Motivating Active Learning: A Design Framework for Interest-Driven Learning

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Abstract

Interest is increasingly being recognized as an effective motivator for learning, however neither the constructivist learning environment design literature nor the motivation research literature directly address the challenges of designing interest-driven learning activities. In this paper, we present a design framework for the creation of learning activities that draw on interest as their primary source of motivation. This Interest-Driven Learning design framework is the embodiment of a theory that addresses two challenges to the large-scale implementation of interest-driven learning. These challenges are *coverage,* the difficulty of motivating the wide range of learning objectives valued by our educational system with interest, and *strength,* the variation over time and across learners of the motivational strength of interest in a particular topic or activity. The Interest-Driven Learning framework is based on a novel categorization of motivational constructs into interest and context-based motivators.

MOTIVATING ACTIVE LEARNING: A DESIGN FRAMEWORK FOR INTEREST-DRIVEN LEARNING

Common sense and cognitive theory concur: Interest and engagement lead to robust learning. Translating that recognition into clear principles for learning environment design is a complex problem. How can materials, teachers, peer groups, and activity structures be designed to capitalize on interest as a motivation to learn?

This question exposes a critical gap between the literature on the design of constructivist learning environments and the educational psychology literature on motivation. Recent research on constructivist learning environment design has argued for the motivational importance of authentic, interesting tasks and contexts (e.g., Blumenfeld, 1992; Cognition and Technology Group at Vanderbilt, 1992; Guthrie & Alao, 1997; Schank, Fano, Bell, & Jona, 1993/1994). The motivation research literature describes the value of the same kind of motivation in studies and in theoretical work regarding interest. However, neither literature specifically addresses the challenges of designing interest-driven learning activities, such as how to motivate learning objectives that do not appear to be interesting and how to deal with variations in interests across learners and across time. Historically, the motivation research literature has been descriptive, offering explanations of observed phenomena rather than principles for design. Where the literature has included design principles, these have been primarily targeted to the enhancement of traditional instructional approaches, rather than progressive or constructivist approaches[1]. On the other hand, the constructivist learning environment design literature offers guidelines for many elements of curriculum design, but has generally not drawn on the significant body of knowledge in the motivation literature.

In this paper we attempt to fill the gap between these two bodies of literature with an in-depth discussion of interest and motivation in the context of constructivist approaches to

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[1] There are some notable exceptions, such as (Guthrie & Alao, 1997) and (Blumenfeld, 1992). These have been important sources for our work.

learning environment design. If effective designs for interest-driven, active learning are to become widespread, the educational community needs research that bridges these two literatures by providing principles for the design of active learning that reflect the richness of the research on both learning and motivation. Our goal in this paper is to begin to create such a bridge in order to develop useful design strategies that take advantage of learner interest to motivate learning.

In this paper, we present a model for the design of learning activities that exploit the power of interest to motivate learning. We call this framework the *Interest-Driven Learning (IDL) Design Framework*. The IDL framework is designed to address two major challenges to the design of interest-driven learning. The first challenge is motivating the broad range of learning objectives that are valued in our educational systems, many of which do not appear to hold any interest to their intended audience. We call this the challenge of *coverage*. The IDL framework addresses the challenge of coverage through strategies for creating relevance for learning objectives. The second challenge is accommodating the variation in the motivational strength of interests among different individuals and within the same individual at different times. We call this the challenge of *strength*. The IDL framework addresses the challenge of strength through the use of a variety of types of motivation to supplement interest.

The IDL Framework is a design theory. It presents strategies for the design of activities that benefit from interest as a motivator for learning. This framework draws extensively from the existing literatures on motivation and the design of learning environments. It was created through an iterative process based on the research literature, an analysis of existing designs for interest-driven, active learning, and our own experiences in the design of learning environments.

We begin this paper by describing a core distinction essential to understanding the IDL framework, between aspects of learning environment design that connect with learner interest, and aspects of learning environment design that connect with other kinds of

motivation. In the following section, we elaborate upon our understanding of particular aspects of motivation, or motivational "constructs," as they are termed. In the third section, we describe central challenges in using interest in learning environment design, and strategies for addressing those challenges. In the fourth section, we present an example of a learning environment design model (Author, 2000) that demonstrates strategies for designing interest-driven learning activities. In our final section, we lay out an agenda for empirical research on interest-driven learning.

INTEREST-BASED VERSUS CONTEXT-BASED MOTIVATION

The IDL framework incorporates a taxonomy of motivational constructs. At the top level, this taxonomy distinguishes between two major categories of motivational constructs. As the name implies, the Interest-Driven Learning framework emphasizes learner interest as the motivator of learning. Therefore, interest is the first of two high-level categories in the taxonomy. The second category is context-based motivation. This distinction is based on the focus of the motivation. The distinction between the two focuses on which elements of a learning environment relate to each kind of motivation. Interest is focused on the "content" of a learning environment – the topics, objects, and activities with which the learner interacts. [2] Other forms of motivation, such as the desire for challenge, reward motivation, and a social sense of obligation, are focused the "context" of the learning environment – the structure of the learning environment (for example, work groupings, the degree to which the task is structured, the difficulty of the task). In the Interest-Driven Learning Framework, we

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[2] Our view of content differs slightly from the notion of content involved in recent discussions among motivation researchers regarding content and interest, beginning in Europe in the last decade (Nenniger, 1992). In Nenniger's language, "content" refers to the knowledge and skills students are expected to learn (we would call these the learning objectives). In our framework, while the object of interest might very well be identified with set of learning objectives, the defining characteristic of content is that students would view it as being what the task is "about." For example, in an investigative science project regarding lions, the content has to do with lions, though the most important learning objectives may be about scientific investigation. By using the term "content" as we do, we have a language for talking about the design of tasks from a student interest perspective. This also allows us to explicitly consider content outside the traditional school domains as appropriate for learning environments

call these forms of motivation *context-based* motivation. This categorization differs from those that appear in the motivation literature, such as, intrinsic versus extrinsic, or performance versus achievement. We do not dispute the validity or value of these prior categorizations -- in fact, our taxonomy is built from such prior work. We developed this taxonomy to serve a specific use, the design of learning activities that benefit from interest motivation. The framework therefore organizes motivational constructs according to the role they can play in the design of interest-driven learning.

In the remainder of this section, we provide an overview of our categories of interest and context motivation. We begin with a characterization of interest, including its benefits for learning and its practical limitations for design. We then describe key categories of context motivation and how they can interact with specific attributes of learning environments.

Interest

The study of interest and learning has a history that dates back to Dewey (1913) and beyond[3]. Historically, the term *interest* has been used to describe a range of intrinsic motivations. In recent research, two key frames of reference with respect to interest have emerged: individual (personal) interest, and situational interest (e.g., Hidi, 1990; Krapp, 1999; Schiefele, 1991; Todt & Schreiber, 1998). The individual interest perspective describes interest as a personal trait, an attraction emerging from experience, carried with the individual into different settings. Situational interest is shorter term. It emerges from the situation, rather than the history of the individual (Hidi, 1990; Krapp, Hidi, & Renninger, 1992; Mitchell, 1993). Using either frame of reference, interest results when an activity or topic has what Dewey (1913) called *identification* and what Blumenfeld (1992) calls *meaning* for an individual. Interest is an intrinsic motivator in the sense that engaging in an activity that is the subject of an interest is inherently satisfying and requires no additional reward. While researchers have developed many different ways to characterize the factors

[3] See Schiefele (Schiefele, 1996) and Hidi (Hidi, 1990) for summaries of this history.

that contribute to interest, they describe similar effects once interest develops: Interest creates the inclination to attend to certain stimuli, to engage in certain activities, and to acquire specific knowledge or skills.

The IDL framework looks at motivational constructs from a design perspective. Interest, in its connection with objects and stimuli, can be used in learning environment design to shape the set of objects learners interact with and the specific activities they undertake. Children's interests in objects such as dinosaurs, and actions such as photography, can become the focus of learning activities.

Interest as an Implicit Motivation to Learn

When a learner sees a learning activity as engaging or serving an interest, we describe that activity as being motivated by interest. For the purposes of the IDL framework, the most important aspect of interest is that it carries an implicit motivation to learn, over and above motivation to engage in an activity. When people derive satisfaction from engaging with a topic or activity, they naturally to want to learn more about the topic or to increase their skills at the activity. While their desire to learn might not be explicitly named as such, people are naturally motivated to participate in activities that will enhance their ability to engage that interest. As Renninger (2000) says, "People working with individual interests are motivated learners, in the sense that their activity appears purposeful, sustained, and ever-deepening…. People do not really need to make a choice to learn subject matter that is of individual interest to them; choice in this instance is largely an effortless process" (p. 19). Dewey (1913) describes this implicit motivation to learn in terms of identification:

> The genuine principle of interest is the principle of the recognized identity of the fact to be learned or the action proposed with the growing self; that it lies in the direction of the agent's own growth, and is, therefore, *imperiously demanded if the agent is to be himself*. (p. 7, emphasis added.)

Interest is connected with two forms of satisfaction from learning activities that engage an interest: the immediate satisfaction of engaging with the interest, and the long-term benefit of new skills and knowledge that will enhance self development as well as ability to experience the interest more deeply in the future.

The Benefits of Interest as a Motivator for Learning

The IDL Framework is designed to take advantage of the unique benefits of interest as a motivator for learning. Prior research has described three benefits of interest in comparison to other sources of motivation: Association with a mastery orientation toward learning, increased persistence and effort, and more richly and strongly connected knowledge.

