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Chapter 12 – Motivational Design Research and Development

Forethoughts

What is one thing that

- a study in the Netherlands on the usability of instruction manuals for seniors (Loorbach, Karreman, & Steehouder, 2007),

- the design of pharmaceutical instruction in Bangkok (Wongwiwat-thananukit & Popovich, 2000),

- research in South Korea on cross-cultural differences in online learning (Lim, 2004),

- a training program in North Ireland to promote breast feeding (Stockdale et al., 2008),

- research in Greece on a usability evaluation method (Zaharias & Poylymenakou, 2009),

- a review in Germany of challenges to maintaining persistence in online learning (Deimann & Keller, 2006), and

- action research on undergraduate motivation at Florida State University (Kim & Keller, 2008)

have in common?

Figure 12.1. The Quest for Motivational Solutions!

Introduction

The purpose of this chapter is to illustrate some of the diverse settings (Figure 12.1) in which research and development incorporating the ARCS model is occurring and that were not described in earlier parts of

this book. Diversity in this context refers to several things including geography, organizations, and school subjects. Researchers and practitioners in virtually every part of the world are incorporating the ARCS model in their research and practices, as illustrated in part by the above list of studies. This illustrates the cross-cultural adaptability of the model and its perceived applicability to many areas of research and practice. The model is also incorporated in every type of organization in which instruction occurs. These include universities, elementary through secondary schools, health care organizations, corporations, military organizations, and government agencies. With regard to subject matter areas, it has been incorporated in mathematics education, second language learning, social studies, midwifery education, pharmaceutical training, nuclear power operations training, sales training, school administrator training, management training, nutrition education, and basically any subject that is taught in formal education settings. And, it has been studied in conjunction with instructional delivery system design including self-directed computer-based instruction, online instruction, distance learning, mobile learning, and, of course, classroom instruction. In these various areas, purposes range from disciplined inquiry into learner motivation and learning to motivational design support for instructional development.

Even though the model has this broad range of applicability, there are several key challenges to be considered with regard to motivational design inquiry. One of them concerns inquiry design. Some of the research consists of traditional experimental or quasi-experimental designs but it also includes correlational studies, qualitative studies, action research, and what might be called evaluation or validation studies whose aim is to confirm whether a given strategy or intervention is effective. The overarching purpose of motivational design research is to understand how to improve people's motivation to learn by means of learning environment design and guidance for learner self-motivation. This implies that motivational design research and development will occur most often in applied settings where there can be multiple obstacles such as

- minimal control over the application environment;
- challenges in isolating and manipulating specific variables;
- unintended influences due to novelty effects;
- challenges in diagnosing the motivational profiles of learners and tracking their changes over time; and
- difficulties in measuring results in ways that render clear inferences and conclusions.

These problems are characteristic of many areas of inquiry and are discussed in books on research design, but there are three issues that are somewhat specific to motivational design research. They relate to problems with diagnosing motivational gaps, designing tactics for different types of delivery systems, and methods of delivering motivational tactics.

With respect to the first issue, "identifying motivational gaps," there are three types to consider. The first is whether there are gaps that impede the participant's desire to learn the given material. The second is whether there are motivational deficiencies in the instructional materials or other aspects of the learning environment such as student support by means of motivational feedback and guidance. Methods for assessing and analyzing these kinds of gaps were presented in detail in Chapter 8. The third type of gap is whether the learner wants to close the gap. A student might be aware that he or she has low confidence or can't perceive any relevance for the instructional content. But, does this imply a desire to close the gap? Maybe not. The learner's attitude might be that he simply doesn't care about the situation. This problem relates back to one of the basic assumptions underlying motivational design mentioned in Chapter 1 which is that you cannot control another person's motivation. If he or she truly does not want to learn, there is little if anything you can do about it. However, you might be able to inspire the student to learn by doing such things as using persuasive techniques, expressing your own enthusiasm for the subject, or challenging the learner to a competition. The point is that knowing that there are specific motivational problems with a student's feelings of curiosity, perceptions of relevance, and expectancies for success does not automatically imply that strategies aimed at changing those attitudes will result in a motivated student. First, the student must be inspired to want to learn the subject and then helpful strategies can be implemented.

Even though there is substantial guidance for audience motivational analysis in Chapter 8, the process is most easily applied in face-to-face settings where learners can be analyzed prior to the beginning of the instructional event and their motivational states can be monitored during the event. But, as will be mentioned in reference to some of the studies and projects described in this chapter, it is very challenging to find ways to assess learner motivation in distributed learning settings, especially with regard to monitoring changes in motivation levels.

The second issue under consideration here has to do with the design of strategies for different delivery systems. Strategies that are both accessible and effective in a face-to-face setting may not be possible in distributed learning systems. An instructor can design motivational tactics to be integrated with the instructional materials and also provide motivational support when appropriate. For example, an instructor in a classroom can engage the students in a motivating simulation and can also recognize when a student has done something noteworthy. The instructor can then provide immediate motivational feedback, or when the student is having difficulties the instructor can offer encouragement. But, the detection of motivational problems followed by meaningful feedback cannot be done in distributed systems in a spontaneous manner, at least not at the present time. It might become more possible with the development of highly sophisticated intelligent tutoring systems, but at present we are limited to more primitive methods. Even so, innovative techniques for embedding motivational

tactics in distributed learning settings and for providing motivational support to students have been created and tested. They will be mentioned while describing the various studies and projects in this chapter.

The third issue is related to the previous one but its focus is on problems regarding the delivery of motivational strategies in distributed learning settings. A technique that has been used for years in computer-based instruction is to embed motivational or corrective feedback that is presented automatically following the learner's response in a self-check exercise or test. A typical message following a correct answer is something like ''Congratulations! You are doing a great job.'' This type of feedback can be useful but it is severely limited and does not address numerous motivational challenges regarding learner problems with confidence, perceived relevance, persistence, etc. The studies included in this chapter contain numerous innovative strategies for motivational feedback and guidance including the use of animated pedagogical agents, motivational and volitional e-mail messages, and motivationally adaptive computer programs.

In summary, a key point in this book is that the ARCS model provides a problem-solving approach to motivational design. Strategies, or tactics, are created after identifying what the specific motivational problems or goals are in a given situation. However, there are many challenges in applying this process due to the difficulty of identifying what the motivational problems are and then finding a way to deliver the appropriate motivational tactics to learners at an appropriate time. To be most effective, the tactics must be delivered when the learner is experiencing a motivational challenge related to the specific tactic. If students in an instructional design class are instructed to conduct a job/task analysis which they have never done before and it will be a week before they actually begin working on this assignment, it does little good to tell them to expect to feel somewhat challenged but that they should just keep trying. The time to give them motivational encouragement is when they are working on the task and are experiencing those feelings. Then, they will be receptive to expressions of empathy and suggestions for how to cope with the task.

