Why Children Are Left Behind and What We Can Do About It

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We propose that there are four major reasons that some children are left behind in our schools: (1) they may have unmet needs that effectively block or interfere with their learning, (2) they may lack motivation to exert the effort necessary for learning, (3) they may lack the foundation of knowledge[1] (skills, understandings, and information) that are required for, or facilitate, their learning, and (4) they may lack quality instruction[2] to support their learning. First, we will describe each of these reasons that children are left behind, and then we will discuss what can be done about each.

First is **unmet needs**, because nothing else we do can help children learn if their basic needs are unmet. When children arrive at school hungry, physically abused, or otherwise emotionally distressed, there is clear evidence that they are unlikely to learn. Unless this problem is addressed, children will continue to be left behind.

Second is **motivation** for learning, because without motivation, it doesn't matter if students have the necessary foundation and support for learning—they still will not learn. Although most children begin school excited to learn, that excitement gradually fades the longer they are in school, especially for those who encounter failure and embarrassment. Learning requires effort on the part of children, and unmotivated children do not exert sufficient effort to succeed. Unless this problem is addressed in our classrooms, children will continue to be left behind.

Third is **foundation** for learning, because new knowledge is built on prior knowledge. There is evidence that skills often build on each other—that they are usually comprised of simpler component skills (Gagné, 1985). To learn how to multiply two-digit numbers, a child must first learn how to multiply one-digit numbers and add whole numbers. There is also evidence that understandings are organized into schemata, which are structures of related knowledge (Rumelhart & Ortony, 1977). A sound schema has been shown to facilitate building new understandings and other knowledge through such processes as assimilation and tuning (Rumelhart, 1980; Rumelhart & Norman, 1978). Understandings tend to build on, or at least be facilitated by, other understandings. Our current educational practices tend to force slower students to move on to a new topic before they have mastered the current one. This results in learning deficits that greatly handicap those students in their future learning. Unless this problem is addressed in our classrooms, children will continue to be left behind.

The fourth problem is **support** for learning, because inadequate instruction can make learning difficult for even the most motivated and prepared learners. If you just put children on a tennis court with rackets and tennis balls, they will not learn to play tennis nearly as well in a year as they will with good coaching. Our current educational practices tend not to provide every student with the kinds of support for learning that have proven most successful in promoting student learning. Unless this problem is also addressed in our classrooms, some children will continue to be left behind.

What Can We Do About It?

Understanding these four problems is just the first step in helping all children to succeed. The greatest challenge is figuring out how to overcome each problem in a way that schools can afford. We will address solutions to each of these four problems in order. As we do so, we will explore how technology can be used to help implement these solutions. We will provide several ways that leveraging technology may help, and we will include references to other writings that offer additional solutions—though we will not do so exhaustively.

1. Unmet Needs

Maslow (1999) has shown that there exists a hierarchy of needs (see Figure 1) wherein the lower needs must be met before a person can devote any significant attention to higher ones in the hierarchy. In

[1]We use the term "knowledge" in its broadest meaning, which includes all the levels of Bloom's taxonomy, not just the lowest level.

[2]We use the term "instruction" rather than "teaching" because teaching is usually thought of as being done by a person, whereas instruction can be provided by a teacher or by a computer, textbook, workbook, peer, and so forth.

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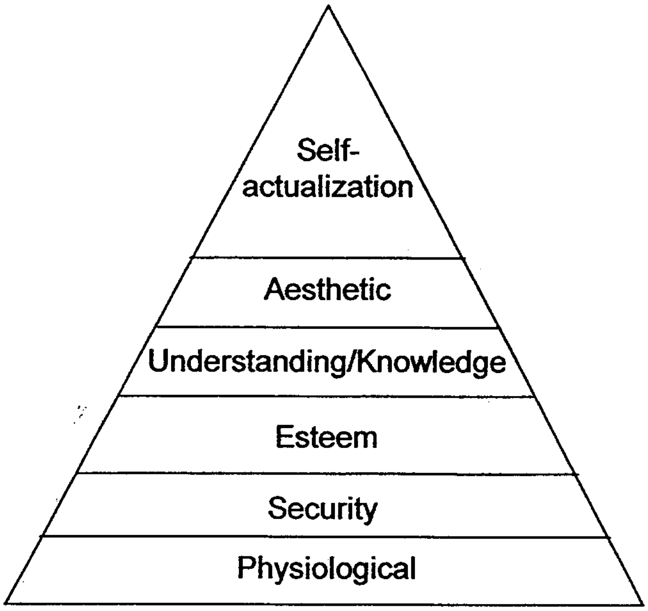