Mastery goal orientation. As Schiefele (1991) has observed, interest leads to a mastery goal orientation When learners are motivated by interest, they are motivated by the intrinsic reward of having knowledge that they recognize will be useful to them. When a learner perceives that certain knowledge or skills are useful to the pursuit of an interest, he or she is drawn to *master* the knowledge or skills, not just to *demonstrate* them. In other words, a learner motivated by interest possesses a natural mastery orientation toward learning[4]. This contrasts with the performance goal orientation that results from sources of motivation in which the perceived value is achievement or recognition. Researchers have accumulated a considerable body of evidence showing the positive impact of a mastery goal orientation on learning outcomes (Ames, 1992; Dweck, 1986; Lepper, 1988; Meece, 1991).

Persistence and effort. Research has shown that when a student has interest in a task, he or she is likely to expend more effort and persist longer at that task. Interest has been shown to lead to more persistent motivation and greater effort in a range of learning tasks. (Hannover, 1998; Nenniger, 1987; Schiefele, 1991; Schiefele, Wild, & Winteler, 1995;

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[4] Research on mastery versus performance orientation has considered mastery orientation as resulting either from a relatively stable disposition of the learner toward certain kinds of activities (e.g., (Dweck, 1986)) or from the nature of the learning context (e.g., (Ames, 1992; Blumenfeld, 1992; Meece, 1991). Both are important determinants of a learner's goal orientation. We wish additionally to goal is to highlight the role that the content can play in influencing a learner's orientation.

Wade, 1992). In a review of the research on interest and learning in reading, Hidi (1990) cites a wide range of experiments showing the positive impact of interest on engagement, attention, and learning outcomes.

More richly and strongly connected knowledge. Individual interest, in particular, carries an important cognitive benefit for learning because people have rich knowledge structures to build upon in their areas of interest. Renninger (2000) describes this as the "stored knowledge" component of an individual interest. These knowledge structures are the result of their prior experiences that both led to the development of the interest and resulted from pursuing the interest. These elaborated knowledge structures offer the opportunity for rich connections between new and prior knowledge. Studies by Schiefele (1991) and Alexander *et al*. (1995), have demonstrated the benefits of high interest and high knowledge in text comprehension and retention. The enduring quality of individual interest also implies that new knowledge is likely to be reinforced by frequent use.

Limitations of Interest as a Motivator of Learning

The most radical view of interest, based on these benefits, would organize learning environments that are entirely responsive to individual learner interest, for example, as in free schools, where students define the curriculum as they so choose (Mercogliano, 1998; Neill & Lamb, 1996). This strategy faces serious obstacles as a practical approach to education. First, it requires rare levels of internal motivation on the part of children. Second, it provides no mechanism for promoting learning objectives even marginally outside of learners' interests. Finally, it requires an impractical level of flexibility in serving the divergent interests of individuals. These limitations need to be taken seriously, but we believe it is possible to create learning environments that take advantage of the benefits of interest while addressing the obstacles, as we describe in Section 3.

Context motivation

The IDL framework distinguishes interest motivation, which is elicited by the content of an activity, from context motivation, which is elicited by an activity's structure and circumstances. Because these forms of motivation arise from different aspects of a learning activity, they can combine to increase the overall level of motivation. For example, a learner interested in photography might also be motivated by a sense of challenge in trying to capture a certain quality of light in a photograph. A learner interested in dinosaurs might also be motivated by an experience of control in having the option to choose dinosaurs as a topic for a research project. In these examples, challenge and control serve as context motivators operating in concert with interest. Context motivators can also operate independently of interest, as in cases where students are induced by extrinsic rewards to participate in learning activities. And, if not carefully addressed in learning environment design, context motivators can operate to thwart interest. For example, if our budding photographer were to be consistently required to work on photography projects that she perceived as too difficult or insultingly easy for her skill level, she might become less interested over time. A further risk is that context motivation, even when it supports work on interest-based activities, can shift learner's focus away from important content. For example, a learner motivated by the challenge of a debate competition might expend more energy playing to the judges than understanding the substance of the argument at hand. Therefore, interest and context motivation must be kept in an appropriate balance in the design of learning activities.

For the purposes of the IDL framework, we have developed a taxonomy of nine context motivators in four categories(Table 1). The categories of context motivation are *effectiveness, progress, social context*, and *extrinsic*. We describe these motivational constructs and their role in the design of interest-driven learning in more detail in the next section.

Table 1. The context motivators.

Context Motivator	Description
Effectiveness	Motivation resulting from activities that enhance a learner's perception of personal effectiveness.
Challenge	Motivation resulting from activities with an appropriate level of difficulty
Control	Motivation resulting from activities with an appropriate level of structure and choice.
Progress	Motivation resulting from progress through a sequence of activities.
Completion	Motivation to complete a task.
Investment	Motivation resulting from time or effort already expended on a task.
Social	Motivation resulting from the social context in which an activity takes place.
Role	Motivation to play a desirable social role in an activity.
Affiliation	Motivation to be a member of a desirable social group.
Obligation	Motivation to fulfill a perceived obligation to others.
Extrinsic	Motivation to receive a benefit that is not integral to the task or activity.
Reward	The motivation to receive a token with real value.
Advancement	The motivation to become eligible for a new opportunity.

DESIGN OF INTEREST-DRIVEN LEARNING

In this section, we turn to design. Building on the motivational constructs described in the previous section, we present strategies for designing learning activities that benefit from interest motivation. In brief, the Interest-Driven Learning approach asks designers to identify or elicit learner interests, and to design activities around those interests that will lead to learning. Clearly, this is easier said than done. Two major challenges arise: First, some learning objectives might be difficult to cover using learner interest alone —the challenge of coverage. Second, the level of interest, and therefore its motivational power, varies across individuals and changes over time. Learner motivation must be maintained in spite of this variability of interest—the challenge of strength. The IDL framework uses strategies for

extending interest through relevance to address the challenge of coverage and uses context motivators to initiate and maintain motivation to address the challenge of strength.

In the remainder of this section, we describe the design strategies of the Interest-Driven Learning framework. We begin by describing some sources of learner interest and strategies for eliciting interest. We then describe the challenges of coverage and strength in more detail. Finally, we explain strategies for exploiting interests and context-based motives in design.

Connecting to Learner Interests

Our goal is to foster the design of learning environments that focus on interest. In order to create this focus, designers must either connect with existing learner interests or create situations that elicit learner interest.

Sources of learner interest

The specific interests of individuals are largely determined by their abilities, environments, and social contexts (Deci, 1992; Todt & Schreiber, 1998). We look upon interests as providing the opportunity to experience a natural sense of satisfaction—what would be called its value in expectancy-value theory (Atkinson & Birch, 1974; Eccles, Barber, Updegraff, & O'Brien, 1998; McClelland, Akinson, Cleark, & Lowell, 1953; Wigfield & Eccles, 2000). The expectancy value model describes task utility, importance, and intrinsic interest. We see utility and importance, as well as concern about personal or global events, personal identity, and curiosity as deeply intertwined with interest – in fact, we see these as potential sources of interest, and therefore, as a basis for identifying learners' interests. In the IDL framework, we describe five sources of satisfaction in interest: pleasure, concern, identity affirmation, life goals, and satisfaction of curiosity. These sources of satisfaction provide insight into the potential interests of learners that designers can draw on.

Pleasure. Engaging with certain topics and activities provides people with a combination of sensational, aesthetic, or intellectual satisfaction.[5] Hobbies, for example, are typically motivated by pleasure. An individual who is interested in photography sees opportunities to practice photography and learn photographic skills as opportunities to experience pleasure in the moment and to enhance future pleasure.

Concern. People value activities and outcomes that they feel are important for emotional, moral, or spiritual reasons, whether or not they result in pleasure. For example, some people are concerned about the natural environment because they feel that its preservation has some important abstract value, independent of its direct impact on them. The value associated with concern might be a moral value, such as a sense of responsibility to future generations; it might be an emotional value, such as an attachment to certain aspects of the environment; or it might be a spiritual value, such as a belief in the spiritual interconnectedness of nature. In all of these cases, the concern creates an interest in the topic of the natural environment and in activities that contribute to its preservation.

Identity affirmation. Identity formation is an important element of the human development process. People have a universal need to establish and reaffirm their own self-image. Therefore, they have an implicit interest in activities that allow them to form and reinforce their individual identities (Eccles et al., 1983; Fivush, 1998; Hannover, 1998). Thus, for example, a Native American might have an interest in participating in and learning about traditional tribal practices because he or she views these activities as being central to the development of a Native American identity. The Chicago Public Schools offers an Indian Studies program for Native American students that is designed to draw on this motivation. Creative activities, and activities in which people are able to express themselves often carry interest for individuals because creative and expressive tasks provide an opportunity to affirm their identity.

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[5] We also include "guilty pleasures", such as the attraction to experiences that provoke fear or revulsion, in

Life goals. Other potential sources of learner interests are based in learners' developmental needs and life-goals. People have needs and desires associated with improving how they function in the world. These can lead to an interest in knowledge and skills that they recognize as preparing them to function more effectively or comfortably (Eccles et al., 1998; Hannover, 1998; Prenzel, Kramer, & Dreschel, 1998). For example, children can become interested in learning to read when they realize that reading will enable them to function more independently. Individuals of all ages have an enduring interest in understanding the social systems to which they belong. For instance, adolescents may become interested in the social groupings and hierarchies in their school and workplaces in part because understanding the dynamics of these social systems will enable them to function more effectively within them. Interests based in these kinds of needs may be very powerful – consider the time spent by teenagers on learning to interact with potential romantic partners!