This chapter describes several areas of motivational design research and application related to these problems, especially in the context of online, computer-based, and other forms of technology-assisted and distributed instruction.

Motivational Messages

A motivational strategy that has general application to many of the instructional delivery settings described in this chapter is called ''the clinical use of motivational messages.'' This concept was formalized by Jan Visser (Visser & Keller, 1990) and it refers to the creation and delivery of motivational messages based on a continuous diagnosis of the audience's motivation. This process was developed while Visser taught a face-to-face

course in a setting where there were severe motivational challenges. The class had 15 participants who were government workers and was conducted on-site where they were employed. The motivational challenges were due to the conditions in Mozambique at that time in which there was constant danger from rebellious groups and an extremely low standard of living, lack of tangible incentives for taking the course, the difficulty level of the course, and difficulties in being responsive to the demands of the course while maintaining adequate job performance. Due to these many motivational challenges, Visser developed the concept of motivational messages as a means of providing motivational support on a "just-in-time" basis. He applied the ARCS systematic motivational design process to diagnose specific learner motivation problems that could be categorized as to their motivational challenge (attention, relevance, etc.) and then created tactics designed to alleviate the problems and stimulate motivated effort toward accomplishing the goals. Some messages were in the form of a mini-poster or a letter, but most were produced in the form of a greeting card with an attention getting cover and the appropriate message on the inside. This format is illustrated in an example in Chapter 6 (Figure 6.2) of a group message that was designed with the intention of alleviating anxiety. Another example (Figure 12.2) illustrates an individual message designed to give positive feedback and encouragement to a student who has been struggling to perform well.
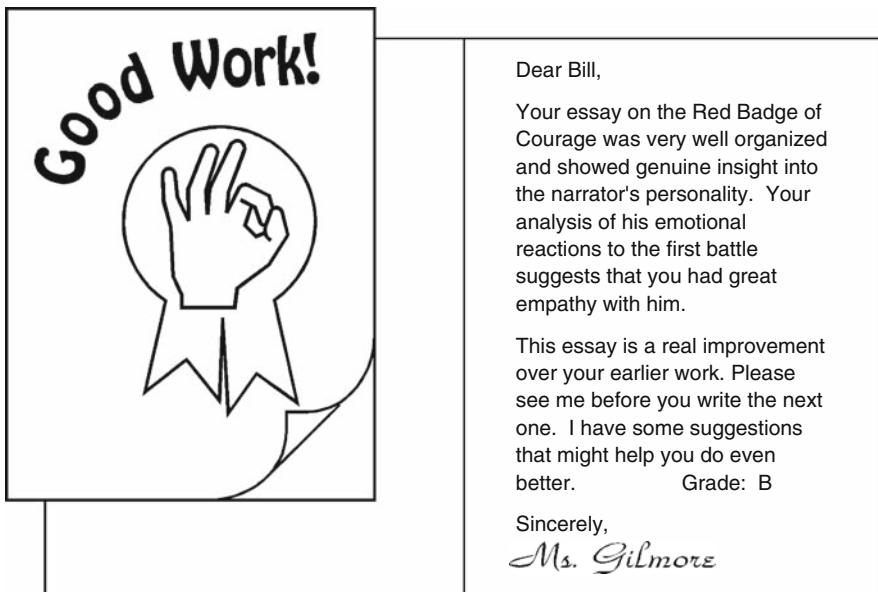

Figure 12.2. Example of an Individualized Motivational Message to Boost Confidence.

The content of the messages was determined by weekly analyses of up to five types of data, depending on what was available at a given time. The first was derived from the instructor's familiarity with motivational stress points based on his experience in teaching the class. For example, the topic of the class was the systematic process of instructional design and students frequently found the instructional analysis task to be difficult. They would find it depressing to receive a great deal of critical feedback after their first draft of a product was formatively evaluated and so he prepared a message to help them view this feedback objectively and productively. He also collected weekly, anonymous self-reports in which the students would describe the three greatest motivational challenges and three most positive motivational influences they experienced during the previous week and also describe areas of the course, if any, in most urgent need of attention to improve it. The other three sources of information consisted of spontaneous comments by the students about their progress or lack thereof, comments solicited by the facilitator, and evaluation of the students' progress.

Based on an analysis of these inputs in keeping with the dimensions of the ARCS model, Visser prepared one or more of three types of messages. The first type addressed motivational challenges that the instructor could predict based on past experience in teaching the class (Figure 6.2). Messages in the second category were in response to unexpected events that affected the motivational level of the entire class. And, the third type consisted of messages to individual students whom Visser learnt were having personal motivational challenges. For example, one of his students who was fluent in English (Portuguese is the national language in Mozambique) got dangerously far behind in her course assignments because the workload at her regular job had increased dramatically and excessively. Visser (1990) sent her a signed note saying, ''A Special Message for You. When you are required to do the impossible, you can't be but frustrated. However, be satisfied with the try you gave it, and with what you know could have been the quality of your work had you been given proper conditions'' (p. 384). The student later reported to him that it brought tears to her eyes.

He prepared the messages and distributed them in between class meetings by leaving them without comment at the students' work stations or handing them off in person. This was because he wanted the messages to appear to be a normal part of the course, and he did not want to call special attention to them. They became known as ''little notes'' among the students.

By using a variety of measures (Visser, 1990; Visser & Keller, 1990) it was clear that the messages had a positive effect on the attitudes and persistence of the students. The retention rate was higher than normal, as were the students' persistent efforts and achievement.

Critical attributes of the clinical use of motivational messages were that they were based on data indicating the specific types of motivational challenges faced by the students, they dealt explicitly with motivational

aspects of the learners' feelings and attitudes, and they were timely. This is in contrast to motivational tactics that are embedded into instructional materials and delivery as an integral part of a course which are not targeted to specific motivational gaps in the participants' attitudes toward learning.

Instructor-Facilitated Learning Environments

Instructor-facilitated environments can be face-to-face, online, or blended. Most of the examples of motivational strategies in the earlier parts of this book, including the two examples of the motivational design work-sheets (Chapters 8, 9 and 10), pertained to classroom settings, so this chapter will focus on examples in technology-assisted settings whether in a blended course or online class.

