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An Integrative Theory of Motivation, Volition, and Performance

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There are many independent theories and constructs pertaining to motivation, volition, and learning and the total number continues to expand. In contrast, it could be beneficial for guiding research and practice to have more theories that are integrative in nature; that help explain relationships among theories in relation to motivation, volition, learning, and performance. Typically, researchers focus on a bounded set of questions within a given area of interest that incorporates a specific paradigm of inquiry. However, to have integrative theories it is necessary to move outside of the given paradigms and demonstrate how these various approaches can be combined to provide more explanatory frames of reference than any one of them can do by itself. In this paper such an integrative theory is proposed. It preserves the integrity of the constituent concepts and theories and provides a basis for cross-paradigm studies. This theory of motivation, volition, and performance (MVP) builds upon an established integrative theory but expands it by incorporating the concept of intentions, action control, and information processing within the framework of a system model. Furthermore, the theory illustrates how environmental (external) influences on behavior combine with internal psychological constructs and processes in relation to goal directed effort, performance, consequences, and outcomes. The paper concludes with a discussion of implications of the theory for research and practice.

Keywords: Motivation, intentions, volition, motivational design, ARCS model, self-regulation, performance, learning.

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INTRODUCTION

There are many theories and models that explain aspects of motivation, volition, and learning but most of them tend to stand alone as relatively independent areas of inquiry. For example, a well-established theory pertaining to motivation is the ARCS model (Keller, 1999a) which provides a synthesis of motivational concepts and theories and a motivational design process. With regard to volition, Kuhl's action control theory (Kuhl, 1985), Gollwitzer's work on implementation intentions (Gollwitzer & Brandstätter, 1997), and research on self-regulated learning behaviors (Corno, 2001; Zimmerman, 2001) are well established in this area. There are many theories of learning, but information processing theory (Atkinson & Schiffrin, 1971; Mayer, 2001) still provides a good foundation for research in the context of learning environment design. And, in addition to these relatively comprehensive theories are the numerous more specific concepts and theories in each of these areas. This is not a problem for the scholars who work within specific domains of inquiry and use research paradigms that are well-established within their respective areas, but it is a problem for researchers who want to develop more comprehensive and cross-paradigm programs of inquiry, and for designers who are trying to create effective learning environments that meet the needs of the intended audiences. There are a few theories and models, some of them quite recent (Astleitner & Wiesner, 2004), that attempt to bridge between motivation, volition, and learning, but each of them has limitations that are addressed in the current paper which presents a more comprehensive and integrative theory that can be used for prediction and design.

Thus, the aim of this paper is to present a theory that integrates these and other factors and illustrates how they are connected within a systems perspective that preserves the theoretical foundation of each of the components. This type of theory can be characterized as a concatenated theory (Kaplan, 1964) in contrast to a hierarchical theory. A concatenated theory attempts to assemble explanatory components pertaining to a central phenomenon, in the present case human performance, whereas a hierarchical theory is one in which the component laws and principles are derived from a set of basic principles, as in a hypothetico-deductive theory.

This distinction was also made by Einstein (Kaplan, 1964) who characterized hierarchical theory as principle-theory which builds from hypothetical assumptions through logical extensions to validational studies. Theories in the other class, which he calls "constructive theories", are more empirically-based and strive to build from simpler schemes to more complex ones. This is the case in the present situation in which a central emphasis is on performance, not just learning, because performance is an observable behavior that is an outcome of learning and is also influenced by a variety of psychological, sociological, genetic, and environmental influences. The theory to be presented focuses primarily on the psychological and environmental influences on performance. Genetic influences are reflected through various motivational and ability variables and sociological factors are incorporated into the environmental influences. In this regard the theory to be introduced can also be characterized as a macro theory which means, as the name suggests, that it takes a broad view of the motivational, volitional, learning, and environmental factors influencing performance. Given this ultimate focus on performance and the primary goal of the theory to integrate motivational and volitional influences with learning processes, a convenient title for the theory is the motivation, volition, and performance (MVP) theory. This theory is represented in a systems model to show how all of the parts are interrelated and to illustrate relationships that occur as explained and predicted by the theory. Thus, the phrase MVP model refers to this systems representation while MVP theory refers to the explanatory structures represented by the components of the theory.

The MVP theory builds on an existing theory of learning motivation and motivational design which is described in the following section. This motivation theory is then described in the context of the original version of a comprehensive model of motivation, learning, and performance (Keller, 1979, 1983). Next, the original comprehensive model is expanded into the MVP model by incorporating volitional concepts, an information processing model of learning, and a network of linkages among motivation, volition, and information processing components with respect to learning and performance. The paper also includes discussions of environmental influences and design implications in regard to these components together with summaries of three research studies that provide empirical support for elements of the theory. The paper concludes with a discussion of potential benefits of this theory for research and design together with implications for research and practice.

MOTIVATION, LEARNING, AND PERFORMANCE

Motivational research includes numerous micro theories and motivational constructs as well as at least one theory that synthesizes these various conceptual areas. The motivational theory to be incorporated in this paper is the ARCS model of motivational design (Keller, 1979, 1983, 1999a). It is a well established and validated theory (Astleitner & Hufnagl, 2003; Naime-Diffenbach, 1991; Small & Gluck, 1994) that synthesizes motivational theories and constructs into four categories based on shared attributes. It also provides a systematic approach (Keller, 1999b) to diagnosing motivational problems and designing motivational tactics into instruction. It incorporates needs assessment based on an analysis of the target audience and existing instructional materials, supports the creation of motivational objectives and measurements based on the analyses, provides guidance for creating and selecting motivational tactics, and follows a process that integrates well with instructional design and lesson planning (Keller, 2000 February). The analysis of motivational needs and corresponding selection of tactics are based on four dimensions of motivation that were derived from the synthesis of motivational concepts and theories, and are known as attention (A), relevance (R), confidence (C), and satisfaction (S).