Using sources of interest in design

Signs of pleasure in, concern about, or identification with certain content are keys to discovering learners' interests. In addition, considerations such as group membership and developmental stage can indicate interests – for example, many children develop strong interests in particular genres of popular culture and music. Interests based in these sources can be used immediately in learning environment design: a classroom with many students who like photography, or care about the environment, or are Native American-identified, or are pre-professionals presents a powerful site for learning activities based in connected content. Activity design can capitalize directly on the interests of these learners, using those interests to drive work on related learning objectives.

In addition to meeting existing learner interests, learning environments can offer opportunities to expand interests: potential interests can be awakened under the appropriate circumstances. For instance, a child who takes pleasure in athletics is likely to be interested

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this category.

in learning about a new sport. A photographer might be guided toward an interest in videography. Someone with a strong interest in their own cultural identity might become intrigued by similar cultures.

Eliciting learner interest

The previous section described sources of existing interests that can be used to identify existing or potential long-term interests. A second strategy for exploiting the power of interest-based motivation in the learning environment is to elicit situational interest. Situational interest challenges the distinction in the IDL framework between interest and context-based motivations because it has aspects of both categories. Like enduring interest, situational interest is focused on the content of a learning environment. Like a context motivator, however, it is bounded by the learning context. In the IDL framework, we call interest elicited within a learning environment *curiosity*.

Curiosity arises when learners are confronted by unexpected gaps in their understanding or ability. In order to elicit curiosity, a designer creates a situation in which the learner's expectations are violated by their observations or experience (Schank, 1982). According to Berlyne (Berlyne, 1966), the expectation-violation must be optimally discrepant to trigger learning. That is, the gap between the learner's prior understanding and the current observation should be great enough to matter to the learner but small enough that he or she feels capable of resolving it. The biggest challenge in the design of activities that elicit curiosity is making sure that the learners have expectations that will lead them to recognize the situation as discrepant. This requires that the design be matched to the state of the learner's current knowledge and that the situation be set up to activate that knowledge.

We have seen two strategies in common educational practice that are valuable for eliciting curiosity. The first is the science demonstration. In a typical demonstration the teacher shows a scientific phenomenon that violates the expectations of the students, with

the goal of triggering questions and leading them to seek explanations. In many cases, the teacher will first ask students to make predictions about what will happen, in order to encourage them to form explicit expectations. A second strategy for eliciting curiosity is to ask students to articulate their current conceptions about a topic as an introduction to learning activities on that topic. Students' articulation of prior conceptions has been recognized for its cognitive benefits because it helps students to activate relevant knowledge, identify gaps and inconsistencies in their knowledge, and connect new learning to prior knowledge (Hunt & Minstrell, 1994). The articulation of prior conceptions exposes knowledge gaps that create curiosity -- the motivation to address the gaps. Asking learners to articulate their current conceptions elicits curiosity without requiring an external discrepant event. In fact, the difficulty in adequately describing or explaining a complex phenomenon becomes the discrepant event.

Author and colleagues have created such an articulation activity as part of a unit on climate. In this activity students are asked to draw a color map showing their best guess of the average temperatures around the world in a particular month of the year (Author, 1999). The task enables students to apply their existing knowledge about climate, but also leads them to confront the limits of that knowledge. The activity has proven effective for a wide range of students in triggering questions and creating curiosity about temperature processes.

Facing the coverage problem: Establishing Relevance

As designers, we can tap into the sources of learner interest. We can also elicit interest, particularly situational interest, by exposing children to surprising circumstances that make them curious. Understanding the particular interests of students in context permits the design of activities that are deeply motivating for learners. Significant design problems remain, however: How can we ensure that the interest-focused work offered to learners also addresses important learning objectives? In other words, how can we provide *coverage*?

Children's interests can be broad, but not sufficiently broad to directly encompass all of the learning objectives adults see as important for children to learn. The challenge of coverage is the challenge of broadening the scope of learner interests to topics and skills that students and teachers might not recognize as being interest-related. The IDL framework uses a design strategy of *establishing relevance* to address this challenge. In the context of the IDL Framework, *relevance* describes a specific type of connection between a learning objective and an interest: a learning objective becomes relevant to a learner when he or she recognizes that mastering the objective is useful to the pursuit of an interest. Dewey (1913) described this kind of indirect interest:

> Things indifferent or even repulsive in themselves often become of interest because of assuming relationships and connections of which we were previously unaware. Many a student, of so-called practical make-up, has found mathematical theory, once repellent, lit up by great attractiveness after studying some form of engineering in which this theory was a necessary tool. (p. 22)

A designer establishes relevance for a learning objective by designing an activity that is motivated by interest and that makes the mastery of that objective instrumental to success in the activity. Consider a student who is not interested in writing but who has a strong interest in music. A set of activities in which the student writes song lyrics would make writing relevant to that student's interest in music. The songwriting activities would be motivated by the learner's interest in music, and they create a setting in which the student recognizes writing as a useful skill for the interest. Establishing relevance creates a direct connection between the interest and the learning objectives. It extends the interest to cover the learning objectives, bringing a mastery orientation and the other benefits of interests to those objectives.

A number of recent research efforts in the design of active learning have incorporated strategies for establishing relevance as central elements of their design approaches. These approaches include Goal-based Scenarios (Schank et al., 1993/1994), Anchored Instruction (Cognition and Technology Group at Vanderbilt, 1992), Concept Oriented Reading

Instruction (Guthrie & Alao, 1997) and Project-based Science (Blumenfeld et al., 1991; Krajcik, Czerniak, & Berger, 1999). For example, project-based science establishes relevance by designing science investigations around driving questions that have "meaning and value" to learners (Blumenfeld et al., 1991). Consider, *What is the Air Like in Our Community* (Singer, 2000), a project-based science unit developed through a collaboration between the University of Michigan and the Detroit Public Schools. This unit is designed to capitalize on learners' concern for the welfare of their own community. In it, students conduct an investigation of the air quality in their community. This work requires them to develop inquiry and data analysis skills and to learn about the chemistry of air and its impact on the health of people and other living things. The design of the unit makes these skills and knowledge useful to the students in the context of their concern. In other words, the activity is designed to establish relevance for the students.

While many aspects of their design models differ, all of these innovative approaches to active learning incorporate strategies for establishing relevance -- making learning objectives instrumental to learners' interests. For example, Goal-Based Scenarios (GBS) establish relevance by providing a learner with a role in a simulation. The role is designed to draw on an interest of the learner, and the simulation requires that the learner master the learning objectives in order to succeed in the role. Anchored Instruction creates relevance by establishing concern for the problems of a character in a fictitious story. Drawing on learners' identification with that character, anchored instruction engages them in solving the problems faced by the character, problems which require the mastery of the designers' learning objectives. Concept Oriented Reading Instruction (CORI) creates relevance for reading skills by incorporating interesting themes as topics for open-ended research. In CORI, pursuing themes, such as animal adaptation, creates a need to master the designers' learning objectives, e.g., finding relevant books, reading, and taking notes.

As these examples show, in establishing relevance a designer uses an activity or topic that is already motivated by interest to generate a demand for the target learning objectives.

In some cases, the designer may design an activity around an interest that he or she selects in advance based on knowledge of the learners' interests. In others, the designer can design an activity in such a way that the learners are each able to bring their own interest to the activity. For both approaches there are two conditions that must be met to establish relevance: (1) the learning objectives must be useful to the interest in the context of the activity, and (2) this usefulness must be apparent to the learner. It is not necessary for the learner to recognize the learning objectives explicitly. However, it is essential that the activity be motivated by interest and that the need to develop additional skills or knowledge be natural and coherent within that activity. When these conditions are met, interest and its benefits for learning extend to the learning objectives that are nested within the activity.

Challenges to the Establishment of Relevance

Through our experiences with conducting and teaching design, we have identified three potential pitfalls for establishing relevance. They are misalignment, missed relevance, and unfulfilled interest.

Misalignment. Misalignment occurs when the learner's interest, the activities, and the learning objectives do not connect effectively. There are two possible locations for such a breakdown: Either the interest does not motivate the activities, or the activities do not lead to mastery of the learning objectives. Misalignment between interests and activities occurs when the activities do not effectively engage the interest, even though the interest may be compelling. For example in an analysis of mistakes made by novice designers of goal-based scenarios, Adam Neaman [6]describes a software program designed to teach trigonometry, in which the student is offered the opportunity to play the role of an airplane pilot. The student's task in the simulation is to file a flight plan and calculate fuel requirements. While these are certainly authentic tasks of pilots. Unfortunately, in this

particular software, the learner never gets to "fly," and so there is no link between the learning objectives (trigonometry) and the learners' interest in flying a plane.

Misalignment between activities and learning objectives occurs when it is possible to successfully complete the activities without mastering the learning objectives or when achieving the learning objectives is not a natural or intrinsic requirement of the activities. In situations where it is possible to complete the activities without achieving the objectives, the activities may in fact require significant learning, but not the learning that the designer had targeted. In a second problematic program described by Neaman, the student played the role of an engineer building a rail line from one city to another. While the program was designed to teach geography, the students' primary task was solving engineering problems that did not require any knowledge of geography.