Blended learning settings generally refer to classroom courses augmented by online components. The flexibility of a blended course can result in a more continuous set of learning activities during the week in contrast to the fixed schedule of weekly meetings. More than 100 activities are described by Bonk and Zhang (2008) for use in online and blended courses and teachers can take advantage of online features such as discussion forums, chat rooms, and collaborative group tasks. For example, in the learner motivation course that I teach on campus, I will sometimes have a discussion forum related to one or more of the assigned readings, especially when I want **everyone** in the class to express their thoughts, which typically does not happen in class in which a few students become the predictable active responders. Last semester during the first week of class, I opened two forums. In the first I asked them to describe the concept of motivation as they experienced it; that is, what constitutes "motivation" in their lives. In the second forum I asked them to discuss the role of design in motivation planning; that is, can one design for motivation or is that too mechanical; should one expect motivation to be the result of spontaneous activities? Every student is required to post a response by a certain date but they cannot see each other's responses until I release them on that date. This way, each student must consider the question and formulate a response without "borrowing" from what other students have said. This led to a rich discussion with a high rate of responding. I also have them do collaborative homework assignments and then present the results in class. This worked particularly well with assignments such as the one we did on factors related to intrinsic motivation and extrinsic reinforcement and how they influence each other. Each group had a list of concepts to investigate. Their task was to prepare definitions, negative examples (How to Kill the Joy of Learning), and positive examples (How to Sustain the Joy of Learning). During class time, each group was responsible for teaching and facilitating a discussion of their concepts.

These strategies are easy to implement, manageable with respect to time demands on the instructor, and productive, especially when the instructor participates in the discussions. However, this is due, at least in part, to the relatively small size of the class which seldom exceeds 20 participants. In large

classes the situation is different in kind, not just size. In these classes it might not be feasible to use all of the same learning strategies that could be used in the smaller class, but the problem of student support becomes more salient. In extremely large classes it might not be feasible to the instructor to know every student or to be aware of specific motivational problems being faced by one or more students, but the online part of the course can help with this.

One way to provide student motivational support could be by means of e-mails using the motivational message (Visser & Keller, 1990) method. This approach was tested in two different blended studies (Keller, Deimann, & Liu, 2005; Kim & Keller, 2008) within an undergraduate archeology class. In these studies, messages were prepared to provide motivational support at times in the course when, based on past experience, predictable motivational problems were expected to occur based on observations of the course instructor and her teaching assistant. In this study volitional messages were also included to encourage beneficial self-regulatory behaviors. The messages were created and distributed by the researchers not the instructor, and diagnostic question-naires 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, the instructors had a general knowledge of the motivational challenges faced by the students, but had no regular interactions with the students outside of class and did not have personal knowledge of events in the students' lives that might adversely affect their studies. Also, the instructors were not able to personally distribute messages outside of class. The messages were distributed via e-mail which might be considered to be somewhat impersonal compared to the paper messages that were delivered personally in the Visser study. However, con-sidering 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, the bundled group, received the entire set of messages, called "study tips," at the beginning of a 4-week test period so that the students could have the benefit of all messages at once. A second group, the distributed group, received the study tips at intervals following a model of motivation and volition (Keller, 2008b) 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 con-fidence and achievement, but not the other components of motivation. These results offered limited support for the potential benefits of attempting to support student motivation by means of e-mail-based motivational messages.

In the second study (Kim & Keller, 2008) which occurred during the 4 weeks subsequent to the first study, *personalized motivational messages*

were developed. 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 the individual students.

After the second major test in the class, students were asked, among other things, whether they were satisfied with the results of their test. Prior to taking the test they had received e-mails with study tips in attachments and a final e-mail asking if they had opened the attachments and which of the study tips were useful to them. Based on these inputs, messages were personalized by varying the introductions and including their names in the salutation. For example, the three examples of messages in Table 12.1 were sent to students who said they were dissatisfied with their test results. The messages varied depending on whether the student did not open the attachments, did open them but did not check any of the tactics as being useful, or opened them and also checked some strategies as being useful. The body of the message following the introduction contained additional motivational

Table 12.1. Samples of Individualized Motivational Messages.

Example 1: Student did not open study tips attachment
Dear Frank ,
Congratulations!
In the previous logbook you said that you were not completely satisfied with your grade on Test 2, and I also noticed that you want to earn higher grades than you have earned so far. I have some suggestions, in the form of Study Tips and messages such as this one that might help you raise your grades on the two remaining tests.
Recently, a group of students in the class received these Study Tips in attachments. The overall class average on the second test was the same as the first one, but the grades for a small group of students who said they used these tips went up by two/thirds of a grade (for example, from a C to a B-). Thus, the evidence tells us that these Tips can be very helpful.
If you would like to take advantage of this opportunity, here is what to do.
Example 2: Student opened study tips attachment but did not use any tactics
Dear Francis,
In the previous logbook you said that you were not completely satisfied with your grade on Test 2, and I also noticed that you want to earn higher grades than you have earned so far. I have some suggestions in the form of Study Tips and messages, such as this one, that might help you raise your grades on the two remaining tests.

Table 12.1 (continued)

A few weeks ago, you received some Study Tips in an attachment which you said you opened but did not check any of the strategies as being useful. However, some of students in the class who opened them did use some of the strategies and said they were useful. The grades went up for eighty-two percent of these students and their average improvement was two/thirds of a grade (for example, from a C to a B-). Some went up more, some less, but the evidence tells us that these Tips can be very helpful. In contrast, the overall class average on the second test was the same as the first one.

If you would like to take advantage of this opportunity, here is what to do.

Example 3: Student opened study tips attachment and used some tactics
Dear Fay,

Congratulations on the big increase in your test grade. However, in the previous logbook you said that you were not completely satisfied with your grade on Test 2, and I also noticed that you want to earn higher grades than you have earned so far. I have some suggestions in the form of Study Tips and messages, such as this one, that might help you raise your grades on the two remaining tests.

A few weeks ago, you received some Study Tips in an attachment which you said you opened and checked some of the strategies as being useful. You might be interested to know that almost every student who opened the strategies and said they were useful had a grade increase, even though the total number was small. The average improvement was two/thirds of a grade (for example, from a B to an A-). Some, including yours, went up more, some less, but the evidence tells us that these Tips can be very helpful. In contrast, the overall class average on the second test was the same as the first one. **This time, I encourage you to try again and to use the strategies even more systematically, and maybe you will continue to see an increase!**

If you would like to take advantage of this opportunity, here is what to do.

features but this part was the same in each case and is not reproduced here. A sample of the complete message is contained in Kim and Keller (2008).