Figure 1. Maslow's hierarchy of needs (derived from Maslow, 1999).

our experience we have found the unmet needs that most frequently interfere with children's learning are hunger and emotional distress. Emotional distress can be caused by such factors as neglect, feeling unloved, verbal abuse, physical abuse, and sexual abuse. The alarming increase in "latchkey children" is just the tip of the iceberg. The following are what we believe are the most important guidelines for addressing this problem.

Provide food, safety, and caring. Before- and after-school programs should be created to provide food, safety, and caring to children who need them. Such programs could also provide some instructional support (see #4 below), such as tutoring programs and educational games (using volunteers and/or computers). The major obstacles to this solution are funding for care providers and transportation. Federal and state dollars to help defray these costs would likely do more to help keep these children from being left behind than any other expenditure. However, other possibilities include partnering with social service agencies, local university schools of education, and other organizations (businesses, museums, and so forth). Another possibility is to create a co-op type of arrangement with parents and other citizens whereby they receive so much free child care or use of other school facilities in exchange for so much volunteer service to the program.

Develop partnerships with parents. While for many parents, especially single parents, lack of time is at the root of many unmet needs of children, for other parents it is their attitudes, values, and/or knowledge about parenting. In such cases, partnership programs can make a difference. Many schools offer parenting workshops for parents. Others have developed home visitation programs. Still others provide structured activities designed to improve the quality of time that parents spend with their children. Some provide abuse-prevention programs and sensitivity training. Well designed videos can have an impact on attitudes and values about parenting and children. Online parental support systems may provide connections to school leaders and other parents—connecting parents in a "community of practice" (Lave & Wenger, 1990; Wenger, 1998). Again, the major obstacles to these solutions are funding and expertise. Federal and state dollars should be made available to help defray these costs, and states should make expertise about such programs available to schools. Also, partnering with social service agencies, local university schools of education, and other organizations can help to defray expenses and provide access to expertise.

Without programs like these, many children will be left behind, no matter what else the schools do.

2. Motivation for Learning

John Keller (1987) has identified four major aspects of motivation that schools can influence: attention, relevance, confidence, and satisfaction. He has also identified strategies that can be used to enhance each of these aspects (see Figure 2). While many guidelines have been developed and validated in the research literature by Keller and others, from a broader perspective, we would like to offer the following guidelines for overcoming the motivation problem in our classrooms.

Connect to student interests. Students are more motivated to the extent that what they are learning is related to their interests. There has been much attention to providing "authentic" learning environments and situated learning (Bransford, Sherwood, Hasselbring, Kinzer, & Williams, 1990; Brown, Collins, & Duguid, 1989; Cognition & Technology Group at Vanderbilt, 1993; Lave, 1988). While authenticity and situatedness can greatly improve transfer of what is learned to real-world situations, authentic, situated learning can be unrelated to a student's interests, and some fantasy situations can be of high interest to students. While some interests may be more broadly held than others, different children often have different interests, which means that customizing the learning experience to individual interests may be necessary to significantly improve motivation for some learners. Technology can be a powerful tool for customizing instruction to student interests. One possibility is to have a menu of interests from which a child could choose at the beginning of a computer-based learning program, and

Figure 2. Strategies for motivation (modified from Keller, 1987).

