DOI 10.5216/ia.v35i2.12668

Five fundamental requirements for motivation and volition in Technology-Assisted Distributed Learning Environments*

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Abstract: Many studies have been carried out investigating the differences between the various types of distance learning environments, including face-to-face learning, with respect to motivating learners. But what is often overlooked is that the fundamental requirements for motivating learners and helping them persist until their goals are accomplished are the same for all types of learning environments. The means by which these requirements are accomplished may differ, but the underlying principles are the same and serve to guide both research and practice. This paper presents five fundamental requirements, or principles, derived from a synthesis of research on motivation and persistence. The theoretical foundations for these requirements are described together with research that supports their conceptual validity. In addition, the paper presents several recent and current applied research studies which contribute to the predictive validity of the principles; that is, studies which demonstrate that if the principles are followed, there will be improvements in motivation and learning.

Key words: e-learning, computer-based instruction, motivational design, learning objects, motivational objects, pedagogical agents, frustration

Distributed learning systems are being adopted and developed at ever increasing rates and they have many potential benefits, but they also present challenges. One paramount challenge is that it is difficult to define what the components of distributed learning systems are and to constrain

*Artigo recebido em 21/05/2010 e aprovado em 05/08/2010.

the definition to delivery systems with clearly delineated characteristics. The growth in types of delivery systems to support the accessibility of instruction in a variety of kinds of learning environments and the rapidly expanding universe of electronic applications to support instruction make it increasingly difficult to develop a classification matrix of modes of instructional delivery. For example, a delivery system lexicon contains many overlapping concepts and phrases such as distance learning, e-learning, blended learning, technology-assisted learning, traditional classroom instruction (whatever that means), hybrid learning, online learning, mobile learning (m-learning), and, of course, distributed learning. It is no wonder that people struggle to define the unique characteristics and problems of each of these delivery systems.

In this paper,[1] no effort is made to solve this problem because a key assumption is that it is far more productive to adopt a set of basic requirements, or principles, of learner motivation which apply to all learning environments. These principles can serve as a basis for examining the characteristics of specific situations, such as an instructor-led online course, and then for creating best practices that can be applied in the given situation. Most learning environments now incorporate technology to assist instruction and learning, some of which are more self-directed while others are more instructor-facilitated. Because of this, it is useful in the present context to focus on those who use varying degrees of distributed learning and rely relatively heavily on technological assistance. Even though general principles of motivation and learning apply to all learning environments, there are characteristic problems in a given setting which require analysis and design to create motivational practices which exemplify the principles.

More specifically, the purpose of this paper is to describe a set of basic principles of learning motivation and to illustrate how they can be incorporated into several examples of technology-assisted distributed learning programs. Following a description of the basic principles, this paper contains descriptions of a systematic motivational design process which includes its expansion to volitional, or self-regulatory, strategies, and four examples of e-learning programs which can be improved by more systematically including the basic principles of learning motivation.

Basic principles of motivation to learn

The basic principles of motivation common to all learning settings can be listed. Keller introduced such a set of principles in 1979, which were further developed with a more comprehensive literature review in 1983, even though they were not called 'basic principles' at that time. 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 (p. 6-7).

These four conditions were based on a comprehensive review and synthesis of motivational literature which resulted in the classification of motivational concepts and theories into four categories. These categories depended on whether their primary area of influence was 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, and making the instruction satisfying by managing learners' intrinsic and extrinsic outcomes. This theory is represented by what has become known as the ARCS model (Keller, 1984, 1987a, 1999b) based on the acronym resulting from keywords representing the four categories (attention, relevance, confidence, and satisfaction).

This original synthesis has recently been expanded (Keller, 2008b, 2010) to add concepts of volition (Kuhl, 1987) and self-regulation (Corno, 2001; Zimmerman, 1998). These concepts supplement motivational concepts by investigating and guiding practice with regard to the challenges of maintaining one's goal-oriented motivation and persistence over time.

These five principles 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 which introduces incongruity or conflict. A deeper level of attention, or curiosity, is aroused by using mystery, unresolved problems, and other such techniques to stimulate a sense of inquiry in the learner. And, an additional challenge is to sustain attention and curiosity by using the principle of variability. People adapt to routine stimuli; no matter how interesting a given technique or strategy is, people 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 one's goals.