The results of this study indicated that the students who received these personalized messages had an overall higher level of confidence following the treatment and the gap between their test grades and the comparison group had closed. A key lesson learned from the two preceding studies was that it is critical to create a desire within the student to receive the motivational tactics in order for them to be useful. The researchers thought they had identified critical motivational problems in the audience analysis phase of planning. However, the information about problems came

from the instructor and teaching assistant. This information was true for some students but not others. And even when it was true, it did not mean that all of those students wanted assistance with motivational and volitional problems. The motivational tactics were most effective when the students said they wanted to see them.

Online Instructor-Facilitated Learning Environments

Online instructor-facilitated courses can be synchronous which means that everyone attends a virtual meeting at the same time, asynchronous which means that people log on and work independently, or a combination of the two as when the primary pattern is asynchronous but students meet virtually in small groups for an assignment. And, of course, there can be still other variations on these conditions. The key criterion is that the instructor is actively involved in the course. This can be by means of leading virtual meetings, participating in discussion forums, providing mediated presentations, and by providing guidance and feedback. In general, the same principles and strategies that apply in the online portion of a blended course also apply here, but there is quite a lot of published material that is aimed primarily at online courses.

Johnson and Aragon (2002) proposed an instructional strategy framework for online learning environments that contains seven principles based on three areas of psychology: behavioral learning theory, cognitive learning theory, and social learning theory. They contend that in order for powerful online learning to occur, online learning environments need to contain a combination of these principles: (1) address individual differences, (2) motivate the student, (3) avoid information overload, (4) create a real-life context, (5) encourage social interaction, (6) provide hands-on activities, and (7) encourage student reflection. Their framework is based on well-established concepts and principles from instructional psychology and instructional design, but they do not provide independent empirical support for their model. However, they do provide concrete examples of activities that have proven successful in their own teaching settings. For example, they illustrate their second principle, "motivate the student," by briefly describing the ARCS model and then describing three techniques they have used.

The first strategy they mention for motivation is to incorporate games into the online environment and the example they use is based on the popular television show called "Who Wants to Be a Millionaire." Their second example of a motivational strategy is related to situations where a course contains a great deal of streaming audio or "talking head" video. They make it more interesting by including several people in a simulated broadcast environment with multiple disk jockeys (DJs) and "guests" who call in. Their third strategy suggestion is to incorporate multimedia whenever possible. They refer to contemporary audiences that expect to have a variety

of media with relatively frequent changes of pace just as they would see in popular television shows. The authors mention that it can be helpful to have a variety of graphic images, photographs, and video clips including entertaining clips that illustrate specific concepts and procedures from the class.

A limitation of their framework is that they do not provide guidance for when to use given strategies representing these principles. For example, their recommendation for using a variety of multimedia whenever possible illustrates one of the three subcategories of Attention in the ARCS model (see Chapter 4); specifically the third one dealing with variability to sustain curiosity. The strategy needs to be modified based on the characteristics of a given audience. Some audiences would be annoyed by short, frequently changing modes of presentation. Some academic topics require a more sustained presentation such as an illustration of a complex procedure. In other words, all seven of their categories should be augmented by a process of audience analysis to determine when and how to apply each principle.

Thus, it is important to examine learner characteristics in conjunction with selecting or creating motivational strategies. Lim and Kim (2003) attempted to identify demographic and motivational characteristics of learners in relation to learning and motivational outcomes in an online setting. Their demographic variables included gender, work experience, marital status, distance education experience, and age. A significant improvement in learning occurred for the students in each subcategory of these demographics with the exception of those who had no previous distance education experience. However, there were only 7 students who had no prior distance education experience compared to the 70 who did have. There were no differences in final outcome within these categories except for gender. The women outperformed the men, but marital status, being under or over 30 years of age, or being employed full-time, part-time, or unemployed did not make any difference. In this study there were twice as many women as men (54 versus 23) and the authors do not have an explanation for the gender difference. It would be interesting to investigate this in further studies.

The authors constructed an application score for motivation based on students' responses to reasons for taking the course. These included such things as opportunity to use what they learned, relevance of learning content to their work, personal interest, and personal motivation to apply what they learned. The authors found that all motivation variables except course interest were related to learning but only two, reinforcement and self-efficacy, were related to their learning application scores.

This study offers some interesting points in support of learner characteristics that may affect their online learning attitudes and performance. However, it will need to be augmented by numerous other studies before any firm conclusions can be drawn.

With respect to guidance for online course development and motivational tactics, there are books containing guidance that could be used to

supplement the systematic motivational design procedure that is part of the ARCS model. Bonk and Zhang (2008) describe more than 100 strategies that can be used in online learning and they provide a set of indices for each one. They rate the strategies in terms of risk, time, cost, learner-centeredness, and overall duration. These are subjective ratings which assist an instructor in matching strategy constrains with instructional goals and learning activity characteristics. The strategies in their book fall into four categories which constitute an acronym (R2D2) representing the four parts of their model: Read (auditory and verbal learners); Reflect (reflective and observational learners); Display (visual learners), and Do (tactile and kinesthetic learners). In contrast, Ko and Rossen (2001) provide a practical guide to the overall process of planning for online learning, creating an online course and syllabus, developing the online learning environment, designing learning activities, and preparing students for the online learning experience. Several of the sections can be viewed from a motivational perspective. For example, the online learning activities and building the online learning environment provide concrete strategies and design considerations to be considered in the context of a systematic motivational design process. Also, the section on preparing learners provides a context for incorporating motivational tactics.

In summary, it is interesting to note that virtually all of the guidance that is being offered in the literature with respect to learner characteristics, learning environments, and learning activities with regard to various e-learning (that is, electronic-based learning) environments has more features in common regardless of whether one is engaged in classroom instruction, blended instruction or online instruction than unique features that differentiate them. In recognition of this, Specter and Merrill (2008) proposed in a special edition of *Distance Learning* that the "e" in "e-learning" be replaced by "e3" which stands for effective, efficient, and engaging learning. That is, they propose that in the digital age the same basic principles will apply to all delivery systems. There will be differences with respect to specific strategies or tactics that are effective in a given environment and how these strategies have to be configured for various delivery systems, but the basic principles will apply more or less universally. In that edition of the journal, reference was made to Merrill's first principles of learning (Merrill, 2002) which specified that instruction is likely to be effective when

- it is centered around meaningful problems and tasks;
- learning goals and tasks are explicitly linked to knowledge and skills already mastered;
- new knowledge and skills are demonstrated in their natural context;
- students have opportunities to work on a variety of related problems and tasks of increasing complexity with feedback from a variety of sources; and when

- students can regulate their own performance and integrate new knowledge and skills into other activities.