Motivational Aspect	Supporting Strategies
Attention	• Create curiosity or wonderment by using novel approaches and injecting personal and/or emotional material. • Increase curiosity by asking questions, creating paradoxes, generating inquiry, and nurturing thinking challenges. • Sustain interest with variations in presentation style, concrete analogies, human interest examples, and unexpected events.
Relevance	• Provide statements or examples of the utility of the instruction, and either present goals or have learners define them. • Make instruction responsive to learner motives and values by providing personal achievement opportunities, cooperative activities, leadership responsibilities, and positive role models. • Make the materials and concepts familiar by providing concrete examples and analogies related to the learners' work.
Confidence	• Establish trust and positive expectations by explaining the requirements for success and the evaluative criteria. • Increase belief in competence by providing many, varied, and challenging experiences which increase learning success. • Use techniques that offer personal control (whenever possible), and provide feedback that attributes success to personal effort.
Satisfaction	• Provide examples, simulations, or work samples that allow students to see how they can now solve "real-world" problems. • Use verbal praise, real or symbolic rewards, and incentives, or let students present the results of their efforts ("show and tell") to reward success. • Make performance requirements consistent with stated expectations, and provide consistent measurement standards for all learners' tasks and accomplishments.

then have the program modify the instruction in certain ways based on the selected interest. However, one should also keep in mind that it is often possible to generate student interest in a topic; you don't just have to rely on existing student interests. Either way, connecting instruction to student interests is an important tool for not leaving children behind.

Tie to problems or projects. Students are more motivated to the extent that they are given a challenge in the form of an intriguing problem to solve or a useful or exciting mission to accomplish. This is why problem-based instruction (Barrows, 1986; Koschmann, Kelson, Feltovich, & Barrows, 1996; Savery & Duffy, 1996) and project-based instruction (Blumenfeld, Soloway, Marx, Krajcik, Guzdial, & Palincsar, 1991; Guzdial, 1998; Marx, Blumenfeld, Krajcik, & Soloway, 1997) are becoming more widespread. When designing such instruction, it is important to keep in mind the distinction between performance goals (what the student should do or accomplish during the instruction) and learning goals (what the student should learn during the instruction). Different problems or projects require the use of different knowledge, so the learning goals should be used as a basis for selecting the performance goals. Another design consideration is the power of collaboration. When students work together to solve a problem or conduct a project, they can motivate, support, and provide feedback to each other. Some useful guidelines are being developed for collaborative or social learning environments (Nelson, 1999; Riel, 1996; Scardamalia & Bereiter, 1996).

Give some ownership to the student. Students are more motivated to the extent that they are given an appropriate amount of ownership over their learning process (Keller, 1987). This is why self-directed learning (Della-Dora & Blanchard, 1979; Long, 1996) or self-regulated learning (Corno & Randi, 1999; Corno & Rohrkemper, 1985; Pintrich, 1995; Zimmerman & Schunk, 1989) is becoming more widespread. Clearly, not all children have the learning strategies, self-management skills, and other metacognitive skills for complete self-direction. Much of this may be a consequence of our educational practices not affording opportunities to acquire such capabilities. However, the Montessori system has shown that even three-year-olds can be taught to assume considerable amounts of self-direction in their learning. A helpful tool for self-directed learning is to develop a learning contract between the student (or team) and teacher that spells out not only the goals to be accomplished and evidence for their accomplishment, but also the roles that each person will play in accomplishing the goals. The parents could also be parties to that contract. For more information about giving some ownership to the student, see APA, 1995; Bonk & Cunningham, 1998; and Wagner & McCombs, 1995.

3. Foundational Knowledge for Learning

Robert Gagné (1985) popularized the existence of "learning prerequisites"—skills that need to be acquired before a more complex skill can be learned. He developed a technique, called "hierarchical analysis," for identifying the simpler component skills that comprise a more complex skill. But skills are not the only kind of knowledge for which foundations can facilitate learning. Understandings can build upon each other, as well. And higher-order thinking skills (Bloom, 1956; Pogrow, 1999), including learning strategies and metacognitive skills, can also greatly facilitate learning. From a broad perspective, we would like to offer the following guidelines for overcoming the foundations problem.