However, the motivational dynamics represented by the four categories of the ARCS model do not occur in isolation from other influences on learning and performance. Their interactive influences can be illustrated in a process, or systems, model of motivation, learning, and performance (Figure 1). This model illustrates how a person's curiosity ("attention") and motives, or values, ("relevance") combined with his or her expectancy for success ("confidence") will determine which goals have the highest saliency and will therefore lead to purposeful **effort** to accomplish the goal. Environmental influences such as teacher enthusiasm and social values, quality of instruction, clarity of expectations, and availability of resources will also influence goal-directed effort and lead toward some degree of achievement, or **performance**, which will also be influenced by one's knowledge, ability, and skills. One's performance combined with the way in which reinforcement contingencies are administered determines the **consequences** of achievement with respect to whether it leads to an expected outcome. These consequences combined with one's cognitive evaluations and reflections determine levels of **satisfaction** with the process and outcomes. With respect to feedback loops, represented by dotted lines (Figure 1), one's perceptions of the relationship between effort and performance, and between performance and consequences each feed back into and modify one's expectancies (Weiner, 1974). Satisfaction level feeds back into motives and values to either strengthen or weaken the value one attaches to a given goal. Even though these lines follow a traditional representation as feedback loops which is convenient for graphical purposes, this model is a process model that illustrates how various internal and environmental events influence behavior over time. Therefore, the feedback lines are in essence feed forward lines. A person's motives and values at time *a* will result in a chain of events as represented in the model. When an outcome is reached and internally, cognitively, evaluated, the results of one's feelings of satisfaction or dissatisfaction on motives and values would be at time *b*. Hence, the model represents a series of cycles, not changes in a static situation. However, motives and expectancies are not always the starting point in the process. It is possible to begin with a set of observations at any point in the process and examine their relationship to other elements of the model.

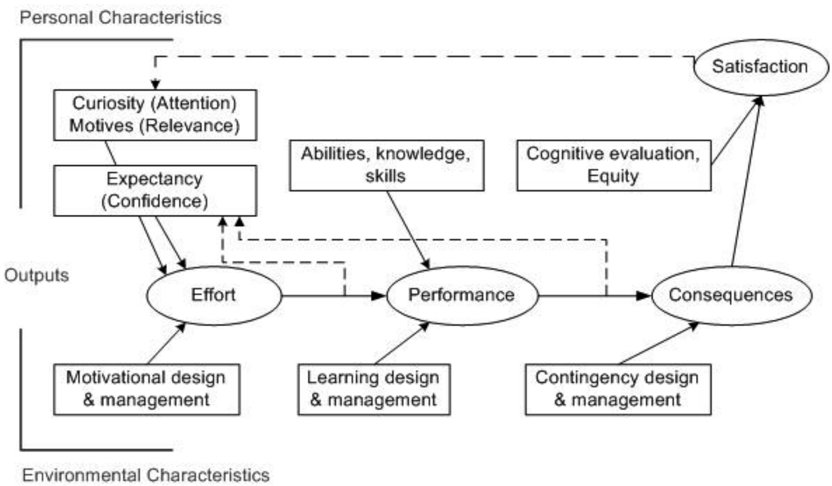

FIGURE 1
A macro-model of motivation, mearning, and performance.

This macro model has been useful in guiding inquiry on motivation and learning and providing a basis for identifying design issues. For example, audience analysis can be used to identify sources of motivation and learning problems and to then design solutions that incorporate the appropriate strategies (environmental stimuli) with regard to motivation, instructional design, and contingency management. As a process model, this macro model illustrates the relationships among various structures but does not detailed illustrations of the activities that occur within the major components. For that, one would have to look into the theories and procedures within the given component. For example, with regard to the expectancy-value part of the model, it is assumed that the goals with the highest valence will automatically result in action in the form of effort to accomplish the desired goals (Pintrich & Schunk, 2002). While this is true, this example also illustrates one of the shortcomings of the model that led to its expansion. Descriptions of the macro-model and the associated ARCS model explain the challenges of sustaining learners' efforts to accomplish a given goal despite distractions and competing goals, but the model does not include specific concepts or procedures pertaining to this problem. Therefore, it would be useful to expand the model to explain the internal volitional, or self-regulatory, processes together with external supports that can assist learners in moving from goal selection to goal-directed actions and persistence. The following sections of this paper explain how this macro model has been expanded to include various volitional factors along with a more detailed representation of learning theory for a more comprehensive integrated theory of motivation, volition, and performance (MVP).

VOLITION

Historically, motivation was considered to have two levels. The first is "will" which refers to a person's desires, wants, or purposes together with a belief about whether it is within one's power to satisfy the desire, or achieve the goal (James, 1890; Pintrich & Schunk, 2002). The second level is the act of using the will, or "volition," which refers to a process for converting intentions into actions. In some cases, the mere saliency of a desire, which is another way of saying strong motivation, is sufficient to lead more or less automatically to action, but often, as William James (1890) pointed out, it is necessary to have a conscious effort supported by determination or extrinsic requirements to convert intentions into action, which is known as volition or self-regulation.

Much of motivation research has focused on understanding what people's goals are and why they choose them. For example, the original conceptualization of "will" as being a combination of desires and beliefs about being able to achieve them is reflected in expectancy-value theory (Vroom, 1964) which postulates that behavior potential is a function, assumed to be multiplicative, of the perceived importance of a given goal in relation to other goals (value) and one's subjective probability of being able to achieve the goal (expectancy). While this theory has had a powerful influence in motivational theory and is an integral part of the model illustrated in Figure 1, its primary contribution is in explaining how people choose a particular goal or set of goals. It provides a necessary but not always sufficient condition for understanding what impels people to action and helps them sustain their initial goal intentions, especially when motivation wanes in the face of competing intentions. In this regard, the concepts of action control (Kuhl, 1987), implementation intentions (Gollwitzer, 1999), and self-regulation (Zimmerman, 1998) are relevant. All of these pertain to the problem of maintaining goal-oriented behavior and overcoming discouragement and attrition, problems that have been experienced especially in self-directed learning environments including distributed learning (for example, distance learning and e-learning), and even classroom courses that put a high level of scheduling control into the students' hands.