Merrill derived these principles from the vast literature on instructional psychology and instructional systems design. He found that these general principles subsume the many concrete and specific principles and findings in the literature.

Similarly, I included an article (Keller, 2008a) entitled, "First Principles of Motivation to Learn and e3-Learning." The first four of these principles were originally derived from the comprehensive synthesis of the literature on human motivation and learning which formed the basis for the ARCS model. A fifth principle was added which relates to volition, or self-regulation. These principles are the following:

1. Motivation to learn is promoted when a learner's curiosity is aroused due to a perceived gap in current knowledge.
2. Motivation to learn is promoted when the knowledge to be learned is perceived to be meaningfully related to one's goals.
3. Motivation to learn is promoted when learners believe they can succeed in mastering the learning task.
4. Motivation to learn is promoted when learners anticipate and experience satisfying outcomes to a learning task.
5. Motivation to learn is promoted and maintained when learners employ volitional (self-regulatory) strategies to protect their intentions.

Together, these two lists of principles provide a basis for analyzing learner characteristics, learner needs, and instructional characteristics. Both sets of these principles have been validated in many empirical studies as documented by Merrill (2002) and Keller (2008a) and other associated publications.

Self-Directed Learning Environments

Self-directed learning environments present challenges that are different from instructor-facilitated settings. A cardinal difference between the two settings is that the instructional materials are prepared in advance of the instructional event and are then delivered as self-paced print materials, as computer-based instruction, or an online program via the web. This means that motivational strategies as well as instructional strategies have to be included in the materials at the time they are developed based on predictions about learner attitudes, abilities, and entry-level knowledge and skills. As one means of trying to add individualization, efforts have been made since the early days of programmed instruction to design adaptive instructional programs that are responsive to individual differences in student performance. A simple form of this is to direct the student along a remedial path after making a mistake. More complex versions attempted to offer alternate paths based on learning styles and entry-level knowledge. For the most part,

these efforts were not highly successful because it was more cost-effective to develop programs that accommodated a variety of learning styles and to specify the required entry-level knowledge before beginning the program.

Anticipating the motivational attitudes of learners and designing tactics in advance is also quite challenging. It isn't too difficult to identify motivational tactics to include at the beginning of a lesson that will help capture the learners attention and to use instructional strategies such as case studies that help build relevance, but there can be significant differences in the entry-level motivational profiles of learners and their motivational attitudes can change as they progress through the program. Even so, many self-instructional programs can be greatly improved by giving systematic attention to the motivational characteristics of the lesson based on an application of the ARCS design process.

There have been attempts to incorporate adaptive features into the motivational features of self-instructional programs. Several of them are reviewed in this section. They include the development of motivationally adaptive computer-based instruction, incorporation of animated pedagogical agents to supplement instructional support with motivational support, and the development of reusable motivational objects.

Motivationally Adaptive Computer-Based Instruction

There can be a range of motivational conditions that characterize learners at different points in time while working through a computer-based program. One way to deal with this problem would be to include a large number of motivational tactics to cover a broad range of motivational conditions to ensure that the program is responsive to many types of motivational problems that might arise. However, this would most likely have a negative effect on motivation and performance because when students are motivated to learn, they want to work on highly task-relevant activities and they do not want to be distracted with unnecessary motivational activities. For example, students who already feel highly confident about their ability to learn the content will be annoyed by receiving motivational messages aimed at improving their confidence. For these reasons, it would be desirable to have computer-based programs that can identify learners' motivational levels and respond adaptively with the appropriate strategies.

There has been a persistent, though not voluminous, series of studies of motivationally adaptive computer-based instruction (Astleitner & Keller, 1995; del Soldato & du Boulay, 1995; Rezabek, 1994). Rezabek discussed the use of intrinsic motivational strategies for the development of a motivationally adaptive instructional system. He created a model that integrated Csikszentmihalyi's flow theory (Csikszentmihalyi, 1990) with the ARCS model and then proposed sets of tactics that could be used to maintain an optimal flow experience during an

instructional event by incorporating them into an adaptive instructional system. However, he did not develop or test a prototype of his model or explain exactly what types of adaptivity would be included in his adaptive instructional system.

The phrase "adaptive instruction" is frequently used without specifying what is meant by it apart from most general interpretation as offering feedback or alternative pathways based on learner behaviors. Jonassen (1985) introduced a taxonomy for adaptive lesson design which provided a basis for a six-level model of motivational adaptivity proposed by Astleitner & Keller (1995):

1. At the first level the instructional system reacts to the learner's actual performance. Fixed motivational feedback is given based on right or wrong completion of a task.
2. The second level expands on the first by encouraging or the development of a performance. That is, the computer gives feedback as a reaction to several past performances, such as summary feedback at the end of a module or unit.
3. The third level introduces differentiated feedback based on different kinds of performances. Motivational feedback is presented, or branching options are offered, based on, for example, whether a difficult or easy task was completed successfully.
4. The fourth level introduces adaptability options based on individual difference measures that are taken prior to the beginning of instruction. The lesson contains several tracks based on measured differences in learner motivation and learners are automatically directed into a path based on their profiles. For example, students who score low in self-efficacy would be entered into a track containing tactics designed to improve this aspect of confidence. The high self-efficacy track would not contain these additional features. This is not a highly individualized form of adaptation, but it can accommodate some important differences in individual motivational dynamics.
5. The fifth level contains a variety of types of adaptive options ranging from simple management functions (e.g., control over pacing and sequencing) to more complex control over the motivational characteristics of the instructional events. Keller and Keller (1991) outlined important types of learner control in relation to motivation.
6. At this highest level of adaptability, the computer would be able to react to motivational states of learners. In this case, the computer models the motivational states of the learner based on actual and past learner performances or self-reported indicators and then implements appropriate motivational tactics during the teaching–learning interaction.

Astleitner and Keller (1995) tested the highest level of this model with a simulation of performance under several different motivational conditions based on an adaptation of Atkinson and Birch's (1970) theory of the dynamics of action. In this model, four different sets of conditions were

created based on such things as performance, difficulty level, outcome expectancies, and outcome certainty (the belief that achieving a given outcome can be replicated). The results of implementing a simulation based on this model illustrate that there are differences in percentages of time spent on a task and different patterns of action tendencies based on the motivational characteristics of each condition. This model and simulation were highly theoretical but provide a basis for more pragmatic adaptations of the approach.

