have the benefit of all messages at once. A second group received the study tips at intervals following a model of motivation and volition (Keller, 2008) in which one progresses from motivational tactics to commitment tactics to volitional support (self-regulation) tactics. The control group received placebo messages, which were also sent to the other groups, to control for the novelty effects that might result from general knowledge that an experiment was underway. The results indicated that there was a positive influence on confidence and achievement, but not the other components of

motivation. They offered limited support for the potential benefits of attempting to support student motivation by means of email-based motivational messages.

In the second study (Kim & Keller, 2008), which occurred during the four weeks subsequent to the first study, an effort was made to make the messages more personal based on diagnostic questionnaires, sending the messages individually to students with their names in the salutation, and customizing the motivational message content for individual students. The results of this study indicated that the students in the personalized group had an overall higher level of confidence following the treatment and the gap between their test grades and the control group had closed. Again, this study provided positive results in support of the concept of auxiliary motivational messages sent via email in a blended learning environment and a means for incorporating the motivational first principles into instruction.

Conclusion

These various lines of research demonstrate a variety of ways in which motivational and volitional support strategies can be incorporated systematically into the design and delivery of instruction in e^3-learning environments. In some cases (Keller, 2000) the process has become efficient enough for a busy teacher to integrate it with other lesson planning activities. In other cases, such as the design of motivationally adaptive CAI and the development of learning systems incorporating RMOs, the early prototypes still require the assistance of a specialist in motivational design. But these studies are leading toward more procedural applications that can be incorporated by teachers and other instructional designers, and they provide a basis for continued inquiry on ways to systematically diagnose and develop solutions for motivational and volitional problems and to develop more refined and sophisticated approaches to the various types of e^3-learning. In conclusion, both previous research and new developments in e^3-learning illustrate validity of the five motivational and volitional principles when combined with a systematic design process to develop practices that exemplify the principles.

Notes on contributor

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References

Adams, J.S. (1965). Inequity in social exchange. In L. Berkowitz (Ed.), *Advances in experimental social psychology* (Vol. 2). New York: Academic Press.

Astleitner, H., & Keller, J.M. (1995). A model for motivationally adaptive computer-assisted instruction. *Journal of Computing in Education, 27*(30), 270–280.

Bandura, A. (1977). Self-efficacy: Toward a unifying theory of behavioral change. *Psychological Review, 84*(2), 191–215.

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

Baylor, A. (1999). Intelligent agents as cognitive tools for education. *Educational Technology, 39*(2), 373–382.

Berlyne, D.E. (1965). Motivational problems raised by exploratory and epistemic behavior. In S. Koch (Ed.), *Psychology: A study of a science* (Vol. 5). New York: McGraw-Hill.

Chang, M.M., & Lehman, J. (2002). Learning foreign language through an interactive multimedia program: An experimental study on the effects of the relevance component of the ARCS model. *CALICO Journal, 20*(1), 81–98.

Chyung, Y., Winiecki, D., & Fenner, J.A. (1999). Evaluation of effective interventions to solve the dropout problem in adult distance education. In B. Collis & R. Oliver (Eds.), *Proceedings of ED-MEDIA 99, Eleventh World Conference on Educational Multimedia, Hypermedia & Telecommunications.* Charlottesville, VA: Association for the Advancement of Computing in Education (AACE). Retrieved December 18, 2007, from http://coen.boisestate.edu/ychyung/edmedia.htm

Condry, J. (1977). Enemies of exploration: Self-initiated versus other-initiated learning. *Journal of Personality and Social Psychology, 35*(7), 459–477.

Corno, L. (2001). Volitional aspects of self-regulated learning. In B.J. Zimmerman & D.H. Schunk (Eds.), *Self-regulated learning and academic achievement: Theoretical perspectives* (2nd ed., pp. 191–226). Mahwah, NJ: Lawrence Erlbaum Associates.

Csikszentmihalyi, M. (1990). *Flow: The psychology of optimal experience.* New York: Harper & Row.

Deci, E.L., & Ryan, R. (1985). *Intrinsic motivation and self-determination in human behavior.* New York: Plenum.

del Soldato, T., & du Boulay, B. (1995). Implementation of motivational tactics in tutoring systems. *Journal of Artificial Intelligence, 6*(4), 337–338.

Duffy, T.M., Lowyck, J., & Jonassen, D.H. (1993). *Designing environments for constructivist learning.* New York: Springer-Verlag.

Dweck, C.S., & Leggett, E.L. (1988). A social–cognitive approach to motivation and personality. *Psychological Review, 95*(2), 256–273.

Gollwitzer, P.M. (1999). Implementation intentions: Strong effects of simple plans. *American Psychologist, 54*(7), 493–503.

Keller, J.M. (1979). Motivation and instructional design: A theoretical perspective. *Journal of Instructional Development, 2*(4), 26–34.

Keller, J.M. (1983). Motivational design of instruction. In C.M. Reigeluth (Ed.), *Instructional-design theories and models: An overview of their current status* (pp. 386–434). Hillsdale, NJ: Lawrence Erlbaum Associates.

Keller, J.M. (1984). The use of the ARCS model of motivation in teacher training. In K.S.A.J. Trott (Ed.), *Aspects of educational technology: Volume XVII: Staff development and career updating* (pp. 140–145). London: Kogan Page.

Keller, J.M. (1987a). Development and use of the ARCS model of motivational design. *Journal of Instructional Development, 10*(3), 2–10.

Keller, J.M. (1987b). The systematic process of motivational design. *Performance & Instruction, 26*(9), 1–8.

Keller, J.M. (1999a). Motivation in cyber learning environments. *Educational Technology International, 1*(1), 7–30.