Kuhl (1985) defines volition as a mediating factor that "energizes the maintenance and enactment of intended actions" (Kuhl, 1985, p. 90) and therefore goes beyond motivation. Wolters (1998) commented about how students can express sincere desires to accomplish a goal but have a very difficult time in managing competing goals and distractions that interfere with their academic work. Similarly, Pintrich and Garcia (1994) pointed out that the influence of volition becomes even more important for college students "who, when you talk to them, are very motivated and concerned about doing well, but often have a very difficult time enacting their intentions, given all the internal and external distractions they confront in college life" (p. 126f). These observations are, of course, readily apparent to teachers, counselors, therapists, or anyone else who tries to facilitate change in people. In this regard, Kuhl's action control theory was developed in the context of helping people overcome maladaptive behaviors in their lives while the work of Zimmerman (2001) and Corno (1993) focuses more on self-regulatory behaviors in students.

Kuhl's theory postulates six action control strategies that can be employed as soon as a goal ("an action tendency") achieves the status of a current intention. In other words, commitment to achieving a given goal is a prerequisite to employing the set of action control strategies, which are:

1. Selective attention: also called the "protective function of volition" (Kuhl, 1984, p. 125): it shields the current intention by inhibiting the processing of information about competing action tendencies.
2. Encoding control: facilitates the protective function of volition by selectively encoding those features of incoming stimulus that are related to the current intention and ignoring irrelevant features.
3. Emotion control: managing emotional states to allow those that support the current intention and suppress those, such as sadness or attraction, in regard to a competing intention that might undermine it.
4. Motivation control: maintaining and reestablishing saliency of the current intention, especially when the strength of the original tendency was not strong ("I must do this even though I don't really want to.")

5. Environment control: Creating an environment that is free of uncontrollable distractions and making social commitments, such as telling people what you plan to do, that help you protect the current intention.
6. Parsimonious information processing: Knowing when to stop, making judgments about how much information is enough and to make decisions that maintain active behaviors to support the current intentions.

Kuhl assumes that processes of action control underlie virtually any kind of activity and may be called into play to protect a current intention when the strength of competing tendencies grows too strong or one's ability to perform the intended actions is weakened (Kuhl, 1985). The effectiveness of employing action control strategies has been confirmed in many studies in a variety of behavior change settings (Kuhl, 1987) as well as in educational settings (Corno, 2001; Zimmerman, 2001). Consequently, action control strategies will be an important component of the MVP theory. However, action control theory does not provide detailed explanation of the process by which one moves from the state of having a predominant goal to active commitment to achieving the goal. For this, Gollwitzer's work (Gollwitzer, 1996) on intention commitment, or implementation intentions is helpful.

The first step in moving from desire to action, that is, from the identification and acceptance of a personal goal to a set of actions to accomplish the goal is that of intention formation. On the one hand, the concept of "good intentions" is used as a rationalization when things go wrong, or an excuse for not taking action as in the expression, "the road to hell is paved with good intentions." But, on the other hand, intentions can be a powerful influence on goal accomplishment. In a laboratory study with preschool children who were asked to work on a repetitive, boring task that was interrupted with a tempting distraction (a clown head encouraging children to select and play with toys instead of working on their assigned task), Patterson and Mischel (1976) tested the effects of task-facilitating intentions versus temptation-inhibiting intentions. The children were told that a clown box might tempt them to stop working. The task-facilitating group was told to keep their attention on the task if this happened, and the temptation-inhibiting group was told to direct their attention away from the clown box. This study and subsequent research (Gollwitzer & Schaal, 2001) shows that temptation-inhibiting intentions have the superior effect no matter whether motivation to perform the task is high or low. However, these studies have been conducted in laboratory settings and it would be interesting to see if the same strong effects can be observed with older students in learning environments which often contain many distractions.

Implementation intentions are but one part of a more complete model, called the Rubicon model, that explains that transition from goals to action (Gollwitzer, 1996), This model has some elements in common with Keller's macro model and others that are not which will be important additions in the development of the MVP model. The first phase is a pre-decisional motivation phase that includes activities associated with identifying and choosing goals, but stops short of making a full commitment to pursuing a given goal. It is based on expectancy value theory and is similar to the motivational (values and expectancies) phase in Keller's macro model (Figure 1), but does not have the same level of inclusion of motivation elements that can influence goal selection and expectancies. At the conclusion of this phase one moves forward into the committed stage, which is why it is metaphorically called the Rubicon model, This refers to Julius Caesar's famous decision to cross the Rubicon into Italy proper, which was against the law and from which there was no turning back. This "committed phase" is the pre-actional phase of volition which includes committing oneself to action developing what Gollwitzer calls "strong" intentions that result from anticipating and immunizing oneself against obstacles. The third phase covers volitional, or self-regulatory, activities that help sustain goal seeking behaviors. It is in this part of the Rubicon model that Kuhl's action control theory can add depth in regard to volition. The final phase consists of post-actional motivational behaviors such as reflecting on one's actions and conducting a self-evaluation of outcomes. This is similar to the cognitive evaluation, equity part of Keller's macro model (Figure 1).

INTEGRATING VOLITIONAL INFLUENCES INTO THE MVP MODEL

MVP theory expands Keller's macro model to incorporate action control theory and implementation planning. First, however, it is important to note that a major graphical modification was made when designing the MVP model. First, the bottom row of Keller's original model (Figure 1) containing inputs from the environment was moved to the top (Figure 2) and relabeled as "external inputs," which better communicates the variety of social, cultural, and physical environmental factors that can influence individual motivation and performance. Also, this new placement facilitates communication of the interactive influences of environmental and internal psychological processes on each other and on the major categories of outputs, or measurable behaviors, associated with each stage.