Del Soldato and du Boulay (1995) introduced a motivational adaptive model that was more concrete and operational than that of Astleitner and Keller (1995). They used the framework of an intelligent tutoring system and specified that the system must detect the student's motivational state and then conduct motivational planning to introduce strategies to counteract negative motivational states. They suggested four sources of information for motivational diagnosis. The first consists of questionnaires administered during the pre-instructional period. As in the ARCS audience analysis process this provides information to guide the inclusion of appropriate motivational strategies at the beginning of instruction. But this pre-instructional information is static and must be supplemented on an ongoing basis in order to have an adaptive program. The second kind of information consists of data collection during the lesson. For example, a student can click on standardized sets of prompts such as,"OK," "too difficult," "too easy," or "please give me a hint." A third type of data is based on student requests for help. A very different level of confidence is indicated by a student who requested help before attempting to solve a problem compared to a student who requests help only after making several attempts. Their fourth type of data consists of learners' self-evaluations of their motivational states during the instruction. For example, a student could move a slider on a scrollbar to indicate his level of confidence at any given point in time. In the planning function within their intelligent tutor, the computer would assess the influence, the overall structure of the lesson, and determine what motivational tactics to introduce.

Their model demonstrated several features that can be incorporated into a motivationally adaptive environment. They focused primarily on the requirements of developing an effective intelligent tutoring system to support the motivational aspects of adaptive instruction, and their work was limited in that it did not fully incorporate motivational theory or multiple dimensions of motivational characteristics of learners. They focused on confidence in relation to effort and the relative amount of independence demonstrated by the learner while working through the tutorial.

Song (Song & Keller, 2001) expanded upon the preceding studies by developing an approach that was adaptive at the sixth level of the taxonomy of Astleitner and Keller (1995). Song prepared three versions of a lesson on genetics for 10th grade students. The lessons differed with respect to their levels of motivational enhancements. The first was motivationally

unenhanced and contained minimal motivational tactics. It was not possible to remove all features that might influence motivation without damaging the quality of the lesson. For example, including an explanation at the beginning of the lesson of what the objectives are and how the learner will be assessed has positive motivational benefits but it is also a feature of a well-designed lesson. However, there were very few features that could be considered to affect motivation independently of their necessity for instructional effectiveness. This motivationally unenhanced version of the lesson was used with one of the control groups. Song also developed a pool of 24 motivational tactics that could be used in the lesson and included all of them in a second control group called the motivationally saturated group. In the third group, the motivationally enhanced group, he incorporated a motivationally adaptive process that allowed the instructional program to be modified for each learner based on the motivational state of the learner.

At predetermined points, students in the motivationally adaptive group received a screen asking several questions about their motivational attitudes and they responded to a short practice quiz which allowed them to check their understanding. Based on their responses to the motivational questions, students would receive motivational tactics designed to improve attention, relevance, or confidence. For example, if a student said the lesson was becoming boring, the computer would add tactics to enhance the curiosity arousal features of the lesson. The computer would also compare the students motivational attitudes to their performance on the progress quiz and this would influence the motivational tactic that was introduced. For example, if a student said that he or she felt confident and the student had also performed well on the quiz the computer would give them a congratulatory message but would not add any motivational tactics designed to improve confidence. However, if a boy, for example, said he was not confident in his ability to learn the content but he had gotten the progress quiz questions correct, the computer would introduce a tactic designed to reinforce his achievement and encourage positive feelings of expectancy for success.

The results indicated that both the adaptive and full-featured treatments were superior to the minimalist treatment and in most instances the adaptive treatment was superior to the full-featured one. There were limitations on the types of computer features that could be used in this study (for example, there was no sound), but a more sophisticated treatment and also one which was longer than 1 hour could be expected, based on these results, to show even stronger treatment effects.

These early studies were promising in their results in two ways. They demonstrated that it is feasible to consider the development of motivationally adaptive lessons and they also demonstrated there can be positive results from these techniques. However, all of the studies were prototypical in nature and require further development before they can

become fully operational. They also provide a foundation for another area of development in self-directed learning which is the incorporation of animated pedagogical agents to facilitate motivation as well as instruction.

Pedagogical Agents (Agent-Facilitated Computer-Based Instruction)

There is an already large and growing body of research which demonstrates that animated pedagogical agents can be beneficial in support of learning and attitude development in a computer-based learning environment. These pedagogical agents are animated life-like characters that support learning in a computer-based learning environment (Johnson, Rickel, & Lester, 2000) by assisting with direct instruction, being available to answer questions, serve as coaches to provide guidance and problem-solving situations, and to give feedback to learners based on their performance. Generally speaking, learners readily accept these avatars as meaningful social agents (Baylor, 2007). Research shows that people seem to assume that their computers with the embedded agents have the same characteristics as human beings (Reeves & Nass, 1996). Through a series of experiments, Reeves and Nass (1996) concluded that "individual interactions with computers, television, and new media are fundamentally social and natural, just like interaction in real life" (p. 5). Furthermore, consistent with Johnson's definition of pedagogical agents (Johnson, Rickel, & Lester, 2000) and Picard's concept of "affective computing" (Picard, 1997), it is reasonable to assume that an affective pedagogical agent can be used to provide learners with affective support providing that the agent can sense and recognize a learner's affective state and respond appropriately to a learner's emotional status in real time. One of the benefits of these agents is that they can express emotions by means of facial expressions and verbal comments as they provide feedback and guidance to students.

In a study designed to alleviate math anxiety and improve performance among a group of high school dropouts who were studying for their high school equivalency certificate, Shen (2009) incorporated two agents. The primary agent, Dr. Hendricks, served as a tutor by actively explaining the concept of the Pythagorean Theorem, how to apply it, and the steps in solving problems with it. Dr. Hendricks also provided motivational support to the students by means of cognitive and emotional motivational messages. The cognitive messages were designed to instill confidence, illustrate the relevance of the material being learned, and stimulate curiosity by means of questions and other specific tactics. Dr. Hendricks also provided emotional support by means of messages designed to help reduce student anxiety and promote positive feelings regarding the learning experience. From time to time, especially when students were working on certain problems, Dr. Hendricks would ask them if they were feeling anxious. If they clicked on the "Yes" response, he asked them if they would like to talk to a buddy. If

they again said "yes," a screen opened with the other agent. This agent, Kate, had been introduced as a peer and she invited the students to express their concerns by typing them into a text window on the screen. This was consistent with one of the tactics called venting in a model of emotional support called COPE (Carver, Scheier, & Weintraub, 1989).