Missed relevance. Establishing relevance requires that the learner perceive the connection between the learning activities and the interest. Missed relevance occurs in two situations: when the designer fails to make the connection apparent between the activities and students' interests initially, or when students lose sight of the connection over the course of the activities. To deal with the initial establishment of relevance, designers must often create lead-in activities with the specific goal of establishing relevance. For example, in a 10-week curriculum on global warming designed by Author and others (Author, 1999), the first week of activities is devoted to creating concern among the students about the potential implications of global warming and to setting up a role-play in which students serve as science advisors for leaders of countries who must develop strategies for dealing with the global warming threat. To prevent students from losing track of the relevance during extended activity sequences, designers must include activities that reinforce or remind students of the connection between the activities and the motivating interest. For example, the 10-week global warming curriculum includes frequent activities and elements of

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[6] Personal Communication

activities that are designed to highlight the relationship between the individual tasks students are performing and their role as science advisors on global warming policy.

Unfulfilled Interest. In the process of establishing relevance, a designer makes an implicit promise to the learner. The promise is that the activities will enable the learner to engage the motivating interest in a meaningful and satisfying way. Unfulfilled interest happens when the designer succeeds in motivating the learner to engage in the activities based on the perceived connection to interest, but then fails to satisfy the interest in some significant way. A good example of this pitfall is the XXX system (Author, 1998). XXX was a computer-based system that invited students to create their own animal on the computer. In the interaction, the program engaged the student in a dialogue about how the new animal would survive. Students found the idea of creating their own animal to be very appealing , and they found the dialogue to be relevant in the context of their interest in creating an animal, but they were disappointed when they found out that there was nothing else beside the dialogue. To satisfy their interest, XXX should have allowed them to construct their animal in some graphical form and observe its simulated behavior. Instead, it left students' interests unfulfilled. Riesbeck (1998) describes one form of unfulfilled interest that is particular to computer software: he terms it "the pitfall of the simulated sundae." As he points out, students' desire to have an ice cream sundae is not fulfilled by the opportunity to have a computer-simulated sundae!

Facing the strength problem: Supporting Interest with Context Motivation

Strength problems occur when a learner's interest is not strong enough to drive deep engagement in activities, at least not with sufficient effort or attention to achieve the intended learning objectives. Strength problems can take three different forms, problems of perception, fluctuation, or unpleasantness. In a perception problem, the relevance of a set of activities to an interest may not be apparent until a learner has partially completed them. For example, a physics curriculum designed to capitalize on learners' interests in architecture

and construction might require that learners develop a significant amount of physics knowledge up front. However, the value of the physics learning to the interest-driven architecture activities may not be apparent to the learners until they have learned a good deal of physics. Here, because of the perception problem, relevance and interest may not be strong enough to motivate the activities necessary to learn the physics.

Fluctuation problems are the result of the natural variation in learners' levels of interest over time. For example, young students working on a project that will culminate in a public performance several months in the future may lose some of their interest after a few weeks, only to regain it later. The problem of unpleasantness occurs in tasks that, even when motivated by interest, may have some aversive aspect that interferes with the interest. Certain activities may be difficult, may require repetition, or may require a student to participate in an undesired social grouping.

The IDL framework addresses the strength problem by supplementing interest motivation with context motivators. Context motivators can support interest in two ways: through *initiation* and through *maintenance* of motivation. Context motivators can be used to *initiate* learners' engagement in an activity that is not readily recognized as relevant to interest. For example, when a teacher is concerned that the relevance of a set of activities may take a while to become clear, she may arrange the classroom structures to provide additional social motivation that will help to engage students until the relevance is established. To follow the physics example above, the relevance of trajectory calculations might be initiated by a catapult construction competition. Here two context motivators, challenge and social role motivation, act as initiators until the real value of understanding trajectory becomes apparent to the learner.

Maintenance addresses the problems of interest fluctuation and necessary but aversive activities. Context motivation can be used to support interest in these moments. For example, in an extended activity, interest might be expected to drop at some point. A

designer might use deadlines to tap into a learner's sense of investment and anticipation of completion, providing enough of supplementary progress motivation to maintain the learner's engagement.

To illustrate the use of context motivation for initiation and maintenance, we use a representation that we call a motivation strength graph, describing motivation of a particular learner over a particular activity or set of activities (Figure 1 and Figure 2). The idea behind a strength graph is that at any particular time, a learning activity requires a certain amount of effort and attention from a learner if he or she is to be engaged enough to learn from it. Before a learner will expend this level of effort he or she must have a sufficient amount of motivation, which we call the *motivational threshold* for the activity[7]. If the learner's motivation to engage in that activity exceeds the motivational threshold, then the learner will engage; otherwise, the learner will not. Figure 1 shows simplified strength graphs for a single activity in which the interest and motivation threshold remain constant. In Figure 1a, interest is sufficient to meet the motivational threshold. In figure 1b, a strength problem, interest motivation fails to reach the motivational threshold of an activity at a particular point in time[8] (Figure 1b). Figure 1c shows the same strength graph for an activity that uses context-based motivation to raise learner engagement above the threshold.

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[7] The threshold in a strength graph only describes the strength of motivation required, not the nature of that motivation. It assumes that the motivation is directed appropriately for engaging an individual, not just in the activity, but in learning from the activity.

[8] The axes on these graphs are deliberately un-numbered – we do not wish to claim that motivation level or motivation threshold are measurable in any objective sense

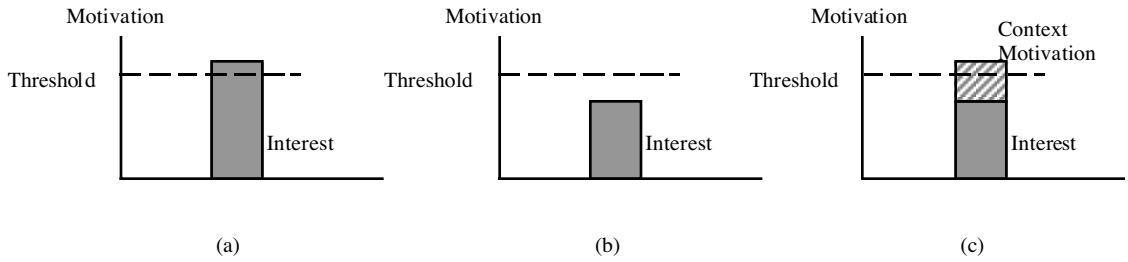

Figure 1. A simple motivation strength graph representing a moment in the experience of a learner who manifests: (a) sufficient interest for an activity's motivation threshold, (b) insufficient interest (a strength problem), and (c) insufficient interest supplemented by context motivation.

The graph in Figure 1 is simplified. Real-world learning is spread across a sequence of activities with different motivation thresholds. At the same time that the threshold is varying, the strength of a learner's interest may fluctuate. Figure 2 depicts a strength graph for a more complex situation in which context motivation is being used for both initiation and maintenance.

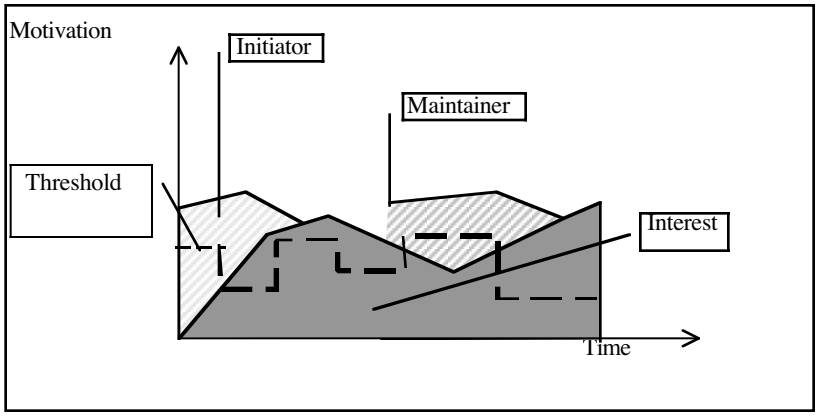

Figure 2. A strength graph showing context motivation used as an initiator and maintainer in support of interest.

At the beginning of the sequence depicted in Figure 2, relevance has not yet been established, so the interest motivation is insufficient. To compensate, an initiator is being used to provide supplementary motivation until the interest exceeds the activity threshold by itself. Later in the sequence, the interest wanes, and a maintainer provides additional motivation until the interest once again becomes strong enough to motivate the activities alone.

As we mentioned previously, the use of context motivators to initiate or maintain interest carries with it certain risks. Even while maintaining student engagement, context motivation may reduce the focus on learning because it does not carry the mastery orientation that interest motivation does. Therefore, context motivation must be kept in balance, so that it does not undermine the motivation to learn that interest provides. In Figure 2, context motivation plays a large role in motivating the activity at times, but interest is the main motivator overall.

Using specific context-based motivations

We turn now to specific strategies for using context motivation to support interest. Context motivation encompasses both intrinsic and extrinsic sources of motivation. There is already an enormous literature describing the different forms of non-interest-based motivation, and we do not presume to add to that literature. Our goal instead, is to synthesize that literature in a way that supports the design of interest-driven learning. The taxonomy that we present in this section is one that we have employed in our own design efforts in the course of our research on the design of interest-driven learning. We focus on four categories of context motivation: Effectiveness, progress, social context, and reinforcement (Table 1).

Effectiveness

Research has shown that activities that enhance an individual's sense of competence and influence over the world around him are motivating (deCharms, 1984; Deci & Ryan, 1992;

Harter, 1992; White, 1959). In the IDL Framework, we divide effectiveness motivation into two constructs called *challenge* and *control*.

Challenge.

