

# Synthesis of Research on Time and Learning

We can help students learn by increasing time-on-task, but we can achieve more learning if we expect "productive time," where students engage in lessons adjusted to their differences in learning rate and background knowledge.

Educational research confirms the ancient wisdom that practice makes perfect; and educational reform groups such as the National Governors' Association (1986) are calling on educators to allocate more time for students to learn. In this paper, I review current psychological research on the effects of time and discuss policy and practical implications. I also propose that "productive time" rather than "allocated time" or "time-on-task" should be a new focus of educational renewal.

Educators, parents, and policymakers have begun a variety of programs to increase learning time. These include preschool, half-day and full-day kindergarten, active parental stimulation of children at home, the use of instructional methods and motivational techniques in the classroom to increase "engaged time" in school, more homework with feedback, extended-day school, and summer school for children who fall behind. To elucidate the principles of such various programs and to provide an understanding to increase their effectiveness, I will discuss psychological theory and research on the effects of time on learning and talent develop-

ment, and how students spend their time in school.

## Psychological Perspectives on Educational Time

Since Socrates, psychological views of the learner have influenced educational theory and practice; and current research provides useful insights on time and learning. In this section I discuss recent developments in cognitive psychology and theories of instruction, including the question of whether long and hard work causes psychological harm.

### Insights from Cognitive Psychology

Psychological phenomena can often best be understood by study of extreme cases; creativity and talent are cases in point. Until recently, they had only been intuitively understood as innate or accidental. But, contrary to the notion of instant creativity that was popular in the 1960s, great accomplishments are matters of opportunity and of continuous, concentrated effort over at least a decade. When Isaac Newton, for example, was asked how he had managed to surpass the discoveries of his predecessors, he replied,

"By always thinking about them." And the eminent mathematician Friedrich Gauss said that if others had reflected on mathematical truths as deeply and continuously as he had, they would have made his discoveries.

Accomplishments in other areas are also matters of opportunity and devoted effort. Psychological studies of the lives of eminent painters, writers, musicians, philosophers, religious leaders, and scientists of previous centuries, as well as prizewinning adolescents in this country today, reveal early, intense concentration on previous work in their fields, often to the near exclusion of other activities. It appears, though, that science and mathematics, because of their highly specialized and abstract symbolism, may require the greatest concentration and perseverance (Csikszentmihalyi 1982, Walberg in press).

The same fundamental thought processes, moreover, appear to be required in both elementary and advanced study, as Simon (1981) and his colleagues have shown. The acquisition of information and the problem solving of beginners differ in degree rather than in kind from the mental activities of experts. The scarce re-

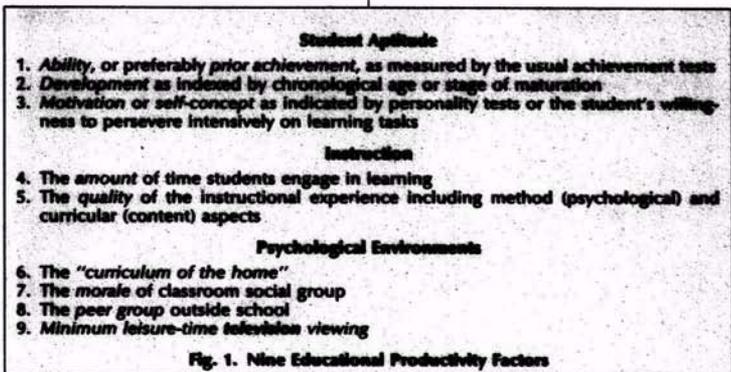
sources are the amounts of time and concentration rather than the information available or the processing capacity of the mind, both of which, for practical purposes, seem unlimited.

Simon's work shows that, aside from motivation and opportunities, the constraints on the acquisition of knowledge are the few items of information, perhaps two to seven, that can be held to conscious memory, and the time required—5 to 10 seconds—to store an item in long-term memory. Experts differ from novices in science, chess, and other fields not only in having more information in permanent memory but also, and more significantly, in being able to process it efficiently.

Among experts, for example, items of information are more thoroughly indexed and thus can be rapidly brought to conscious memory. The items, moreover, are elaborately associated or linked with one another. Two consequences of these associations—the ability to recover information by alternative links, even when parts of the direct indexing are lost, and the capacity for trial-and-error searches—are the essential routines called into play in problem solving from the most elementary to the most advanced.

Increased understanding of these cognitive processes is likely to result in greater efficiencies in memory and thought and in teaching and learning. An undergraduate of average intelligence, for example, given 230 hours of instruction and practice based on cognitive science, raised his memory for numbers from 7 to 79 digits, which is 9 times larger than the number taken by psychologists as indicative of superior intelligence (Ericsson et al. 1980). It will be more difficult, of course, to produce such results for "higher cognitive processes," such as analysis and synthesis, and to apply their implications in educational practice. Thus, human time and concentration are likely to remain essential for learning.

The greatest advantage of the expert—and, conversely, the biggest problem for the novice attempting to learn cognitively demanding material—is "chunking," the representation



of abstract groups of items as linked clusters that can be efficiently processed as an ensemble. Such chunks may underlie mental processes ranging from the childhood stages of cognitive development identified by Jean Piaget, to scientific discoveries. Simon (1981) estimates that about 50 thousand chunks, about the same magnitude as the recognition vocabulary of college-educated readers, may be required for the expert mastery of a special field. The highest achievements in various disciplines, however, may require a memory store of one million chunks, which may take even the talented about 70 hours of concentrated effort per week for a decade to acquire, although 7- to 9-year-old exceptions such as Mozart and Bobby Fischer can be cited.