Shen found significant results with respect to reductions in math anxiety and improvements in performance for the emotional support portion of the treatment but not for the cognitive motivational message component. The emotional support component was personal in that it gave the students an opportunity to express themselves and also provided a connection with their long-established feelings of anxiety toward learning mathematics. The cognitive messages were based on a general appraisal of attitudes in the audience and may have been regarded as too abstract by this particular audience. The overall design and results from the study provide strong support for the actual and potential benefits of agents with regard to affecting learner attitudes and performance. Further research is needed to refine the cognitive motivational support component, to learn more about the possibilities for emotional support, and to test a generalizability of these results with a variety of types of audiences.

Reusable Motivational Objects

Reviews of the literature on computer-based instruction and technology-rich learning environments have consistently shown benefits in terms of better achievement and more positive attitudes, especially in K-12 education (Kulik, 1994; Sivin-Kachala, 1998). But, the development of these programs requires far more time during the design phase, which might be one of the reasons for the superior results from this type of instruction, than instructor-led courses which can be much more spontaneous. And, this increased design and development time translates into higher costs (Robinson & Anderson, 2002). In an effort to reduce costs and shorten the development time of computer-based instruction, the concept of reusable learning objects (RLO), which are based on the techniques of object-oriented program (Friesen, 2003; Masie, 2002), was developed. RLOs consist of an objective, content, practice, and assessment but there can be variations in the structure. They include "tags," or metadata, that allow them to be stored in repositories and easily retrieved. The expectation is that any number of lessons can be constructed by assembling RLOs that are appropriate for the overall topic of the lesson and characteristics of the learners. To be maximally efficient and reusable, RLOs should be decontextualized as much as possible. For example, if an RLO designed to teach the concept of "holy" includes an image of the Christian cross, it would not be effective with an audience of people of the Jewish, Muslim, or Hindu faith. In environments where the same elements of instruction are used in many different lessons, as when a company that develops self-instructional lessons on computer applications or a military organization that teaches basic concepts of electronic

circuitry in many different content areas, it is much easier to decontextualize RLOs. But, even in these environments there are limitations on the effectiveness of RLOs and lessons constructed entirely from RLOs because of the severe limitations including contextual examples. Also, there has been no provision for incorporating motivational tactics into the learning objects or into programs of instruction that are constructed from learning objects.

In this regard, Oh (2006) introduced the concept of reusable motivational objects (RMO) and he developed and tested a prototype of this concept in his dissertation (Oh, 2006). He specified that the RMOs could be fixed or flexible. The ones that are fixed specify an exact strategy to use in a given context which makes them similar to RLOs. But, it was assumed that most RMOs cannot be decontextualized to the same degree as RLOs because key elements of most motivational tactics are related to building connections with the learners' attitudes and environments. For each type of RMO, he listed five types of metadata:

1. Related topic. It is necessary with fixed RMOs to specify the topic, such as the Pythagorean Theorem, to which they apply.
2. Title. This is a unique title that applies to one and only one RMO.
3. Sequence. This indicates whether the RMO should appear in the introductory part of the lesson, in the middle of the lesson, or toward the end.
4. Motivational category. Each RMO should be classified as to the major ARCS category and subcategory that describes its motivational goal. For example, ''Attention – Inquiry – Arousal.''
5. Target audience. This could specify grade level, such as 6th – 8th graders, or professional specialization, such as realtors or engineers.

The purpose of Oh's initial study of RMOs was to determine their feasibility, effect on instructional design performance, and efficiency. Graduate students in math 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 (MDA). 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. In other words, a combination of high-quality output and short development time would produce the highest efficiency scores. High-quality output combined with long development time or low-quality output combined with quick development time would result in lower efficiency scores. Attitudes toward the RMOs and MDA were measured with the Instructional Material Motivation Survey (see Chapter 11).

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 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 RMO is feasible with regard to developing meaningful motivational objects, they can be used effectively even by teachers with minimal instructional design skills, and they provide a means of representing the motivational first principles in this type of learning environment.

Motivational Design of Job Aids and Manuals

The ARCS model can be used to guide the development of motivational features in job aids and other materials such as manuals. Job aids are commonly used in settings as diverse as consumer banks, airplanes, telephone books, restaurant bathrooms, and board games. They provide clear, often illustrated, summaries of principles, procedures, or decision rules. For example, The "employees must wash hands" signs in the restrooms of business establishments, the illustrated guidelines for constructing "assemble-it-yourself" furniture, the emergency evacuation cards in the seat pockets of airplanes, the step-by-step guidance for relighting the pilot light on your water heater, and the payment calculators available in booklets or online that tell you your monthly payment after you input the loan amount, interest rate, and number of months or years of the loan are all examples of job aids. Imagine, as Paul Elliott (1999) points out, how difficult and cumbersome life would be if you had to memorize each of these processes or remember how to calculate answers from formulas!

Job aids can make life simpler and safer and can even eliminate or reduce the time required for training (Elliott, 1999). For example, Knebel et al. (2000) tested the use of print-based job aids by health care providers in developing countries where electronic performance support systems would not be readily available. They found that these job aids which are inexpensive to produce often reduced or even replaced the need for off-site training. They also found that the job aids helped reduce non-compliance due to such things as forgetfulness, time constraints, and some organizational barriers. But in spite of their potential and actual benefits, job aids are frequently underutilized or not used at all (Tilaro & Rossett, 1993). One reason why people choose to use them or not use them may be related to the combination of their internal desires to succeed and the characteristics of the job aids themselves (Tilaro & Rossett, 1993). On the one hand, if people are motivated to perform well, they are more likely to use job aids and any other performance support tools that are available. On the other hand, if they are not so highly motivated, a motivationally enhanced job aid might result in higher levels of utilization.

Table 12.2. Job Aid for Motivational Design of Job Aids (Based on Tilaro & Rossett, 1993).