The level of challenge a learner experiences in a particular activity can be represented by a scale, one end denoting the perception that the activity is "too easy," and the other the perception that the activity is "too hard." In the middle falls a range that is perceived as challenging – difficult enough to require attention and effort, but not so difficult as to be intimidating. Activities in this range, successfully completed, enhance the learner's sense of self-efficacy (Bandura, 1977).

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too easy challenging too hard

Each learner presents an idiosyncratic scale, and often that scale differs from activity to activity: Some scales might be narrow, and some broad. An over-confident learner might present a scale with an infinitely distant high end – no task would ever be perceived as too hard, even when such a perception would be appropriate. A traumatized learner's scale might present nothing but the high end (Dweck & Goetz, 1978).[9]

The ideal learning environment design would take into account each learner's self-perception of competence. Teachers and learners would collaboratively select activities that fell into the challenging range for each students (or that help to develop an appropriate range for those students with neurotic perceptions). This kind of intimacy with individual students is difficult to arrange in large classes. A more generalized design strategy is to

[9] For learners whose challenge motivation is determined by a mis-placed self-perception of competence, the kinds of activities that are challenging in a motivational sense may not lead to learning – these activities are too simplistic or too complex from a cognitive point of view (Brophy, 1983). Ideally, emphasis should be placed on re-tooling the self-perception, perhaps through the creation of surprising opportunities to display competence, or surprisingly difficult activities.

allow learners to self-identify activities and difficulty ranges that they find challenging. Or, a designer might create a sequence of activities that allows learners to move rapidly through easier tasks until they reach a motivating level of challenge. A less preferable alternative is to set a level of challenge that is acceptable, if not optimal, for the largest possible group of learners.

Feedback is an important component in the design of challenging activities. Feedback can be viewed as a way of helping learner to set their perceptions appropriately. Deci (1992, p. 57) cites numerous studies indicating that confidence-promoting information enhances and confidence-diminishing information reduces motivation. Brophy (1983) documents the power of teacher praise for providing feedback that enhances learner confidence. Another source of feedback can be the observation of peers. When a learner observes a peer engaged in a task, he can gather information about the difficulty of the task based on his understanding of the peer's competence relative to his own. These forms of feedback can enhance challenge motivation by increasing a learner's sense of competence, which can increase his comfort with difficulty. However, an over-reliance on comparison to others can establish a performance goal orientation and distract from the learning goals.

Control.

Like challenge, control motivation can also be represented by a scale. One end of this scale describes the perception that a task is overconstrained, and the other the perception that a task is underdefined. Activities that fall within the optimum range on this scale enhance a sense of personal causation (deCharms, 1984; Deci & Ryan, 1992)[10].

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[10] Deci (1992) cites numerous studies from both laboratory and classroom settings that show that providing learners with choices and other support for autonomy leads to higher intrinsic motivation and interest. DeCharms (1984) focuses on providing the right balance of structure and choice as enhancing *personal causation* and provides evidence that too much control can undermine motivation as effectively as too little.

rigid under personal control underdefined

As with challenge, desire for control differs across individuals. Some learners operate with a strong, specific internal set of goals that allow them to operate well in an open-ended environment. Other learners tend to operate more effectively in an environment that supplies some specific options, boundaries, and processes. Environments that offer too many or to few choices can be limiting. For instance, in the middle of summer vacation, children at home may become bored for lack of structure. Surrounded by opportunities (sports equipment, art supplies, media, books), they many not feel driven to take advantage of any of them. At the same time, school environments that offer children no options whatsoever tend to dampen engagement because they tend to diminish a learner's sense of an internal locus of control.

From a design point of view, control motivation is linked with the notion of scaffolding and fading support for learning (Brown, Collins, & Duguid, 1989) – providing effective scaffolding, and then fading that scaffolding away in a way that enhances a student's sense of control may enhance motivation as well as learning.

Designing for control, then, is a complex process of identifying appropriate locales for structure and for choice in the learning environment. Structure can be provided in design through materials, the organization of space and time, social structures, work structures, and in instruction. Structure can be explicit, as with written rules, or implicit, as when space is organized to foster certain kinds of work in certain places. Choice is provided through decision points, such as the decision whether or not to participate in learning activities, the choice of which activities to engage in, and decisions on meaningful characteristics of activities or products.

Control motivation can be used to enhance other forms of motivation by giving learners choices related to those motivators. For example, a learning environment that allows learners to pursue topics of their choosing can tap into control and relevance at the same

time. For example, a science teacher might allow students to select a phenomenon to study as long as they collect and analyze data in a structured way. The activity provides structure in the experimental procedure, and choice in the selection of research question, as well as an opportunity to incorporate an existing interest.

Progress

Closure and investment, the progress motivators, reflect forward- and backward-looking perspectives on progress. Closure motivation is the natural drive for completion. Investment is the motivation to continue with a task specifically because of the amount of time or resources that have already been expended.

Closure.

Closure motivation takes effect when the student perceives an upcoming milestone as being within reach. Such milestones represent proximal goals that have more power to motivate activity than more distant ones (Schunk, 1991). In this respect, closure is linked to challenge because the perceived difficulty of a task is an important determinant of how close a learner feels to completion. Opportunities for closure can be increased by breaking large tasks down into smaller ones, each of which offers a satisfying experience of completion. Since it takes longer to reach the point at which completion seems imminent, longer tasks benefit from closure motivation for a smaller percentage of the time than shorter tasks.

Closure motivation depends on having clear indicators of completion. Some tasks, such as the creation of tangible products, have natural indicators of completion. For example, when students are building a model, the model itself provides them with a natural sense of how close they are to finishing. In these activities, the state of the product is the indicator of progress. When the learner values the product because its serves a true interest, the product can unite relevance and closure motivation. When learners are engaged in a process that does not have a tangible product, a designer can encourage closure motivation by providing learners with feedback that lets them monitor how close they are to completion. For

example, elementary school teachers often post tables of checkmarks on their bulletin boards to provide their students with feedback on their progress toward completion.

Completion can be associated with an external reward. When a reward is perceived by the student as natural and appropriate to the task, then closure and reward can be a potent combination. On the other hand, if the reward is viewed as unrelated, arbitrary, or overly generous, it will undermine the intrinsic motivation. The same applies to punishments, such as deadlines. If the rewards or punishments seem inappropriate or perceived as controlling (Deci, 1992), they risk undermining the intrinsic motivation of closure. Closure can also be enhanced by control motivation when learners are given the opportunity to establish their own milestones.

Investment.

Investment motivation results from a sense of commitment on the part of a learner. Investment is a natural response to the expenditure of time and effort. Designers foster investment motivation by creating tasks that require significant effort. To use investment as a maintainer, a designer must build investment through the strategic sequencing of activities. By placing activities that are easily motivated toward the beginning of an extended set of learning activities, the designer can build investment that will help to sustain the learners' motivation through subsequent activities. By moving less easily motivated activities later in extended sequences, the designer can build investment motivation that will carry through those activities.

Investment motivation combines naturally with interest-driven motivation. Typically, the strength of interest-driven motivation is greatest at the beginning and end of a set of extended learning activities, when the interest is fresh in the minds of learners and when new knowledge and skills can start to be applied to the pursuit of the interest. Investment motivation can be a useful maintainer of motivation in the middle period because the learner's sense of investment begins to be significant during this time.

There are two prerequisites for establishing investment. First, the learner must feel that continuing with the task or tasks will be productive. If not— if, for example, the level of difficulty is too intimidating—then investment will not be capable of motivating effort that appears fruitless. Second, the investment must be based on actual expended effort. Progress is only an indirect indicator of a learner's sense of investment. If a learner is able to make progress with only a minimal expenditure of effort, he or she is not building an investment that will motivate subsequent effort.

Social context

The social context motivators—social role, affiliation, and obligation—arise in the interaction between group identity and individual identity. Social context motivation appeals to the human desire to understand and maintain social identity. These motivators arise in activities that require collaboration, reinforce a desirable social position, or lead to a desirable change in social position. A new role, a move to a new working group, the formation of a new friendship can all be sources of social context motivation. Designing for social context motivation requires an understanding of the particular social relationships among students and between students and teachers.

The models of apprenticeship learning of Brown, Collins, & Duguid (1989) and Lave and Wenger [, 1991 #132] provide intriguing examples of the potential interplay between interest and social context motivation. They portray apprenticeship learning as a process of enculturation into communities of practice. In traditional apprenticeship, the learner's interest in acquiring the skills and knowledge of the community of practice is likely rooted in his or her life goals.[11] In the apprenticeship process, this interest is supplemented and maintained by the apprentice's desire for affiliation with the community and sense of obligation to those members of the community who have contributed to his or her learning. Once the learner begins to enter the community through the process of legitimate peripheral

participation then social role motivation can become significant as the learner begins to focus on moving from apprentice status to full membership in the community. As this example shows, the social context motivators can be powerful as both initiators and maintainers of motivation.

Social Role

Social role motivation results when a learner has the opportunity to play a desirable role in a social network. It is based in the learner's understanding of what is expected of an individual in that role, both in terms of work and social relationships. When given the opportunity to take a social role that they find desirable, people are motivated to meet the expectations associated with that role. Designing for social role motivation means organizing activities around formal roles and enhancing existing informal roles. The structure of the learning environment should provide opportunities to take roles that combine social context motivation with challenge and control motivation.