This principle, which is represented by the second ARCS category of *relevance*, includes concepts and strategies which 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 do 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 which are personally interesting and freely chosen. In recent years it has become popular to refer to these learning activities, highly relevant to a context of application, as authentic learning experiences, a concept taken from constructivist literature (Duffy; Lowyck; Jonassen, 1993). Other motivational concepts which help explain relevance are motives such as the need 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 *confidence*, the third ARCS category. It incorporates variables related to students' feelings of personal control and expectancy for success. It is achieved by helping them build positive expectations for success and then experience success under conditions where they attribute their accomplishments to their own abilities and efforts rather than to luck or the task being too easy (Weiner, 1974). Because successful achievement is not likely to increase one's confidence if one believes that it is due only to good luck or an easy task. 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. The latter 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 more productive than if they are focused on outcomes such as people's attitudes about them and about how

successful they will be, 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. The fourth, represented in the ARCS model by the fourth category, *satisfaction*, is necessary if learners are to have positive feelings about their learning experiences and develop continuing motivation to learn (Maehr, 1976). This means that extrinsic reinforcements, such as positive 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 the 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.

Having been motivated to achieve a goal, it is then necessary to persist in one's efforts to achieve it, and this 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 with the task. But, this is not 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 which help them stay with the task. Consequently, it is beneficial to make a distinction between *selection motivation* and *realization motivation* (Kuhl, 1985), or volition, which Kuhl defines as a mediating factor that "energizes the maintenance and enactment of intended actions" (Kuhl, 1985, p. 90). This principle is supported by research and practice 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 which have been experienced especially in self-directed learning environments, which include technology-assisted distributed 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 practice used to achieve them (Keller, 1999a, 2008b, 2010). 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 motivational features. She found significant results which demonstrated that the four components of motivation could be varied independently of one another. Small and Gluck tested the perceived similarity of elements of the four categories and confirmed their categorizations.

There are many examples of empirical studies supporting the validity of this model, and several of these studies have been carried out in technology-assisted distributed 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 which decreased from 44% to 22%.

A study of motivation and performance in a distance learning class, by Chang & Lehman (2001), provides a further example from a technology-assisted distributed learning environment. They used the ARCS model to guide the development of a set of tactics that were designed to facilitate easy scanning of an online text, reduce the word count on a screen compared to 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 experience high levels of motivation and persistence in their immediate environments and also present 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 explain, in and of themselves, what motivational tactics to use or when to use them. Both of the preceding studies used the ARCS model as a basis for analyzing their audiences and prescribing strategies for the motivational issues they identified. Thus, it is useful to employ a motivational design process when applying the five principles.

Designing Motivational Practices

The motivational design process, 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, 1999c). For example, sometimes an instructional event will have a high level of perceived relevance on the part of the students and sometimes it will not. 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 which are weak. To do so, 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, 1999c).

In its most complete formulation the process has ten steps. The first two consist of gathering information about the learners and the learning environment. This information provides a basis for the third step, audience analysis, in order to determine what kinds of motivational problems, if any, to address in the design steps. Next, an environmental analysis is conducted in the fourth step. This can include a critique of existing instructional materials, the delivery system, learning conditions, or other pertinent parts of the setting. Based on these analyses, the fifth step consists of formulating a set of project objectives which describe the motivational goals to be accomplished and ways of assessing whether the goals are accomplished. Then, there are two design steps. The first is brainstorming within each motivational

category to generate a broad list of potential solutions, and selection of the final tactics. This is a more critical and analytical process for selecting the tactics which best fit the time, resources, and other constraining factors in the situation. The final steps include both development and evaluation, 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). In addition, a simplified approach which 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. In summary, the purpose of the systematic design process is to support a problem-solving approach in order to determine what motivational gaps exist in a given situation and then prescribe appropriate strategies rather than prescribing selected motivational tactics to improve instruction without regard to the situational characteristics.