With respect to modifying the substance of the macro model, the motivational, or expectancy-value) portions of the model is the same. Gollwitzer has a “Motivation: Pre-decisional phase” in the Rubicon model, but Keller’s original formulation, which includes expectancy theory, is more complete. However, substantial changes were incorporated in the MVP model by adding a

pre-actional stage of volition patterned after Gollwitzer’s (1999) work (Figure 2). This provides a more complete representation of the processes that occur in moving from initial motivation to sustained effort. An action stage has also been added to include volition as represented in the six components of Kuhl’s action control theory and other concepts of self-regulation (Corno, 2001; Zimmerman, 2001). Figure 2 illustrates the relationships that occur among these components in the form of internal motivational/volitional processing and also illustrates how each of them can be related to an observable outcome variable. However, the magnitudes of the relationships are not illustrated in the diagram. For example, if ‘effort direction’ is extremely high, then it might not be necessary for the learner to invoke implementation intentions or action control strategies. This condition would be similar to a state of flow (Csikszentmihalyi, 1990) in which the learner is fully absorbed in the immediate activity and not relying on metacognitively induced strategies of self-regulation to stay on task. The volitional elements would become activated when necessary to protect the intention if it began to wane for the previously described reasons (too many competing tendencies or excessive challenge in goal pursuit). This condition would be similar to a state of flow (Csikszentmihalyi, 1990) in which the learner is fully absorbed in the immediate activity and not relying on metacognitively induced strategies of self-regulation to stay on task.

In keeping with these two new elements of the model, two outputs were added to clarify the outcomes of motivation, pre-actional planning, and action control. Instead of the unitary designation of effort (Figure 1) the result of choosing a goal is called **effort direction** (Figure 2), which refers to a person’s desires, or goal choices. Next is **effort initiation** which refers to the initiation of effort to achieve the chosen goals. The third is **effort persistence** which is influenced by the strength of the goal, the level of commitment, and the use of volitional strategies if any are employed by the learner. These can be measured in many ways ranging from self-reports through direct observation to performance indicators such as on-task versus procrastination times.

The remaining part of the Rubicon model, “Motivation: Post Actional Phase,” is similar to the cognitive evaluation component of Keller’s original model (Figure 1), but has some useful distinctions related to reflection and emotional processing. It is now called “outcomes processing” (Figure 2) and includes these

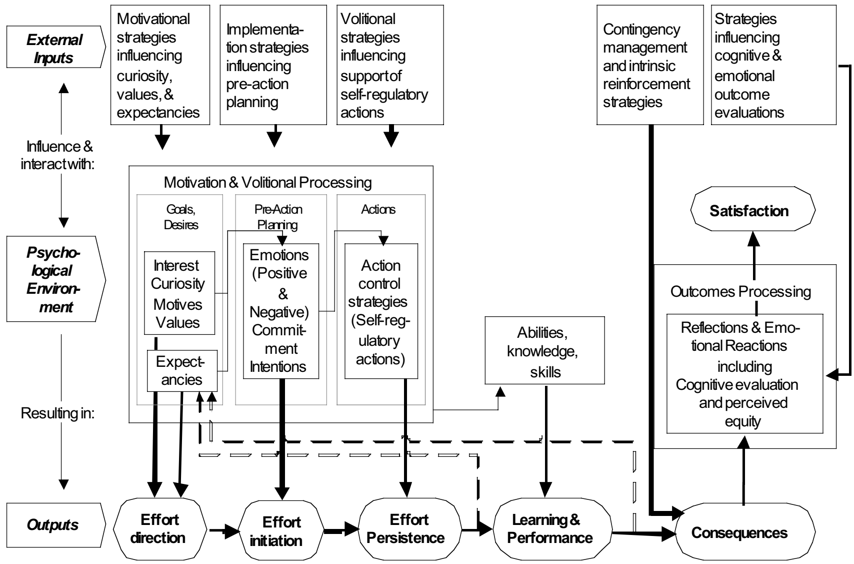

FIGURE 2
Integration of volitional and post-actional concepts into Keller's macro model.

elements. Also, note that the influence of behavior management by means of reinforcement contingencies has been retained from Keller's original model, but there is a new block (Figure 2) within external inputs that refers to strategies that can be implemented to influence how people manage their emotional and evaluative reactions to events.

In summary, keep in mind that the goal of the MVP, as with Keller's original macro model and the ARCS model, is to provide an explanatory shell that synthesizes theories and models based on shared attributes, and organizes them by means of a general systems model that illustrates mutual influences on other aspects of learning and performance. This is not a glib aggregation based on a few similarities in semantics or "surface level" attributes, but is based on the theory, purpose, and empirical research underlying each of these components. However, as synthesis requires generalization, some of the unique properties of each of the component theories and constructs will not be highlighted in this concatenated theory. This theory does not purport to supplant any of the component theories and constructs, but only to portray their relationships with the aim of facilitating new directions in research and aiding designers in diagnosing and developing solutions to human performance problems.