Affiliation and obligation

Affiliation motivation, related to the motivational construct, "belongingness," (Ford, 1992) arises in collaborative activities, or in individual activities that take place in a communal setting. Affiliation motivation is based on a desire to identify with a particular group. In order to invoke affiliation motivation, groups need a coherent identity—a solid core membership, a personality, specific working intentions and habits, perhaps a name. One way to help groups define a coherent identity is to place them in opposition to other groups within a competitive model. When this happens, the group's shared interest in differentiating themselves from other groups provides additional motivation. Competition is not necessary for this form of enhanced group identity motivation to occur, however. Any

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[11] Assuming a context where apprentices enter the community by choice.

situation where the groups are able to develop and exercise identities as distinct from other groups can provide this motivation.

Obligation motivation arises when learners feel a sense of responsibility to the other members of a group. Obligation motivation builds on investment—the more effort that the participants put into a group, the greater the sense of obligation they feel toward that group. Affiliative groups that engage in substantive work tend to invoke obligation motivation in their members, provided that the group's work depends on contributions from each participant.

Extrinsic motivation

In the IDL Framework, we describe two forms of extrinsic motivation, *reward* and *advancement*. In both cases, the reward is extrinsic because the learner perceives it as an external incentive to perform a task rather than an inherent benefit of that task. For example, an "A" grade received for in writing a letter in French is an extrinsic reward[12]. In contrast, a reply to that letter from a francophone pen pal would not be an extrinsic reward, because it is a natural consequence of the task.

Reward

Rewards can be tangible (e.g., candy or money), or intangible (e.g., praise or grades). According to behaviorist theory, extrinsic rewards motivate activity through positive reinforcement. The value associated with positive reinforcement is pleasure in the reward itself, and, according to behaviorist theory, once they have been rewarded in this way learners can be expected to seek out opportunities for similar reward. In education, the use of reward has traditionally been based on the belief that if teachers reward performances that demonstrate the use of knowledge or skills, students will be motivated to acquire that knowledge or skill set.

Advancement

Advancement is the form of extrinsic motivation that results from tasks that open new opportunities for learners. Advancement is a very powerful element of motivation in traditional public schools, at least for those students with ambitions that rely on academic success. Many learners work hard in courses based simply on the goal of reaching the next level of achievement – for example, some math-averse students work very hard in math classes because they believe their math skills will be judged as part of the college admissions process. This reward is extrinsic advancement to the extent that students perceive doing well in high school math as a pre-requisite for college admissions, rather than as a useful skill.

Advancement is a close relative of interest based in life goals. The same high school activities that one student views as meaningless may be seen by another as valuable preparation for employment. Practically speaking, advancement and life goal interest are often involved together in the same activities.[13] While it is not necessary to tease them apart entirely, it is important to avoid too strong a reliance on advancement in the design of learning activities. Where life goal interest tends to help focus learners on important content (because they believe that content necessary to the work they care about), advancement motivation tends to focus learners on the reward. They learn only what is necessary to pass the test or earn the right grade, and may even reduce their interest in the content. Furthermore, many learners do not perceive advancement as sufficient reward to motivate work.

Concerns about Extrinsic Motivation

Extrinsic motivation is generally viewed with concern by proponents of active learning for two reasons. In numerous studies of the "hidden costs" of reward since the 1970's,

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[12] It is important to recognize that a good grade is only a reward to the extent that students perceive grades as incentives to achieve, as opposed to value-neutral assessments of their work.

researchers have demonstrated that reinforcement motivation can be counter-productive. Specifically, researchers found that in certain situations providing an extrinsic reward for tasks that people were already motivated to do, reduced their natural level of motivation to perform those tasks (Lepper & Greene, 1978). In other words extrinsic motivation undermined intrinsic motivation. One explanation for this effect is based on dissonance reduction, i.e., if a behavior requires a reward then it must not be as intrinsically motivating as it was originally perceived. (Deci, 1992) provides another explanation for this undermining of intrinsic motivation by extrinsic reward: learners perceive rewards as controlling, thereby reducing their sense of self-determination. Educators have long been aware that extrinsic rewards for learning can lead students to pursue behaviors that achieve the rewards most efficiently rather than achieving their desired learning objectives most effectively. Thus, if the performance measures associated with rewards are not aligned with the learning objectives, the reward structure will lead learners to focus on the performance measures, at the potential cost of the learning objectives.

A summary of the model

To summarize, the IDL framework consists of four phases (Table 2): Determining learner interest, linking activities with interest (either directly or through relevance), developing initiators where relevance may not be apparent, and developing maintainers where interest may flag.

Table 2. The Interest-Driven Learning Model for Design

Phase	Process
Determine learner interest	Expose or infer existing personal interests, or incite situational interest.
Link activities with learner interest	Use the interest to directly drive activity design.

[13] Eccles (1983) groups these kinds of motivations under the category of *utility*.

	Use relevance to expand the set of activities linked to the interest.
Initiate motivation	Where relevance is not apparent, use challenge, control, and social motives to initiate motivation.
Maintain motivation	When interest flags over extended time and effort, use progress, effectiveness, and social motives to maintain motivation.

In the next section, we provide an elaborated example of a learning environment methodology that uses the IDL framework.

AN EXAMPLE OF INTEREST-DRIVEN LEARNING: THE PASSION CURRICULUM APPROACH

Since 1994, one of the authors (Author) has been working on an approach to the design of interest-driven curricula, called the Passion Curriculum approach (Author, 2000). In this section, we present the Video Crew, an implemented passion curriculum in which students learn to produce their own videos, as an example of the constructs and strategies that make up the IDL framework we have described. We begin with overviews of the Video Crew and the Passion Curriculum approach, followed by a discussion of how the IDL constructs and design strategies were used in the design and implementation of the Video Crew.

A day in the life of the Video Crew

At 2:35 p.m., five minutes after the last school bell of the day, ten students from four different classrooms come pounding into the Video Crew half-trailer (a regular classroom during the day). The teacher speaks over the noise: "OK, no business meeting today. Keep in mind that we only have ten more working days before the film festival. You should be working on one of the videos you want to show there, or on certifications. Anita and

Loretta[14], you're working on planning the film festival, right? I need to see the plans before Anita leaves at 3:30. Novices, you need to get your joint piece done before the film festival. I'd like you to start by brainstorming some ideas for a video. Mentors, please be prepared to help the novices if they get stuck. Go to it, and let me know if you need any help."

Two students race to two of the three computers. One student begins work on an animation sequence, the other is designing a website for the Video Crew. Anita and Loretta ask for permission to work outside, and they head out the door. The four novices join together in a corner of the room and begin coming up with ideas for videos. An older student sits near them, quietly listening to their brainstorming process, occasionally prodding them to be more creative and less TV-based. Another student joins Anita and Loretta outside.

Still another student, Julie, wanders to the third computer, where she begins to play an arithmetic education game. The teacher walks over to her. "Julie, I thought you wanted to work on your camera certification." Julie has a video shoot planned for the weekend, and will need to borrow the camera. To earn the right to take the camera home overnight, she must complete her camera operator certification. She has just one task remaining: to organize her classmates to watch a one-minute interview video Julie shot on the previous day, and discuss the qualities that make that video better than a previous version.

"Why should I?" replies Julie, "I have to tell everybody about my video, and they won't listen to me." The task Julie is avoiding is designed to address, among other skills, capturing the attention of an audience. Julie has run up against an obstacle, and the strength of her interest, though considerable, is not sufficient to carry her through this activity.

The teacher says " No one has earned their camera certification yet."

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[14] All names are pseudonyms.

"No one?" asks Julie. "OK, I'm going to do it. Where's my notebook?" Julie's fears about the difficulty of organizing her classmates are overcome by the thrill of being the first to complete the camera certification.

"In the notebook box, where it always is."

Julie heads to the corner of the room to find her notebook, and then to another corner to find her videotape. By 3:45, she has captured the attention of five colleagues and is launching into a discussion of the qualities of her interview video, and why the shots she chose are better than those she rejected.

Passion Curriculum Structures

Passion curricula are designs for classrooms that create and sustain communities of learners focused on topics of deep interest. In the passion curriculum model, a classroom houses a group of students of various ages who have a deep interest (passion) about a particular theme. Each community is hosted by one or two adult leaders with expertise in teaching and in the domain of the theme. Activities in the curriculum provide opportunities for development toward academic, theme-based, and social learning objectives. Students select (or are guided) into the passion curriculum that best suits their deep interests[15]. Each passion curriculum is based in four key design elements that support motivation: interest-based themes, projects, certifications, and community life. Here, we briefly summarize these elements and describe their roles in supporting interest motivation. We spell out their use in supporting interest-driven learning in greater detail below.

Interest-based themes. Passion curricula are conducted in classroom communities organized around a theme of interest. The theme centers the learning environment on active learner interests—it provides a central focus for a community of interest and a basis for

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[15] Passion curriculum researchers intend ultimately to build a full-scale passion school, based entirely on the passion curriculum concept. Currently, the basic structures for passion curriculum design are in place, and researchers are developing principles for teaching in passion curricula. The passion curriculum approach was developed to meet two main goals: intellectual rigor and rich motivation. In this paper, we focus on

forms of work that learners enjoy in common. Ideally, learners engaged in passion curricula would choose their own classrooms based on interest in their themes. All activities in a passion curriculum are organized around its theme. In addition to serving learner's deep interests, themes for passion curricula must be rich and complex enough to support a full-scale learning environment. Some of the vast number of potential passion curriculum themes that have been discussed include dinosaurs, architecture, poetry, trucks, cooking, and video production.