Integrating motivational practices into technology-assisted distributed learning programs

In addition to the validation studies described above, there are several recent developments which illustrate new directions in research on motivation and technology-assisted distributed learning and demonstrate how these basic principles of learning motivation, combined with the systematic design process, can be used to improve learning environments. A complete description of an instructional program would include discussions of principles and practices associated with instruction (Merrill, 2002), as well as motivation, but in this paper the focus is on motivation and volition. The four programs to be discussed are (a) motivationally-adaptive computer-based instruction, (b) reusable motivational objects (RMO), (c) animated pedagogical agents, and (d) blended learning.

Motivationally-adaptive computer-based instruction

A challenge in technology-assisted distributed learning, especially in self-directed learning programs such as computer-assisted instruction (CAI), is how to anticipate and match the motivation levels of 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. A persistent, while not voluminous, series of studies of motivationally adaptive computer-based

instruction (Astleitner; Keller, 1995; del Soldato; du Boulay, 1995; Rezabek, 1994) has been produced. Rezabek discussed the use of intrinsic motivational strategies for the development of a motivationally-adaptive instructional system, but neither of these studies provided an adaptive approach based on an ongoing assessment of learner motivation. In contrast, Song & Keller (2001) developed an approach which 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 10th 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. When compared to the control group which studied the well designed but motivationally unenhanced version and the saturated group that received all 24 tactics in the tactic folder, the motivationally-adaptive CAI showed higher effectiveness, overall motivation, and attention. This study supported the conclusion that CAI can be designed to be motivationally-adaptive in order to respond to the changes in learner motivation which may occur over time. It also illustrates that incorporating practices, consistent with the motivational principles, can be useful and effective in support of designing for these dynamic aspects of motivation.

Reusable motivational objects (RMO)

Another new area of development in regard to motivational design and technology-assisted distributed learning pertains to the design of reusable *motivational* objects (RMO). For years there has been a focus on the concept of reusable *learning* objects (RLO) which 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, at a minimum, consist of an objective, content, practice, and assessment. But one 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 which are constructed from learning objects. However, Oh & Keller have recently developed the concept of reusable motivation objects (RMO) and Oh (2006) developed and tested a prototype of this concept in his dissertation (Oh, 2006). Graduate students in math education who were subject matter experts and had training in lesson planning, were provided with stimulus materials enabling them to build lessons incorporating both RLOs and RMOs. They were compared to groups who had RLOs only or RLOs plus RMOs and a motivational design job

aid (MDA). Performance was an efficiency score based on the ratio between the time spent on a task and a product's score, as determined by evaluators using a checklist. Attitudes toward the RMOs and MDA were measured with an instructional material motivation survey. Oh (2006) found that the RMO significantly affected motivational design performance but the MDA 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 was relatively short and participants did not have any experience of 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 RMO is feasible with regard to developing meaningful motivational objects, which can be used effectively even by teachers with minimal instructional design skills. It has also been concluded that they provide a means of representing the motivational principles in this type of learning environment.

Animated pedagogical agents

The third example of a recent and growing trend in technology-assisted distributed learning is the use of animated pedagogical agents which can be used in many ways to facilitate learning and motivation. A motivational problem frequently occurring in technology-assisted distributed learning environments is frustration (Baylor, 1999), because a computer-based learning environment can contain annoying glitches and the learning tasks can contain various kinds of challenges. Student effort is generally required to interpret ambiguously described tasks and solve difficult problems. This can result in the violations of several of the basic principles, especially attention and confidence. For example, one of the most common causes of frustration in the fields of mathematics, science and engineering may be presumed to be due to the complexity of the learning tasks and this can translate into confidence problems in the learners (Bias, 1994). Moderate levels of frustration, in the form of difficult or challenging tasks, can facilitate motivation and achievement (Keller, 1999), but if the perceived or actual challenge is too great, the learner will give up out of feelings of helplessness (Seligman, 1975). A motivational practice that has proven to be helpful in supporting the basic principles consists of cognitively- and affectively--focused motivational messages (Kim; Keller, 2008; Song; Keller, 2001; Visser; Keller, 1990), and these can be embodied by an agent. The use of agents in computer--based instruction in the fields of math, 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

and colleagues evaluated an affective agent, designed to alleviate frustration during a mathematics quiz game by delivering empathetic *happy for* or *sorry for* responses (Mori; Prendinger; Ishisuka, 2003); however, results were limited because of its reduced sample size. While Johnson and colleagues have found that agent *politeness* is valuable in a tutoring environment (Wang et al., 2005), they have not focused on learner frustration. Baylor and colleagues investigated the role of interface agent message (presence/absence of motivation) and affective state (positive versus evasive) on student attitude for mathematically-anxious students (Baylor, 1999). Their results supported the value of cognitively-focused motivational messages (e.g., Bandura, 1997; Visser; Keller, 1990) on student confidence whereas agent affective states played a lesser role.