INFORMATION PROCESSING

Another limitation of Keller's (1983) macro model is that it does not illustrate how information processing elements are part of the learning process and how they interact with motivation and volition. In other words, even though Keller's macro-model illustrates that abilities, knowledge, and skills influence performance (Figure 1), it does not illustrate the dynamics of perceptual and cognitive activities involved in learning. Therefore, the next step in expanding the macro model was to replace the simple designation of knowledge, ability, and skill with an information processing model (Figure 3) based on Atkinson & Shifferin's original formulation (1971), but modified to incorporate distinctions between words versus pictures or, more precisely, digital versus iconic signs (Knowlton, 1966; Langer, 1942) as environmental inputs because of the differences in the ways they can affect perception, attention, motivation, and learning. Paivio (Paivio, 1969, 1971) explained this by postulating dual processing theory which assumes that there are two different encoding systems in working memory for perceiving and processing digital (verbal, textual) versus iconic (pictures, diagrams) information. Many of these concepts have been incorporated into research on learning in a multimedia environment which has re-emerged as a major area of interest given the breadth and depth of technology integration into instruction. For example, Mayer's (2001) research on learning from pictures versus words reconfirms and adds to the large volume of research on this topic that was done in the 1960s and 1970s (Levie & Dickie, 1973; Levie & Lentz, 1982).

Another important concept to include in conjunction with general information processing theory is cognitive load (Paas, Renkl, & Sweller, 2003), which refers to the amount of information that a person can process in working memory. This is another of the problematic situations in many learning environments, especially when learning complex cognitive skills or working with multimedia because there are several additions to cognitive load that are not typically present in a more structured lecture or textbook situation. For example, Sweller (1994) distinguishes between intrinsic cognitive load which refers to the inherent complexity of the material to be learned, germane cognitive load which refers to the level of cognitive activity resulting from task-oriented efforts of the learner, and extraneous cognitive load which is induced by instructional activities and distractions that are divergent and not effective in accomplishing the task. In traditional self-directed learning environments, such as programmed instruction, it was difficult to manage intrinsic cognitive load. Programs of instruction would be used by students with differing entry levels of knowledge

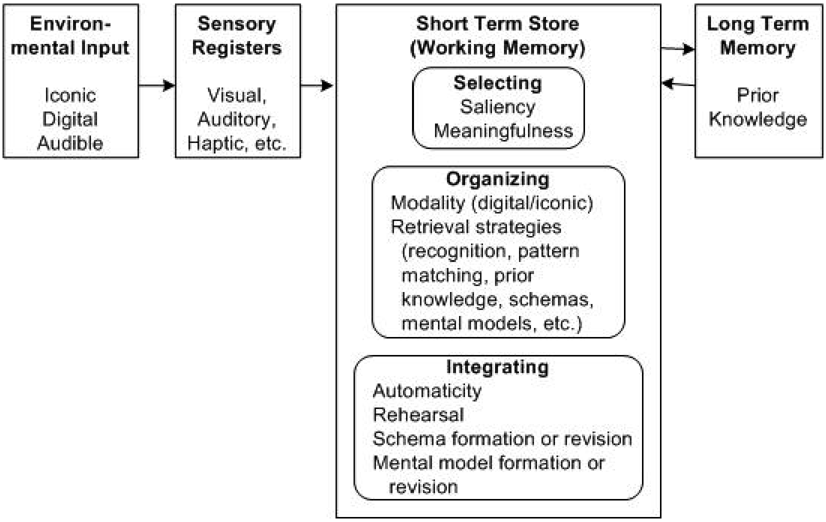

FIGURE 3
An information processing model incorporating dual processing theory.

and skill, but it was not feasible to provide a single program that would not produce cognitive overload for some students and under-load for others despite the efforts to include features such as branching. In multimedia instruction it is even more challenging because of the number and types of stimuli that can occur in this environment. With the availability of hot links, internet excursions, multiple stimuli (rollovers, branching topics, navigational innovations) within the multimedia program, the potential for excessive cognitive load is high, especially in the area of extraneous cognitive load. Deimann & Keller (2006) documented many of these problems such as "lost in hyperspace" and the "serendipity effect" and how they can be managed by the appropriate use of volitional strategies. Cognitive load problems can also occur when learning complex cognitive skills. The intrinsic load tends to be very high, which means that extraneous load in the form of competing intentions or distractions can lead to excessive cognitive load and the need to invoke action control strategies to stay on task.

Information processing theory combined with motivation and volition principles has implications for principles of cognitive load and how to best design instruction to maximize germane, or useful, cognitive load (Sweller, 1994) while minimizing extraneous, or dysfunctional, cognitive load. One can find support for these assumptions in the general principles of message design compiled by Fleming & Levie (1978), as well as many other established principles of perception and memory that could apply to and be empirically tested in the design of instruction. One such example, based on the work of Anderson and Faust (1973) and which could be presumed to be related to cognitive load is Principle 2.12 (Fleming & Levie, 1978) “Learning is facilitated where criterial cues are salient (dominant, apparent, conspicuous). Add non-criterial cues only if and as necessary” (p. 115). Unnecessary cues would add to extraneous cognitive load. Additional implications are discussed below in the descriptions of the final restructuring of the original macro model.

MOTIVATION IN RELATION TO INFORMATION PROCESSING

One of the limitations of information processing theory in general, including Mayer’s, is that they do not include motivational or volitional considerations. Astleitner & Wiesner (2004), building on the work of Mayer (2001), Rheinberg, Vollmeyer, and Rollet (2000), and Keller (1983, 1997, 1999a) have proposed an integrated theory of information processing and motivation that includes “motivational processing” as well as elements of mental resource management (Figure 4). They draw primarily on Kuhl (1985) who postulated that such things as wishes, intentions, values, and emotions are also part of working memory in addition to the traditionally recognized perceptual and cognitive processing components. The motivational components specified by Astleitner & Wiesner (Figure 4) are goal setting and action control. They are connected to the information processing model by means of mental resource management activites such as attention, engagement, and monitoring (Figure 4). It should be noted that their use of the term “attention” refers to actions that facilitate learning, such as providing cues to focus attention to salient parts of the mental tasks at hand. This is different from using “attention” in the motivational sense (Keller, 1999a) which refers to stimulating and sustaining arousal and curiosity. Astleitner & Wiesner’s model has promise for assisting in conceptualizing research on the interplay of cognitive and motivation elements in learning, as illustrated by the authors’ presentation of a list of general predictions, especially learning in a multimedia environment which is the focus of their paper. However, their model has limitations that can be illustrated by the third and final expansion of Keller’s macro model which incorporates both information processing theory with dual encoding specifications and a revised version of Astleitner & Wiesner’s model together with several integrating elements that are not present in either of those models.