ATTENTION

Subcategory	Process Questions (Challenges)	Strategies/Tactics
A1. Perceptual Arousal	*Original Version:* 　What can I do to capture their interest? *Job Aid Version:* ・ What can I do to capture the workers' interest?	*Original Version:* 　Create curiosity and wonderment by using novel approaches, injecting personal and/or emotional material. *Job Aid Version:* ・ Replace words with pictures. ・ Use humor where possible. ・ Maximize visibility.
A2. Inquiry Arousal	*Original Version:* 　How can I stimulate an attitude of inquiry? *Job Aid Version:* ・ How can I stimulate interest in using this job aid (JA)?	*Original Version:* 　Increase curiosity by asking questions, creating paradoxes, generating inquiry, and nurturing thinking challenges. *Job Aid Version:* ・ Create small, compact, and simple JAs. ・ Make sure the JA is accessible and convenient to use. ・ Follow good design principles. ・ Balance aesthetics, usability, visibility, and other variables.
A3. Variability	*Original Version:* 　How can I maintain their attention? *Job Aid Version* ・ How can I maintain the workers' attention?	*Original Version:* 　Sustain interest by variations in presentation style, concrete analogies, human interest examples, and unexpected events. *Job Aid Version:* ・ Put critical information first and "chunk" data. ・ Use color coding, highlighting, boldfacing, outlining, or bulleted items.

RELEVANCE

Subcategory	Process Questions (Challenges)	Strategies/Tactics
R1. Goal Orienta-tion	*Original Version:* 　How can I best meet my learner's needs? (Do I know their needs?)	*Original Version:* 　Provide statements or examples of the utility of the instruction, and either present goals or have learners define them.

Table 12.2 (continued)

	Job Aid Version: • How can I meet worker needs? Do I know their needs?	Job Aid Version: • Conduct needs assessments, i.e., perform thorough work, worker, and workplace analyses. • Determine the goal of the JA based on where, when, how, and why it will be used.
R2. Motive Matching	Original Version: How and when can I link my instruction to the learning styles and personal interests of the learners? Job Aid Version: • How can I link the JA to the way employees prefer to work or to their personal interests?	Original Version: Make instruction responsive to learner motives and values by providing personal achievement opportunities, cooperative activities, leadership responsibilities, and positive role models. Job Aid Version: • Look at the JA from the worker's point of view. • Build JAs based on ones that employees have created for themselves. • Make employees partners in the developmental process.
		• Look for "buy-in" factors from end users and management.
R3. Familiarity	Original Version: How can I tie the instruction to the learners' experiences? Job Aid Version • How can I tie the JA to the workers' experiences?	Original Version: Make the materials and concepts familiar by providing concrete examples and analogies related to the learners' work or background. Job Aid Version: • Use subject matter experts (SMEs). • Modify already-existing JAs. • Pilot test rough drafts of the JA.

CONFIDENCE

SubCategory	Process Questions (Challenges)	Strategies/Tactics
C1. Learning Require- ments	Original Version: How can I assist in building a positive expectation for success?	Original Version: Establish trust and positive expectations by explaining the requirements for success and the evaluative criteria.

Table 12.2 (continued)

	Job Aid Version: • How can I build positive expectations for success when using this JA?	*Job Aid Version:* • Anticipate potential problems, such as "change anxiety," and develop strategies to combat them. • Train workers to use the job aid. • Let workers know what is expected of them.
C2. Success Opportuni-ties	*Original Version:* How will the learning experience support or enhance the learners' beliefs in their competence? *Job Aid Version:* • How will using the JA support or enhance the workers' belief in their competence?	*Original Version:* Increase belief in competence by providing many, varied, and challenging experiences that increase learning success. *Job Aid Version:* • Provide situations for workers to experience success with the JA. • Review old JAs regularly. • Keep a list of who has received the JA for future updates.
C3. Personal Control	*Original Version:* How will the learners clearly know their success is based on their efforts and abilities? *Job Aid Version* • How will workers know their success is based on their efforts and abilities?	*Original Version:* Use techniques that offer personal control (whenever possible) and provide feedback that attributes success to personal effort. *Job Aid Version:* • Create JAs that enable employees to self-monitor. • Get sign-off from SMEs and management during all phases of development.
		• Find an "owner" to maintain the JA.

SATISFACTION

Sub-Category	Process Questions (Challenges)	Strategies/Tactics
S1. Intrinsic Reinforce-ment	*Original Version:* How can I encourage and support their intrinsic enjoyment of the learning experience?	*Original Version:* Provide feedback and other information that reinforces positive feelings for personal effort and accomplishment.

Table 12.2 (continued)

	Job Aid Version: • How can use of the JA be encouraged and supported?	*Job Aid Version:* • Seek input from end users for improving the JA. • Provide feedback to show the benefits of using the JA. • Show management the connection between the JA, improved performance, and bottom-line results.
S2. Extrinsic Rewards	*Original Version:* What will provide rewarding consequences to the learners' successes? *Job Aid Version:* • What will provide positive consequences for successes with JAs?	*Original Version:* Use verbal praise, real or symbolic rewards, and incentives, or let learners present the results of their efforts ("show and tell") to reward success. *Job Aid Version:* • Link organizational incentives and rewards to improved performance. • Have recognition programs for good ideas. • Encourage supervisors to coach and applaud.
S3. Equity	*Original Version:* What can I do to build learner perceptions of fair treatment? *Job Aid Version* • How can workers be convinced of fair treatment?	*Original Version:* Make performance requirements consistent with stated expectations, and use consistent measurement standards for all learners' tasks and accomplishments. *Job Aid Version:* • Standardize rating scales for evaluation-type JAs. • Distribute JAs to all workers who might need them.

Tilaro and Rossett (1993) applied the ARCS model to the design of job aids by examining the motivational properties of several job aids and creating a table of tactics by modifying the original ARCS tables of process questions and major supporting strategies (Tables 3.3, 3.4, and 3.5) to contain tactics that are more directly tied to job aid design. A direct comparison of the two versions is presented in Table 12.2.

Tilaro and Rossett (1993) point out that not all four of the ARCS categories need to be applied to every job aid. For example, the primary motivational goal of some job aids is limited to capturing attention by using\ large colorful type and reinforcing relevance by reminding the audience of the importance of the given procedure. In contrast, the

emergency procedures job aid in airline seat pockets must accomplish both of these goals and also help the passengers feel confident that they can do the right things in an emergency. These motivational goals are, of course, subordinate to the primary goal of a job aid which is to guide and instruct. They present a four-step process for building job aids (planning, building, installing, and maintaining) and their article contains numerous helpful examples.

Summary

This chapter has described issues, strategies, and models pertaining to motivational design in the context of technology-assisted instruction, both instructor-led and self-directed types of delivery systems. It has also described some recent and current areas of research and development on motivational design. Within all of these areas of work on adaptive instruction, motivational objects, job aids, and other innovative uses of technology there are many interesting research questions that can be investigated.