Learner Motivation in Blended Learning

Technology-assisted distributed learning can also be applied to the context of blended learning environments. The integration of technology support and delivery with classroom delivery offers opportunities to integrate motivational planning and delivery in novel ways. A paradigm which 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 on a method established by Visser & Keller (1990), called the clinical use of motivational messages. It was created in an instructor-led setting but its features make adapting and testing it in a blended learning setting feasible. In this approach, messages are prepared to provide motivational support at stages during the course when, based on past experience, predictable motivational problems may occur. In two recent studies this process was modified in several ways. It was expanded to include volitional strategies and 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. In these classes, in contrast to those taught by Visser, the instructors had a general knowledge of the motivational challenges facing the students, but did not have a close working relationship with them or personal knowledge of events in their lives which might adversely affect their studies. Also, the instructors were not able to personally distribute messages outside of class. In addition, the messages distributed via email were somewhat impersonal compared to those of the previous study. 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; Deimann; Liu, 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, 2008b, 2010) 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 the novelty effects that might result from the general knowledge that an experiment was underway. The results indicated that there was a positive influence on confidence and achievement, but not on the other components of motivation. These results 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 over the four weeks subsequent to the first study, an effort was made to make the messages more personal based on diagnostic questionnaires, by sending them individually to students with their names in the salutation, and customizing the motivational message content for the individual students. The results of this study indicated that the students in the personalized group had an overall higher level of confidence following treatment and that the gap between their test grades and those of 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 it provides a means for incorporating the motivational principles into instruction.

Conclusion

These different lines of research demonstrate a variety of ways in which motivational and volitional support strategies can be systematically incorporated into the design and delivery of instruction in technology-assisted distributed 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 computer-based instruction 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. They provide a basis for continued inquiry into ways

of systematically diagnosing and developing solutions for motivational and volitional problems and developing more refined and sophisticated approaches to the various types of technology-assisted distributed learning. In conclusion, both previous research and new developments in technology-assisted distributed learning illustrate the validity of the five motivational and volitional principles when combined with a systematic design process to develop practices which exemplify the principles.

CINCO REQUISITOS FUNDAMENTAIS PARA A MOTIVAÇÃO E A VOLIÇÃO NA APRENDIZAGEM DISTRIBUÍDA TECNOLOGICAMENTE ASSISTIDA

Resumo: Têm sido realizados muitos estudos investigando as diferenças entre os vários tipos de ambientes de aprendizagem a distância, incluindo a aprendizagem presencial, no que diz respeito à motivação dos aprendizes. Mas, o que muitas vezes não é levado em consideração é que os requisitos fundamentais para motivar os aprendizes e para ajudá-los a persistir até que suas metas sejam atingidas são os mesmos para todos os tipos de ambientes de aprendizagem. Os meios pelos quais esses requisitos são preenchidos podem diferir, mas os princípios subjacentes são os mesmos e servem para guiar tanto a pesquisa quanto a prática. Este artigo apresenta cinco requisitos fundamentais, ou princípios, derivados da síntese de uma pesquisa sobre motivação e persistência. Os fundamentos teóricos desses requisitos são descritos em conjunto com a pesquisa que sustenta sua validade conceitual. Além disso, o artigo apresenta alguns estudos e pesquisas aplicadas atuais e recentes que contribuem para a validade mista preditiva dos princípios, ou seja, estudos demonstrando que, se os princípios são seguidos, há melhoras na motivação e na aprendizagem.

Palavras-chave: E-learning. Instrução baseada no computador. Planejamento motivacional. Objetos de aprendizagem. Objetos motivationais. Agentes pedagógicos. Frustração.

NOTA

1. This article is adapted and expanded from Keller (2008a).

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