Projects. Passion curriculum projects are significant works in the domain of the theme. These works must be clearly authentic in their connection with the learner's interests. In the Video Crew, for example, students create their own videos. Work on passion curriculum projects includes a brainstorming phase, a planning phase, a development phase, and a presentation phase. Each of these phases can be further elaborated by establishing them in the traditional language and work forms of the specific theme. In the Video Crew, the planning phase includes a storyboard and a treatment, both of which are elements of the planning phase in professional video production. Projects provide the central mechanism for interweaving interests with learning objectives (establishing relevance) and creating opportunities to pursue interests directly. Projects are structured to provide social context, effectiveness, and progress motivation in conjunction with interest motivation.

Certifications. In passion curricula, learners earn rights, responsibilities and titles through structures called certifications. Like driver's licenses, certifications denote expertise and official authorization, and provide learners with meaningful rights and responsibilities. Also like driver's licenses, they must be earned through demonstration of a specific set of abilities. Certification sheets present lists of tasks that are designed to embed important learning objectives in authentic work in the domain of the theme. For example, the Video Crew includes a Camera Operator certification, which requires completion of ten

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those elements of the passion curriculum approach that are directly related to the design of motivation in learning environments.

tasks which address a variety of learning objectives. The tenth task, "in writing, describe the camera choices in a TV news story (that is, explain why the camera operator chose to focus on what they focused on)," asks learners to work on writing, explanation, and photographic skills. Certifications are generally defined by designers or adult leaders, but learners may also propose certifications and certification tasks. Certifications must be structured and presented in such a way that learners clearly understand the connection between each certification and the theme of interest. Each certification includes tasks of a wide range of difficulty. Completing the required tasks represents a significant achievement. Through earning certifications, learners progress through levels of rank: novice, apprentice, mentor, director. Certifications provide opportunities to supplement relevance and interest with context motivation, particularly effectiveness and progress.

Community life. In order to provide opportunities to address social learning objectives, the passion curriculum design approach requires the learners to take responsibility for many aspects of social life in the classroom. The community life concept provides a mechanism for delivering ownership of the social experience in the curriculum—behavioral standards, communication with the outside world, and planning of special events—to the learners. Learners determine their own rules of behavior, to be revisited periodically as new student joins the community. They are responsible for conflict resolution, and planning of special events, including field trips and culminating activities. Much of the training of novices falls to the responsibility of more experienced students, through one-on-one mentor-apprentice relationships. Participating in and taking control of community life allows learners to translate their interest in social interactions into learning opportunities for important social interaction and organization skills. Community life also creates opportunities for social context motivation to enhance interest motivation. In the Video Crew, community life was centered around a daily meeting, a setting which formalized many of the community life responsibilities and provided opportunities for the teacher to model and scaffold these structured social processes.

The Video Crew Passion Curriculum

The *Video Crew* is a small-scale passion curriculum that has been implemented, evaluated, redesigned, and re-implemented in an urban public elementary school over a period of several years. Seven sixth-graders, two fourth-graders and one third-grader participated in the 1997-98 video crew. Reflecting the demographics of their neighborhood, these students came from varied backgrounds in terms of culture, nation of origin, socio-economic status, and academic performance measures. While the designers of the passion curriculum approach envision passion curricula replacing or being integrated into the normal school day, the Video Crew was implemented as an after-school program. Students attended Video Crew sessions after school two or three days a week and on Saturdays.

As its name suggests, the core theme of the Video Crew was the creation of videos. Video Crew projects included dozens of short videos of a variety of genres, produced, planned and coordinated from start to finish by the learners. The students completed a horror video, a video about the work people do, and several animations using clay, chalk, and computer graphics, as well as many works-in-progress including original fictional works, weather reports, and rituals. These projects were conducted with some adult guidance and support for the technical and planning aspects of video-making, but content and execution were strictly up to the students. Video Crew projects required brainstorming, storyboarding and scripting (planning), production and editing (development), and presentation.

The Video Crew included seven certifications corresponding to different roles in the production of video, including camera operator, pollster, staff writer, storyboarder, graphic artist, editor, and administrator. Each certification came with its own rights and responsibilities. Earning the camera operator certification, for example, qualified students to borrow video equipment overnight. To maintain an effective passion curriculum community, the video crew developed their own rules for behavior, ran meetings, conducted mentor/apprentice relationships, organized fieldtrips, negotiated with school administrators,

and planned a culminating event (the "film festival") that required them to feed and entertain dozens of guests.

These projects, certifications and community life structures were designed to guide learners toward work on a large number of learning objectives, derived mainly from the New Standards (National Center on Education and the Economy, 1997). Projects addressed skills such as writing, camera work, and collaboration. Certifications required work on video skills as well as academic skills that were relevant to the learning of video skills. For example, the pollster certification required learners to collect and analyze survey data using basic statistical methodologies. The Video Crew community provided learners with the opportunity to learn about democracy, about the importance, usefulness, and enforceability of rules, and about planning, to name a few key learning objectives.

Design of Motivation in the Video Crew

The passion curriculum approach and the IDL framework were developed concurrently, with each influencing the other. The Video Crew, therefore, is an example of both. The Video Crew uses relevance and context motivation to address the challenges of implementing interest-driven learning, and incorporates all of the context motivators. In the following, we describe the implementation of the IDL strategies and the use of the individual constructs in the Video Crew.

Interest in the Video Crew

The theme of the Video Crew was video production. All of the students in the Video Crew entered with some interest in video production. Because of their experience as video viewers, they were drawn by the opportunity to learn how video is produced and to express themselves through the medium of video. The main focus of their interest varied from student to student. Some were most interested in the machinery of video production (cameras, tripods, editing mixers), others had particular interest in video as a means to tell a story or present an idea. Since the learning objectives for the video crew included technical

understanding of video production and understanding of video as an expressive medium, these learning objectives were motivated by direct interest for those students who were naturally drawn to them. The participants' interest in video production appeared to have its source in both pleasure and identity affirmation. Some students took obvious pleasure in certain of the elements of video production; some saw the opportunity to demonstrate skills that were important to their identities (e.g., technical or performance skills); and some saw the opportunity to express some element of their identities using video as a communication medium.

The community life element of the Video Crew also served as a source of interest for some students. For example, Melinda was not particularly interested in leading video projects but was very much drawn to maintaining the video crew as a community. She took charge of communication among members of the video community during days off, and initiated a number of special events, including surprise parties and off-site video shoots.

Finally, the Video Crew allowed the participants to bring their own interests to their activities. Students were able to shape most of the Video Crew projects and certification tasks around their own interests. For example, one student, Charles, who loved weather, became fiercely engaged with making weather videos, and spent many hours creating weather reports, special effects, and stories about dramatic weather events. Charles's interest in weather even led him to go beyond the core Video Crew learning objectives to learn about computer graphics and weather phenomena.

Covering Learning Objectives through Relevance in the Video Crew

The three key structures of passion curricula—projects, certifications, and community life—each provide mechanisms for establishing relevance.

Projects create a context in which learners recognize the need for specific skills and knowledge. The design of passion curriculum projects require learners to apply the target skills and knowledge in order to complete the projects successfully. For example, the video production projects in the video crew created a need for writing skills. While video crew

students strongly resisted any direct focus on writing as an explicit learning objective, citing too much work on writing in their regular classroom, they recognized writing as an important need in the context of their video projects, because they required scripts. In fact, one student who was a very poor performer on in-school writing tasks, wrote and utilized a long, detailed, carefully choreographed plan for a wrestling sequence he needed for a video. The design of passion curriculum projects must also satisfy the interest behind them. In the case of video production, having an audience for their work is an important aspect of students' interest. The Video Crew satisfies that part of students' interest through annual "film festivals," where students show their work to parents, teachers and friends.

Certifications also provide a mechanism for connecting learning objectives to the passion curriculum's theme of interest. Certifications are linked to specific roles required by projects, and students obtain these certifications by demonstrating specific skills that are necessary to play those roles. A properly designed certification has two sources of value that contribute to the establishment of relevance. First, learners recognize that the abilities they must demonstrate to achieve the certification are useful for the interest-based projects, e.g., the skills required the storyboarding certificate in the Video Crew are necessary for planning an extended video. Second, each certification enables a learner to take on specific, desirable roles and responsibilities on projects. For example, the camera operator certification in the Video Crew allowed Julie (as described in the vignette that introduced this section) to borrow camera equipment overnight so that she could work on her project at home. Video Crew certifications address general learning objectives such as reading, writing, math, and planning, in addition to theme-specific learning objectives. Video Crew projects and certifications were made relevant, in part, by learners' interest in the passion curriculum theme of video production. The relevance of these activities was further enhanced students' right to bring in their own interests by selecting topics and formats for their videos.

Finally, the community life aspect of the video crew also provided a source of relevance. For example, Melinda, the socially-oriented learner described earlier, worked on planning in the context of the community life—planning special events. She was motivated to develop planning skills by the relevance to her interest in social life, where other students were motivated to work on the same learning objectives in the context of different activities—planning videos—through their interest in video-making.

Supplementing Interest with Context Motivation in the Video Crew

While the level of interest in the Video Crew was strong, additional sources of motivation were also necessary at times. Video projects and certifications took significant periods of time to complete—weeks or even months. In addition, many of the tasks were quite difficult for the students, and it was quite common for them to face obstacles in their work that were more complex than they were used to confronting in their usual school activities. Lastly, the students in the Video Crew represented a range of ages that are notorious for being easily distracted, and the Video Crew took place in a non-traditional educational setting outside of the formal school day. All of these factors meant that the level of the students' interest was frequently challenged by the nature of the activities. To address these challenges, the Video Crew design provided context motivation to supplement interest, in a number of different ways.