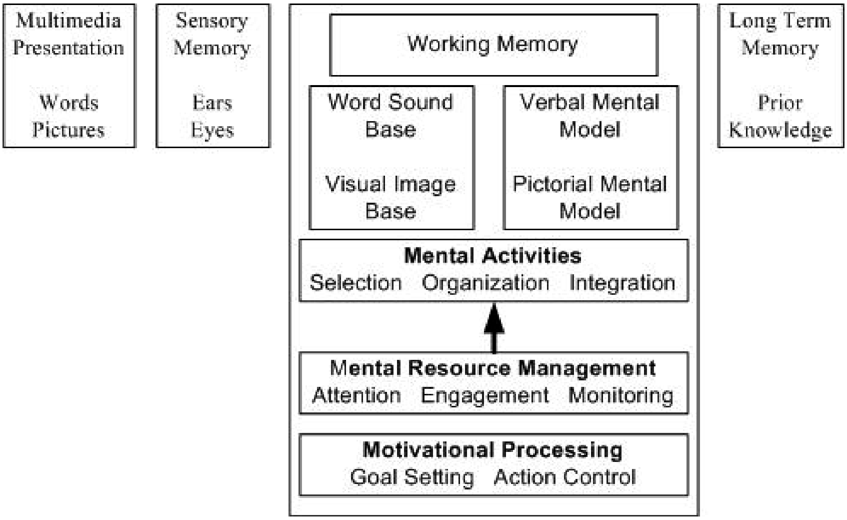

FIGURE 4
A model of multimedia, learning, and motivation (Astleitner & Wiesner, 2004).

ADDING INFORMATION PROCESSING ANDINTERNAL LINKAGES TO THE MVP MODEL

The final phase of modifications to Keller's macro model (Figure 1) results from adding the information processing components into the fully expanded model (Figure 5), specifying cognitive load as a component of working memory, adding a psychomotor component represented by "practice," and illustrating their linkages with motivational and volitional components. In the information processing elements in Figure 5 the dual processing elements are not distinguished due to the already complex structure of the model, but they are presumed to be within the sensory inputs and working memory components. Although there are numerous control processes within working memory (Atkinson & Schiffrin, 1971), attention is called to the concept of cognitive load (Sweller, 1994) in the present model. This variable is presumed by many to be a key factor in designing instruction, especially multimedia, where the stimulus arrays can be complex and distracting and in designing instruction for the teaching of complex cognitive skills (Van Merriënboer, Kirschner, & Kester, 2003). And, the concept of practice is included because, as shown by Ericsson (2006), the type of practice that distinguishes superior performers, called deliberate practice, is a behavior that combines psychomotor, cognitive, and motivational elements in the development and maintenance of expert performance.

Astleitner and Wiesner's modification of Mayer's model has been incorporated in two ways. The first is to include "mental activities" in the information processing section just as they did. But, "mental resource management" has been expanded in terms of its elements and placed into a separate category called "Motivation & Information Processing Interface." This makes it easier to illustrate the direct interactions between the two areas such as the effect of higher levels of motivation on higher capacity for germane cognitive load and how goals and implementation intentions can influence focus of attention which influences mental activities such as selection and organization of stimuli.

With respect to the remaining part of Astleitner and Wiesner's model, called "Motivational Processing," the component parts of this section, which are goal setting and action control, are already part of the MVP model in the section called "Motivation and Volitional Processing." Goal setting is contained within the pre-decisional phase of motivation, and action control is in the actional phase of volition.

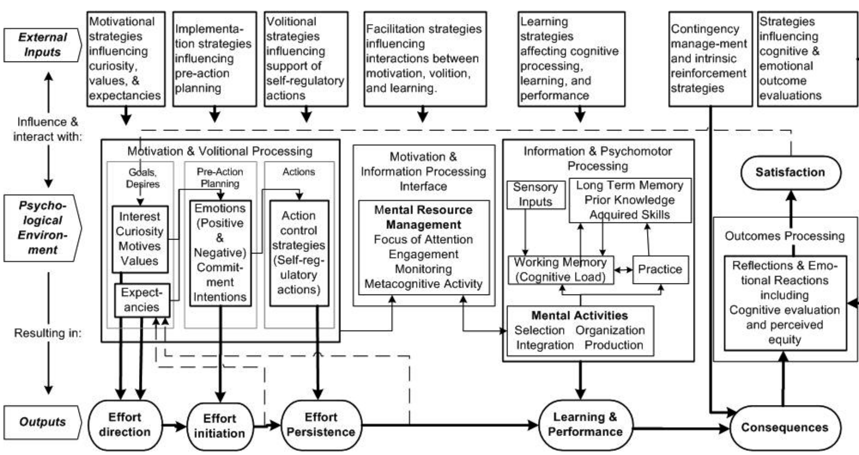

FIGURE 5
The MVP model of motivation, volition, and performance.

SUMMARY OF MODIFICATIONS TO & RESTRUCTURING OF THE MODEL

By expanding the original model of motivation, learning, and performance (Keller, 1979, 1983) to include implementation intentions and action control and by means of other modifications that have been described, the proposed new macro-model seems to offer a more comprehensive basis for developing theory and research on the dynamics of motivation, volition, and information processing in regard to learning, performance, and instructional design.