Insist on mastery. As mentioned earlier, the standard educational practice in schools today is for the calendar to dictate when to move on to the next topic of study. As a consequence, the slower students do not master all the foundational knowledge for future learning. They accumulate learning deficits that make it more difficult, if not impossible, for them to acquire more complex knowledge. To insist that all students reach mastery means that slower students must be given more time to attain the standards. Progress should be determined by student attainments rather than by time. This will require fundamental changes in the structure of the school day, the use of technology (see section 4 below), and the roles of teacher and student (Duffy, Rogerson, & Blick, 2000; Reigeluth, 1994; Schlechty, 1990; Senge, 2000).

Use sound curriculum sequencing. Ensuring mastery of foundational knowledge also requires that the curriculum be sequenced in ways that teach prerequisite and facilitative knowledge prior to the knowledge it supports. To build schemata effectively, the curriculum should progress from broader, more inclusive ideas to narrower, more detailed ideas (Ausubel, 1968; Mayer,1979; Norman, 1976). And to build complex cognitive skills more effectively, the curriculum should progress from simpler real-world versions of those skills to more complex versions (Reigeluth, 1999a; van Merriënboer, 1997).

Figure 3. Brain/mind learning principles (from Caine & Caine, 1997, p. 19).

Principle 1:	The brain is a complex adaptive system.
Principle 2:	The brain is a social brain.
Principle 3:	The search for meaning is innate.
Principle 4:	The search for meaning occurs through "patterning."
Principle 5:	Emotions are critical to patterning.
Principle 6:	Every brain simultaneously perceives and creates parts and wholes.
Principle 7:	Learning involves both focused attention and peripheral perception.
Principle 8:	Learning always involves conscious and unconscious processes.
Principle 9:	We have at least two ways of organizing memory.
Principle 10:	Learning is developmental.
Principle 11:	Complex learning is enhanced by challenge and inhibited by threat.
Principle 12:	Every brain is uniquely organized.

4. Support for Learning

Brain-based research has revealed much about what is necessary for learning to take place. Caine and Caine (1997) have synthesized this research into a set of 12 principles (see Figure 3). Brain research has shown that the body, brain, and mind interact in very important ways. For example, children who learn to play a musical instrument or sing in a choir tend to improve their spatial reasoning capacity at the same time. Brain research also shows how important emotions are in learning. Emotion and cognition shape each other in unavoidable ways. Brain research has revealed that the right and left hemispheres of the brain work together—interacting in a way that analytical and creative thought processes together create complex learning experiences for students. Brain research shows that focused attention and peripheral perception both affect learning, supporting the assertion that a child's whole environment, school, home, and other settings should be considered as part of the learning environment. Brain research shows that learning is developmental, that each brain is uniquely organized, and that children experience windows of opportunity for learning at different ages. This finding supports the need for performance-based progression through a curriculum, rather than the traditional time-based progression that currently predominates. Finally, brain research shows that fear, threat, and fatigue contribute to "down-shifting"—a sense of helplessness that impedes learning by producing a rushed, programmed response to stimuli rather than a thoughtful (higher-order) approach. Learning settings full of experiences that build a sense of self-efficacy in students are more likely to support complex thinking and deep learning. Support for learning should be designed to meet these learning requirements.