Effectiveness motivation in the Video Crew.

Challenge. The Video Crew offers opportunities for learners to select tasks at a wide variety of challenge levels. Projects enable learners to set their own levels of challenge through the choice of roles (for example, camera operator, actor, director). Many video projects required work as sophisticated as computer-based video editing, and as simple as logging shots. Less experienced students chose or were guided toward simpler tasks but ones that helped them learn about the central elements of the complex activities the project involved. More experienced students could do work that required more sophisticated skills.

Instruction in the passion curriculum approach allows for students to select their own level of challenge where possible and for the teacher to provide feedback and set expectations for students when necessary. For example, MaryAnn, a gifted but unmotivated student in the traditional classroom, was self-directed in the Video Crew. During Video Crew sessions and between sessions, she consistently sought new media to add to her video work. In the 1997-98 school year, she produced "clay-mation", stop-action animation, computer animation, and puppet-based videos at an astonishing rate. She also attacked certification tasks enthusiastically. The self-selected project and certification structures served MaryAnn well because she selected appropriate challenges for herself.

Melinda, on the other hand, while she was comfortable challenging herself in the social realm, was reluctant to work with the technology involved in video production. She resisted learning to use the computer-based editing system until the teacher intervened by placing Melinda in the role of editor. In doing so, the teacher helped to set expectations that provided Melinda with feedback about her abilities. By giving her significant responsibility the teacher simultaneously displayed confidence in her. The teacher also made herself unavailable to answer questions when she realized that Melinda was asking questions she already knew the answers to or could figure out on her own. As a result of the feedback from the teacher and Melinda's own confidence-building experiences, the difficulty of the task, previously an obstacle to motivation, became a source of challenge motivation.

Control. The Passion Curriculum approach targets control motivation through projects and certifications. Projects provide control motivation with a balance between structure and freedom of choice. In the Video Crew, each project has a specific structure that includes a predetermined set of tasks (brainstorming, storyboard, script, props and costumes, shooting, editing). Within that structure, students can exert choice by reducing the number of elements (e.g., experienced students may not need a brainstorming phase for a video), or they can add elements not in the predetermined structure (e.g., some videos might require computer graphics, at the discretion of the videographer). On large-scale projects, learners

can choose among various roles—performer, director, producer, camera operator, etc—each of which requires a different level of responsibility and very different kinds of tasks. The content of the videos is generally open-ended—the learners invent their own topics, story lines, and images.

Certifications also help to set control levels appropriately in passion curricula. While the certifications themselves are highly structured, learners choose when to work on certifications, which certifications to work on in which order, and how to address each certification task. For example, while the storyboarder certification requires the student to make certain kinds of storyboards, the content of the storyboards is left to him or her.

Progress Motivation in the Video Crew

Investment. Long-term, high-stakes projects provide an opportunity to develop a real sense of investment. In the video crew, these projects take the tangible form of videos and events, such as the annual film festival.

Closure. In addition, each video project includes a number of smaller tasks (scripting, storyboarding, etc.), each of which must be accepted by a teacher or by other students on the project, resulting in more frequent opportunities for closure motivation.

For some students, progress motivation was a problem, in spite of these structural supports. Charles, for example, began several projects on the general theme of weather during the 1997-98 school year, but he completed none. Our interpretation of this is that the challenge of completing these projects overwhelmed his desire to see them completed, despite the fact that his interest remained. In response, the Video Crew teacher planned to encourage Charles to focus on short-term projects, projects that can be completed in one or two sessions, in order to provide Charles with an opportunity to experience the reward of completion that would hopefully lead to greater closure motivation in the future.

Social Context Motivation in the Video Crew

Social Role Motivation. In passion curricula, social roles are defined both formally and informally. Certifications provide formal role definitions. In the enactment of the Video

Crew, learners who had completed a certification often described themselves in terms of their certification and asked or demanded to be allowed to exercise the rights and responsibilities that went along with it. Julie, for example, placed herself in the role of teacher for a younger student, Alex, who was working on his camera certification, and would not permit interference from the Video Crew teacher until she was satisfied that Alex had acquired the skills involved in the certification. A second layer of formal role definition in passion curricula comes from the mentor-apprentice relationship. In the Video Crew, four of the older students, those four who had completed the most certification tasks, were appointed mentors to the novice students who entered mid-year.

Informal roles came about in the Video Crew as differences in learners' abilities and interests emerged. Melinda, for example, enjoyed memorizing telephone numbers and, while she was very quiet in the classroom, was much more comfortable talking to strangers than most of the other students. Her self-selection of a communicator role became more formalized when the teacher asked her to be responsible for inter- and intra-group communications outside of Video Crew sessions.

Affiliation and Obligation. In the Video Crew, affiliation and obligation motivation exist at two levels—on the one hand, the Video Crew itself was a group, distinguished from other groups at the school. The Video Crew students tended to spend time together (some were friends before the inception of the Video Crew, some were not) and to refer to themselves as members of the Video Crew, in contrast to their other classmates. On the other hand, within the Video Crew, both formal and informal subgroups seemed to promote affiliation and obligation motivation.

Obligation and interest motivation were successfully intertwined during collaborative projects—even learners who had primary interest in projects they were conducting individually made time to attend special weekend shooting sessions of collaborative videos in which they played small roles. Was this because of interest or obligation? For the purposes of the Video Crew and passion curriculum design in general, it is not important to

distinguish the two in any given moment, only to ensure that they tend to nourish, and not to oppose, each other.

Extrinsic Motivation in the Video Crew

Extrinsic reward was not explicitly designed into the Video Crew. Nevertheless, it is apparent that learners in the Video Crew experienced the awarding of certifications as both reward and advancement. Students perceived them as an intangible reward that provided them with stature. They also valued them for the advancement opportunities they provided. Because certifications provide the most direct route to new rights, responsibilities, and titles (e.g., the ability to check out a camera for the weekend), learners often see their advancement value, before they understand how the skills each certification promotes are relevant to interests. In this way, certifications help to initiate and maintain engagement while interest motivation builds.

OPEN QUESTIONS AND NEXT STEPS

The Interest-Driven Learning Design Framework provides strategies for extending interest to motivate learning objectives that could not have been motivated by prior interest alone. These strategies are intended to support designers in creating activities that derive the special benefits of interest for learning—a mastery orientation, persistence and effort, and richly connected knowledge. Our goal is to enable designers to achieve these benefits for a wide range of valued learning objectives. The framework addresses two significant challenges to interest-driven learning, coverage and strength, by providing strategies for connecting learning objectives to learners' interests by creating relevance connecting learning objectives to interests through relevance, and for supplementing interest motivation with context motivation.

The IDL Framework is built on a taxonomy of motivational constructs that is grounded in empirical research. Working from this foundation, the framework embodies a theory of how these constructs can be combined to foster interest-driven learning. This theory raises

a number of important issues that call for additional research. This further research should include:

- Developing a more thorough understanding of how interests arise: Where does interest come from? How do learners shift from context-based motivation to interest-based motivation? How can learning environments use learners' context-based motives to capture their interests? These open questions are crucial to further development of interest-driven design.
- Establishing developmental trajectories for interest: In order to support the large-scale development of curricula around learner interests, it will be necessary to have a robust, research-based understanding of the nature of students' interests at different stages in their schooling. A deeper understanding of the nature of students' interest will enable designers to identify and anticipate interests more effectively. The design of interest-driven learning would be enhanced by theories that link interest to developmental and cultural factors and by empirical data on widespread interests in different populations of learners.
- Empirical validation of the framework: The framework presented here is theoretical. While it rests on empirical work, it extend that work in new directions. Therefore, the framework must be evaluated. Because the framework describes a design approach, we must evaluate it both in terms of its value as a support for design, and the effectiveness of the designs to which it leads. The former will require studies of designers, the latter studies of learners engaged in interest-driven learning activities. In order to properly explore the hypotheses about learning that are embodied by the framework, we must examine learning outcomes, students' goal-orientations within activities, and the nature and strength of students' motivation when they engage in those activities.
- Re-analysis of standards and learning objectives: While relevance provides a strategy for extending the benefits of interest motivation to a wide range of learning

objectives, not all current learning objectives can be made relevant to the student populations for which they are designed. The standards and learning objectives in our current educational systems were not developed with interest motivation in mind. To understand how broadly interest-driven learning can actually be applied, we must examine current standards to identify potential connections to learner interests. With this analysis we will be able to explore an important question for the future of standards development: What is the value of learning objectives that do not have any meaningful connection to students' sources of pleasure, concerns, or life goals? It is possible that such learning objectives should be discarded on the grounds that they are either of too little use to learners or that without interest motivation they will not be effectively mastered. In any case, an analysis of current standards from the perspective of interest motivation will help to determine how broad the effective coverage of interest-driven learning is, and can provide the impetus for a much-needed discussion of the role that motivational considerations should play in the selection of learning objectives.

These research directions extend beyond traditional educational psychology, where most of the research on motivation and learning has taken place historically. Answering the questions raised by these new directions will require new forms of inter-disciplinary collaboration involving expertise in motivation, learning, curriculum design, and educational policy. Advancing our understanding of these areas could have a significant payoff by bringing the benefits of interest motivation to a much broader range of learning objectives than are currently recognized as opportunities for interest-driven learning. The IDL Framework represents a first step in that direction.

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