IMPLICATIONS OF THIS MODEL FOR RESEARCH ON CONCEPTS AND THEORY

What, one may ask, is the value of this type of theoretical integration? High-level theories can be confusing and are by nature complex. Furthermore, for every class of variables and specification of relationships that are included, there are others that could be included. Models such as these have the danger of becoming like an expanding universe as each version leads to the incorporation and conceptualization of multiplicatively more concepts, subordinate models, and relationships. But, even at this level of theorizing, it is important to maintain a sense of parsimony and testability. In the present situation, the goal is to continue efforts to explain the dynamics and inner workings of motivation, learning, achievement, and satisfaction as it results in continuing motivation. Therefore, the model has been expanded only insofar as necessary to integrate a few major concepts and variables that will help accomplish this goal.

An area of research that can be used as an example is curiosity which, as a psychological construct, has a long history of investigation and was initially grounded in conceptualizations of deprivation and sensation-seeking tendencies (Berlyne, 1954). A more formal conceptualization was provided by Berlyne (1954) who expanded this concept by making a distinction between perceptual curiosity which refers to one's more or less automatic response to novel and incongruous stimuli and epistemic curiosity referring to a more intellectual level of curiosity in which one seeks answers to complex and incongruous situations. He also introduced a distinction between specific and diversive curiosity which was elaborated by Day (1968). Specific curiosity is aroused by a situation of interest that has the properties of complexity, novelty, and ambiguity. The specifically curious person tends to focus on the task with the aim of reducing uncertainty by means of exploration and gaining information. In contrast, diversive curiosity is characterized by tendencies to be easily distracted by new stimuli, lack of follow though on tasks, and frequently becoming bored and seeking change. Research on curiosity has focused on refinements of the construct, developing measures, and studying conditions that stimulate one type of curiosity or another (Collins, Litman, & Spielberger, 2004; Day, 1968; Litman & Spielberger, 2003; Maw & Maw, 1977). But, it has remained as a somewhat isolated area of inquiry as is illustrated by its placement in the motivation portion of the MVP model, and even recent studies tend to focus on further definitions of the construct and its relationship to other constructs such as flow and sensation seeking (Kashdan, Rose, & Fincham, 2004). However, a perusal of the MVP model can stimulate the thought that it might be fruitful to consider curiosity concepts such as specific versus diversive curiosity in conjunction with volitional theory and learning environment design. It would seem that curiosity would be positively correlated with achievement in a stimulus-rich environment such as a Montessori classroom or online multimedia environment which typically have characteristics that stimulate exploratory behavior. However, these environments also have the potential for being overwhelming because of their many opportunities for exploration. This could be especially true when one considers individual differences such as specific versus diversive curiosity in relation to the conditions that are optimal for each curiosity type, and how the introduction of volitional supports might differ for each group. For example, people with specific curiosity could be expected to require less volitional support than those with diversive curiosity in a stimulus rich environment. In summary, becoming familiar with the variety of areas of research that are synthesized into the MVP model, one can be in a better position to envision new lines of research.

Another example can be illustrated by the concept of computer rage (Seligman, 2005) which appears to be occurring with greater and greater frequency and has become a topic of interest in computer interface design (Klein, Moon, & Picard, 2002; Selvidge, Chaparro, & Bender, 2002). Like many new areas of inquiry, this one began as an investigation of a particular phenomenon which then gradually expanded to incorporate theory. Ceaparu et al (2004) conducted a series of self-report and observational measures at two universities to determine causes and severity of user frustration when using computers. The primary components that they identified are errors, time delays, and emotional reactions. Their study also provided empirical verification of similar observations reported by others (Klein, Moon, & Picard, 2002; Selvidge, Chaparro, & Bender, 2002).

In addition to this research on documenting causes of problems, researchers are endeavoring to identify solution areas and theoretical bases for understanding the phenomenon. The most common explanation is grounded in the traditional frustration-aggression hypothesis (Dollard et al., 1939). However, this provides only a partial explanation because even though it has been confirmed consistently in many studies that aggression is caused by frustration (Berkowitz, 1989), the converse is not true; that is, frustration does not always lead to aggression. Consequently, researchers have been focusing on ways of alleviating frustration without aggression. The primary methods include removal of the causes of frustration by improving the quality and reliability of computer interfaces and by providing frustration alleviating feedback in the form of apologies and other kinds of messages (Klein, Moon, & Picard, 2002). To provide theoretical support for this approach, researchers are integrating theories of human emotion and emotional management, even to the point of having computers be sensitive to emotional changes in the user and then providing an appropriate response (Klein, Moon, & Picard, 2002; Scheirer, Fernandez, Klein, & Picard, 2002).

Even though this area of inquiry is broadening, it could perhaps expand even more quickly into relevant and potentially useful areas by examining an integrative theory such as that represented in the MVP model. For example, if we try to give an overall characterization of this research with reference to the MVP model, we can see that user efforts to perform well (refer to the "outputs" row, Figure 7) are frustrated by the environmental conditions (external inputs) that either facilitate or restrict performance due to poor man-machine interfaces. This results in emotional frustration (outcomes processing) and a frequent tendency to behave aggressively toward the equipment. The concept of frustration-aggression also falls into the outcomes processing "box" (Figure 7) as an emotional reaction. However, not everyone responds the same way to frustration or to interventions such as apologies from the computer, which some people regard as inappropriate "anthropomorphizing" of the machine. It might be fruitful to incorporate investigations into goal setting (the stronger one's goal motivation, presumably the greater one's frustration in being thwarted from achieving the goal), volition to better understand how to immunize users against these inevitable frustrating obstacles in computer environments, and the influence of interface design on ease of information processing and cognitive load in order to preserve as much working memory as possible for the task-at-hand. It is, of course, possible and even perhaps likely that researchers would eventually identify some of these avenues of inquiry, but the contention of this paper is that an integrative model can facilitate and speed-up the process, and

even perhaps stimulate ideas that would not have otherwise occurred to people.
Implications of This Model for Research on Practice

With respect to practice, there are numerous ways in which the MVP model can be applied. First, it is important to note that there are some fundamental differences between the use of theory in research and practice. For example, a goal of research is to find general principles and in order to do so, the typical paradigm of science is to vary the parameters of interest in a study and hold other potentially confounding parameters constant. However, this is not possible in practice. Solutions to problems or the introduction of innovations is done in actual settings where it is not possible to hold major components of the system constant. It is common in practice to have innovations or solutions, even when based on scientifically proven principles, fail or have only limited success because of unintended outcomes or uncontrollable obstacles.