To effectively support learning (student construction

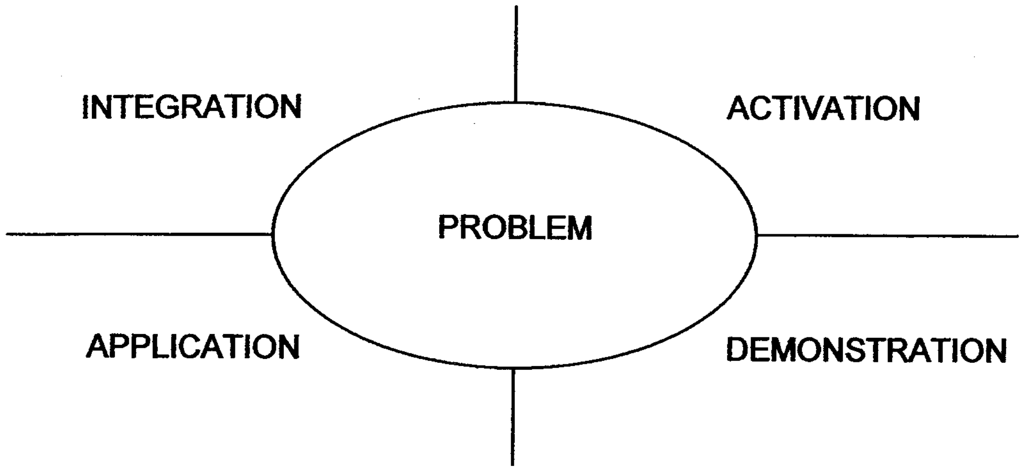

Figure 4. First principles of instruction (from Merrill, 2002).

of knowledge), it is important to identify the kinds of mental activities in which students should engage, for different kinds of learning require different kinds of mental activities. Furthermore, different kinds of mental activities are fostered by different kinds of *overt activities*, so it is important to identify the kinds of overt activities that will best foster the necessary mental activities. But regardless of what those overt activities are, they should be preceded by providing *resources* that help the student to engage in those activities, and they should be followed by *feedback* that helps the student to improve those activities. These three elements can be labeled as presentations, practice, and feedback, and are widely recognized as essential elements of quality instruction (Merrill, 1983).

Use universal principles of instruction. Dave Merrill (2002) extends this notion of three universal elements of instruction by proposing that there are five principles of instruction that are universal—that is, they should be applied in all situations in which one wants to support learning (see Figure 4). According to Merrill, most effective learning environments start with a meaningful problem that provides the focus for four phases of instruction: activation of existing knowledge (including skills), demonstration of new knowledge, application of new knowledge, and integration of new knowledge into the learner's world. Centering instruction on a real-world problem rather than on discrete actions or operations may provide a motivation for student learning (problem #2 discussed earlier). Activating existing knowledge is important because it provides the foundation for learning new knowledge—students should become aware of what they do and do not already know about the topic of study (related to problem #3 discussed earlier). Since every student has a unique set of life experiences and existing knowledge, effective instruction should take this individuality into account. Demonstrating new knowledge (and skills) facilitates learning when the demonstration is aligned with the learning goal, includes necessary guidance (or scaffolding) for students, and uses a variety of media appropriately (addresses problem #4). Applying new knowledge is essential for effective learning. Opportunities for application should include a variety of problems (practice), should offer needed support and resources, and should be consistent with the overall learning objectives (also addresses problem #4). Finally, integrating new knowledge into the student's world refers to the transfer of learning from the specific learning setting to "real" settings that require the application of new knowledge. Integration is facilitated when learners have the opportunity to publicly demonstrate their new knowledge, to reflect upon their learning experiences, and when they are encouraged to develop their own, personally relevant ways of applying their new knowledge (also addresses problem #4).

Use differentiated methods of instruction. However, there is also evidence that different methods of instruction (supports for learning) are better for different situations. Such situations include the nature of the learning desired and the nature of the learner, among others. The term, "differentiated instruction," is commonly used to characterize the need for different methods. One might think in terms of the universal principles being applied differently in different situations. For example, three very different kinds of learning include acquiring skills, understandings, and information.

Different methods for different kinds of learning. There is considerable research evidence that students are more likely to learn a **skill** if three basic methods are used (not necessarily in this order): tell them how to do it, show them how to do it, and have them do it, with immediate feedback on their performance (Merrill, 1983). This is true regardless of whether one uses direct instruction, cognitive apprenticeship, or any other approach to facilitating learning. Similarly, there is considerable evidence that students are more likely to develop an **understanding** if they are helped to make connections with other knowledge they already possess. Discussions (Brookfield & Preskill, 1999; Wilen, 1990) and performances (Perkins & Unger, 1999) are useful tools for helping students to explore connections, ranging from analogical relationships to causal relationships (Reigeluth, 1983). Although memorization is often overdone in our schools, sometimes students need to memorize **information** or facts, especially when those are components of more complex skills and understandings. Several methods have proven to help students remember such information. Repetition is the most common, and can be used for both presenting the information and practice on the information (with corrective feedback on wrong answers). A more powerful method is to use mnemonics, including:

- acronyms (e.g., "Roy G. Biv" for the order of colors in the rainbow: red, orange, yellow, green...);
- phrases (e.g., "My very earnest mother just sent us nine pickles" for the order of planets from the sun (Mercury, Venus, Earth, Mars...); and
- rhymes (e.g., "i before e except after c...") and songs (the alphabet song).

Some children need more support for learning than do others. If they do not receive sufficient appropriate support, they are likely to be left behind, regardless of their motivation and foundations for learning.

Different methods for different kinds of learners. Different learners can benefit most from different methods of instruction. This is largely because they have different "intelligences." Gardner's theory of multiple intelligences (1983, 1993, 1999b) considers intelligences and talents as basically the same construct—"a biophysical potential to process information that can be activated in a cultural setting to solve problems or create products that are of value in a culture" (Gardner, 1999a, pp. 33–34). Gardner classifies intelligence into eight general categories. Logical-Mathematical Intelligence—the ability to detect patterns, reason deductively, and think logically—is most often associated with scientific and mathematical thinking. Linguistic Intelligence—the ability to master language—includes the ability to effectively manipulate language to express oneself rhetorically or poetically, or remember other information using language (e.g., mnemonics). Spatial Intelligence is the ability to manipulate and create mental images in order to solve problems. Musical Intelligence is the ability to recognize and compose musical pitches, tones, and rhythms. Bodily-Kinesthetic Intelligence—the ability to use one's mental abilities to coordinate one's own bodily movements—supports the assertion that mental and physical activity are directly related. Personal Intelligences include interpersonal intelligence—the ability to understand feelings and intentions of others—and intrapersonal intelligence—the ability to understand one's own feelings and motivations. Finally, Naturalist Intelligence is the human ability to discriminate among living things as well as sensitivity to other features of the natural world.

Gardner (1999b) provides a general set of guidelines for implementing MI theory in instructional practice, but these guidelines are useful only at a very high, strategic level. MI theory was never written specifically for education, and does not stipulate what to teach or how to teach it. Rather, Gardner has identified three fundamental principles of MI theory as applied to education: (1) individuals should be encouraged to use their preferred intelligences in learning, (2) instructional activities should appeal to different forms of intelligence, and (3) assessment of learning should measure multiple forms of intelligence. Uniform schooling—the belief that all children should learn the same knowledge in the same way (and at the same pace)—is the greatest hindrance to implementing MI in education (Gardner, 1999b). Effective instruction must be tailored to an individual learner, even when the instruction is following a set curriculum of core subjects.

While implementing this approach on a large scale may seem overwhelming, technology may be useful to implement "individually configured education"—modifying content presentation, demonstration (or practice), and assessment to fit the varying needs of individual learners. Software (EPSSs, learning management systems) can already "learn" or adapt to individual users and modify later instruction and assessment based on prior experience (Park, 1996; Ross & Morrison, 1988). Also, knowledge management systems (Moore & Orey, 2001) within schools might enable teachers to gather and share relevant information about students from year to year as they progress through a school. The ultimate goal is to fit each individual student with support for learning that works best for him or her.

Insist on mastery. Earlier, under "Foundational Knowledge for Learning," we discussed the importance of having every child continue to work on a topic until appropriate standards are met. This may well be the most important principle to support learning, because if a child is motivated to learn and has the necessary foundations for learning, she or he will eventually learn if you keep at it, even if the methods of instruction are not very good. Benjamin Bloom (1981) and John Carroll (1963) present some guidelines for mastery learning based on a considerable body of research. The major obstacles to this method are the time-based structure of our educational systems and the logistical problems of not having all children in a classroom working on the same topics at the same time. Technology can be a cost-effective solution to the latter problem if used in appropriate ways (see next section).