Keller, J.M. (1999b). Motivational systems. In H. Stolovitch & E. Keeps (Eds.), *Handbook of human performance technology: Improving individual and organizational performance worldwide* (2nd ed., pp. 373–394). San Francisco: Jossey-Bass.

Keller, J.M. (2000, February). *How to integrate learner motivation planning into lesson planning: The ARCS model approach.* Paper presented at VII Semanario, Santiago, Cuba. Retrieved March 29, 2008, from http://mailer.fsu.edu/~jkeller/Articles/Keller%202000%20ARCS%20Lesson%20Planning.pdf

Keller, J.M. (2008). An integrative theory of motivation, volition, and performance. *Technology, Instruction, Cognition, and Learning, 6*(2).

Keller, J.M., Deimann, M., & Liu, Z. (2005). Effects of integrated motivational and volitional tactics on study habits, attitudes, and performance. In *Proceedings of the Annual Meeting of the Association for Educational Communications and Technology,* Orlando, FL. Retrieved March 28, 2008, from http://mailer.fsu.edu/~jkeller/Articles/Keller,%20Deimann,%20Liu%20Effects%20of%20integrated.pdf

Kim, C.M., & Keller, J.M. (2008). Effects of motivational and volitional email messages (MVEM) with personal messages on undergraduate students' motivation, study habits and achievement. *British Journal of Educational Technology, 39*(1), 36–51.

Kopp, T. (1982). Designing the boredom out of instruction. *Performance & Instruction, 21*(4), 23–27, 32.

Kuhl, J. (1987). Action control: The maintenance of motivational states. In F. Halisch & J. Kuhl (Eds.), *Motivation, intention and volition* (pp. 279–291). Berlin: Springer.

Maehr, M.L. (1976). Continuing motivation: An analysis of a seldom considered educational outcome. *Review of Educational Research, 46*(3), 443–462.

Masie, E. (2002). *Making sense of learning specifications & standards: A decision maker's guide to their adoption.* Saratoga Springs, NY: The MASIE Center. Retrieved March 10, 2008, from http://www.masie.com/standards/S3_Guide.pdf

McClelland, D.C. (1984). *Motives, personality, and society: Selected papers.* New York: Praeger.

Means, T.B., Jonassen, D.H., & Dwyer, R.M. (1997). Enhancing relevance: Embedded ARCS strategies vs. purpose. *Educational Technology, Research and Development, 45*(1), 5–18.

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

Mori, J., Prendinger, H., & Ishizuka, M. (2003). *Evaluation of an embodied conversational agent with affective behavior.* Paper presented at AAMAS-03, Second International Joint Conference on Autonomous Agents and Multiagent Systems, Melbourne, Australia. Retrieved March 28, 2008, from http://www.vhml.org/workshops/aamas2003/papers/mori/mori.pdf

Naime-Diffenbach, B. (1991). *Validation of attention and confidence as independent components of the ARCS motivational model.* Unpublished PhD thesis, Florida State University, Tallahassee, FL.

Nicholls, J. (1984). Conceptions of ability and achievement motivation. In R. Ames & C. Ames (Eds.), *Research on motivation in education (Vol. 1,* pp. 39–68). Orlando, FL: Academic Press.

Oh, S.Y. (2006). *The effects of reusable motivational objects in designing reusable learning object-based instruction.* Unpublished PhD dissertation, Florida State University, Tallahassee.

Rezabek, R.H. (1994). Utilizing intrinsic motivation in the design of instruction. In *Proceedings of selected research and development presentations at the 1994 National Convention of the Association for Educational Communications and Technology,* Washington, DC. Retrieved March 28, 2008, from Document Reproduction Service No. ED373751.

Skinner, B.F. (1968). *The technology of teaching.* New York: Appleton-Century-Crofts.

Small, R.V., & Gluck, M. (1994). The relationship of motivational conditions to effective instructional attributes: A magnitude scaling approach. *Educational Technology, 34*(8), 33–40.

Song, S.H., & Keller, J.M. (2001). Effectiveness of motivationally adaptive computer-assisted instruction on the dynamic aspects of motivation. *Educational Technology, Research and Development, 49*(2), 5–22.

Suzuki, K., & Keller, J.M. (1996). *Creation and cultural validation of an ARCS motivational design matrix.* Paper presented at the annual meeting of the Japanese Association for Educational Technology, Kanazawa, Japan. Retrieved March 28, 2008, from http://mailer.fsu.edu/~jkeller/Articles/Suzuki%20Keller%201996%20Validation%20of%20Matrix.pdf

Visser, J., & Keller, J.M. (1990). The clinical use of motivational messages: An inquiry into the validity of the ARCS model of motivational design. *Instructional Science, 19*(6), 467–500.

Wang, N., Johnson, W.L., Rizzo, P., Shaw, E., & Mayer, R.E. (2005). Experimental evaluation of polite interaction tactics for pedagogical agents. In *Proceedings of the 10th International Conference on Intelligent User Interfaces* (pp. 12–19). Retrieved March 28, 2008, from http://portal.acm.org/citation.cfm?id=1040830.1040845

Weiner, B. (Ed.). (1974). *Achievement motivation and attribution theory.* Morristown, NJ: General Learning Press.

White, R.W. (1959). Motivation reconsidered: The concept of competence. *Psychological Review, 66*(5), 297–333.

Woods, R.H. (2002). How much communications is enough in online courses?: Exploring the relationship between frequency of instructor-initiated personal email and learners' perceptions of and participation in online learning. *International Journal of Instructional Media, 29*(4), 377–394.

Zimmerman, B.J. (1998). Academic studying and the development of personal skill: A self-regulatory perspective. *Educational Psychologist, 33*(2/3), 73–86.

Zuckerman, M. (1971). Dimensions of sensation seeking. *Journal of Consulting and Clinical Psychology, 36*(1), 45–52.