Because of these multiple levels of interaction, system theory provides an effective approach to representing the phenomena under investigation. Both research and practice incorporate principles of system thinking. As Whitehead (1938) pointed out, “Connectedness is of the essence of all things of all types” (p. 13). He also said that, “It follows that in every consideration of a single fact there is the suppressed presupposition of the environmental coordination requisite for its existence” p. 13.) In any controlled study, there are presuppositions about conditions that can be held constant which, in the “real world” are not constant. This is commonly illustrated by many of the principles in Newtonian physics that presumed a frictionless universe. But it can also be illustrated by contemporary events such as unexpected side effects of medicines resulting from presuppositions that might not even have been evident during the development and initial testing of the drug. Even though both research and practice use system thinking, and both are concerned about inputs and outputs, the emphasis is different. In research the emphasis is more on identifying and controlling inputs (independent variables) while in practice the emphasis is more on anticipating and managing the effects of outputs. For example, with regard to practice, students may achieve mastery in job skill workshops but follow-up evaluations frequently show that the workers are not using their newly acquired skills. This could be for many reasons including lack of opportunity, lack of essential resources, conflicting demands on their time, or conflicting incentives. The lesson from this is that in practice, one must take a system-wide perspective and attempt to manage the effects of an intervention in one system with respect to its interactive influences with coordinate systems, subsystems, and suprasystems. When workers are expected to change their skills, then job definitions, incentives, resource supports, and even management procedures might have to be changed to accommodate and support the new skill sets.

In this regard, each of the major components of the MVP model can be viewed as a subsystem with multiple interactions with the other subsystems. It is common to introduce new instructional strategies or models of instruction into a course and they tend to be successful as long as they are being implemented by the advocate who created them, but they tend to die out when the advocate leaves or not succeed when other people try to use the approach. This can be because people other than the advocate understand the new approach only as a new instructional technique, which places it within the performance facilitating external inputs portion of the MVP. They might not consider changes that have to be made in techniques to motivate students, changes in volitional requirements, and scaffolding requirements to manage cognitive load. Why, then, one might ask, did the innovation succeed in the hands of the advocate, but not with others? The advocate might very well have been making the adjustments to the other subsystems, but without being consciously aware of it and not seeing these as essential parts of the intervention which he perceived to be strictly a new instructional strategy without a need to consider motivational, volitional, or information processing components. The same thing can happen in research (Rosenthal & Rosnow, 1969) where researchers are not able to reproduce the findings of the original studies but again, this tends to result from unintended influences of inputs rather than consequences of outputs.

Thus, the MVP model can be used as a tool for diagnosis and design. When there are problems in a learning system, the MVP model can guide a needs assessment to determine where the sources of the problem are located. For example, if students are not scoring well on a standardized test of mathematics, one can examine each input into this performance setting to identify potential causes. The problem could be due to a lack of ability on the part of the students, lack of volitional skills, lack of motivation due to boredom, irrelevance of the task, or lack of confidence, or cognitive overload. It could also be due to ineffective design in the learning environment, which falls under external inputs, or a lack of reinforcing consequences when the students do succeed. The benefit of the MVP model is that it facilitates a systematic examination of all these factors and then provides the basis for a coordinated set of improvements that take all the relevant factors into consideration. Its utility can also be expanded by integrating it with instructional design models such as the 4C/ID-model (Van Merriënboer, Jelsma, & Paas, 1992) which includes four major components that are presumed to be essential in building blueprints for complex learning, especially in regard to the components called “supportive information” and “just-in-time information.” By integrating motivational and volitional support systematically with instructional support, there is a much greater likelihood that students will maintain their persistence to succeed when trying to master the learning of complex cognitive skills. This type of coordinated process was demonstrated (Bickford, 1989) with the ARCS model in which audience analysis identifies what the specific motivational deficits are in a given situation, and then motivational strategies were prepared and integrated with the instructional strategies that resulted from the application of a systematic instructional design process.

CONCLUSION

The overall purpose of this paper was to present process-oriented model grounded in a system representation of a set of logical interfaces between several major theories and models pertaining to motivation, volition, learning, and performance. The focus has been on building a frame of reference for incorporating existing research and practices in an organized manner that facilitates efforts to move outside the boundaries of defined areas of research in order to study the relationships between and among these areas. Keller's macro-model of motivation, learning, and performance (1983) was retained to provide the initial structural and process frames of reference. Major modifications to the model consisted of the incorporation of the concepts of implementation intentions (Gollwitzer & Brandstätter, 1997) and action control (Kuhl, 1987). Both of these have their own history of theory and research and provide useful additions to the model. They also help provide a basis for studying and explaining the relationships between motivation and mental activities in working memory. To facilitate this set of understandings and relationships, Astleitner and Wiesner's (2004) integrated model of multimedia learning and motivation was incorporated into the present structure, but not without modification. They proposed the addition of sets of activities for mental resource management and motivational processing to Mayer's (2001) multimedia learning theory. In the present model, the motivational processing elements were incorporated in the motivational and volitional components of the MVP model, and they were supplemented by other motivational elements that help constitute a more holistic consideration of motivational factors. The result of this process is a frame of reference, as confirmed by early empirical studies, that has the potential for offering a more comprehensive explanation of the relationships among motivation, learning, and performance and supports continued theory building, empirical studies, and application strategy development and testing.

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