The Bottom Line

It is not going to be easy to have no child left behind. The four problems identified at the beginning of this article are not easy to solve. The solutions require changes in children's homes as well as their schools. And in their schools, the changes require fundamental transformation of the ways we use "time, talent, and technology" (Schlechty, 1990). These changes constitute what Tyack and Cuban (1995) refer to as a new "grammar" of schooling and what Fullan (2001) refers to as reculturing the school.

In our current school system, student progress is dictated by time. We know that different children learn at different rates, yet we force them all to learn the same knowledge in the same amount of time. This time-based system is not designed to maximize learning, rather it is designed for sorting—it is designed to leave some children behind. That served us well in the industrial age when we needed people of little education to work on assembly lines, but those kinds of jobs are rare today. Even manufacturing jobs today require workers who can solve problems, work well on teams, and take initiative.

Today, we need an educational system designed for learning, not sorting. When we hold time constant, we force achievement to vary—we force some children to be left behind. The alternative is to hold achievement constant (all students are required to reach standards), which requires time to vary. This means we need to rethink the grammar of schooling that says we organize children into a classroom in which all children learn the same thing at the same time, and that says we have grade levels with promotion from one to another based on calendar time. The report card epitomizes the present grammar of schooling, with its emphasis on comparing one student to another. Imagine an alternative assessment system that is an inventory of attainments, which are checked off as they are mastered. Without such fundamental changes in the grammar of schooling, children will continue to be left behind, no matter what else we do.

But how can we bring about this fundamental change in the use of time in our schools? To do so requires fundamental changes in the use of talent and technology. If different students are attaining standards at different rates and times, instruction must be customized rather than standardized. This means that both the teacher's role and the student's role have to change. The students need to become knowledge workers, while the teachers become managers and coaches (Duffy *et al.*, 2000; Schlechty, 2001). Students should collaborate on teams that are focused on solving a problem or conducting an engaging project. The teacher needs to help the students become more self-directed in their learning (Corno & Randi, 1999).

If the teacher is to relinquish the role of dispenser of knowledge, at least two other changes must take place to help children build their knowledge. Technology must play a more central role in providing access to knowledge and to well-designed instruction—instruction that utilizes the differentiated instructional methods described earlier. And peers (teammates) must play a more central role in providing feedback and support to each other in the learning process. Instructional theories are being developed to provide guidance for this new paradigm of education (see, e.g., Reigeluth, 1999b). This magazine focuses on how technology can be used more effectively in our schools. But we must keep in mind the nature of the problems that technology must help us to solve, and we must keep in mind that technology is only part of the solutions to those problems. □

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Author Guidelines for Magazine Articles

In preparing an article for *Educational Technology* Magazine the primary fact to keep in mind is that this magazine is not a research journal. It is, as the name implies, a magazine. The Editors are looking generally for articles which *interpret* research and/or practical applications of scientific knowledge in education and training environments.

Thus, your article should not be cast in the form of a traditional research report. The facts of your research, and the research of others, should be stated succinctly. Then you should go on to explain the implications of this research, how it can be applied in actual practice, what suggestions can be made to school administrators, trainers, designers, and others.

The style of writing should be on the informal side—an essay—since once again this is a magazine and not a formal academic journal. Authors are free to state their opinions, as long as the opinions are clearly identified as such. The use of specialized jargon should be kept to a minimum, since this magazine has a very wide interdisciplinary audience and what may be common words in one sub-field of educational technology will be considered unintelligible to others.

There are no minimum and maximum length restrictions. Make your article about as short as possible to do the job you intend. As a general rule, most articles are about 3,000 words, and one would require more words only in unusual circumstances. Include charts and photographs as necessary.

Note too that this magazine is read in more than 110 countries, by persons holding prominent and influential positions. They expect a very high level of discourse, and it is our goal to provide articles of excellence.

You will be notified of acceptance or rejection within two weeks of our receipt of your manuscript. Publication will follow, as a rule, within six months.