The prospect of such prodigious and sustained concentration should impress—if not daunt—novices. Yet only a small fraction of the total is required for impressive achievement; and only an extra hour or two per day may enable beginners to attain results far beyond unpracticed adults in many fields. Children of normal intelligence, moreover, possess the requisite talent for respectable attainments; they can acquire the information and skills that constitute a small but important fraction of what experts command. The data on achievement test scores of children in the U.S. and in other countries (discussed later) suggest that this fraction can be raised considerably.

### ***Hard Work: An Unlikely Cause of Stress and Suicide***

Some educators fear that American children cannot sustain the long hours necessary to achieve well by international standards. They apparently believe that either heredity or American culture prevents students from learning, and that to press them further might result in psychological stress, unhappiness, heart disease, suicide,

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and the like. Although such fears are frequently expressed, there is little research to support them; and some evidence suggests that effortful, constructive engagement enhances psychological well-being.

One source of anxiety about hard academic work stems from analogies drawn from speculation that the "Type A behavior pattern, manifested primarily by competitiveness, excessive drive, and enhanced sense of time urgency" causes coronary heart disease. The largest prospective surveys, however, showed that this pattern predicted no elevation in coronary disease (Shekelle 1985). Moreover, a synthesis of 83 studies of psychological predictors of heart disease concluded: "The picture of coronary-proneness . . . is not one of a hurried, impatient workaholic but instead is one of a person with one or more negative emotions" such as hostility and depression (Booth-Kewley and Friedman 1987, p. 343).

What about suicides of hard-working Japanese students—well known for their prodigious amounts of study? For ages 10 to 19, Japanese rates per 100,000 in 1984 were about half the U.S. rates, which had more than doubled since 1965 (U.S. Department of Education 1987, p. 79)—a period, according to U.S. education reform reports, of slackened educational standards and declining student effort.

Does effort cause unhappiness? Psychological research on optimal and exhilarating experiences shows that life's greatest pleasures include the development of skills and absorption in constructive activities (Csikszentmihalyi 1982, Argyle 1987, p. 216). Research on adults, moreover, shows that such experiences are more often encountered in work than in leisure; and high school students encounter them most frequently when opportunities sufficiently challenge their skills both in school and in outside pursuits (Csikszentmihalyi 1982, pp. 18–24).

To be sure, students can work too hard. But average students seem far from that danger if for no other reason than they watch nearly as much television as they study in school during the academic year (Walberg and Shanahan

**"The greatest advantage of the expert . . . is 'chunking,' the representation of abstract groups of items as linked clusters. . . ."**

1983). Television viewing is sedentary. It is passive. It displaces homework, leisure reading, and active pursuits.

Although time and effort hardly seem causes of undue stress, too much external pressure, of course, can produce anxiety. If students feel driven by parents and teachers; if they fall far behind their peers with little hope of catching up or blame themselves for failure to attain perfection; if they lose a sense of control and autonomy—then they can become depressed and feel helpless (Abramson et al. 1978). Encouragement, the setting of realistic goals, support and recognition for accomplishment, and learning for its own sake—these are more in the interest of children than are extreme external pressures.

#### ***Productivity Theory Related to Time***

In recent years, several breakthroughs have occurred in the analyses of large-scale educational surveys and in the syntheses of thousands of educational research results (see Walberg 1984a, 1984b, 1986 for details). These surveys and syntheses show that nine factors increase learning (see fig. 1).

Collectively the various studies suggest that the nine factors are powerful and consistent in influencing learning. Syntheses of 2,575 studies suggest that these generalizable factors are the chief influences on academic achievement and, more broadly, school-related cognitive, affective, and behavioral learning. Many aspects of these factors, especially the amount and quality of instruction, can be altered by educators; and these deserve our attention especially in improving opportunities for at-risk youth.

Each of the first five factors—prior achievement, development, motivation, and the quantity and quality of instruction—seems necessary for learning in school; without at least a small amount of each, the student can learn little. Large amounts of instruction and high degrees of ability, for example, may count for little if students are unmotivated or instruction is unsuitable.

If this theory is combined with insights from cognitive psychology (discussed earlier), then it can be seen that time is a central and irreducible ingredient among the alterable factors in learning. First, recall that the acquisition of an item of information requires an estimated 5 to 10 seconds. Relating it "meaningfully" to assimilated chunks requires additional seconds; and problem solving or discovery by trial-and-error combinations of chunks may take minutes, hours, days, or years.

But not all allocated time in school and outside study is employed for these fundamental processes of learning and discovery. Quality of instruction, for example, can be understood as providing optimal cues, correctives, and reinforcement to ensure the fruitfulness of engaged time. Diagnosis and tutoring can help ensure that instruction is suitable to the individual student. Inspired teaching can enhance motivation to keep students persevering. Quality of instruction, then, may be considered an efficient enhancement of allocated or engaged learning time.

Similarly, the four psychological environments can enlarge and enhance learning time. Good classroom morale

may reflect the match of the lesson to student aptitude, the socially stimulating properties of the academic group, or, in general, the degree to which students are concentrating on learning rather than diverting their energies because of unconstructive social climates. Peer groups outside school and stimulating home environments can help by enlarging learning time and enhancing its efficiency; students can both learn in these environments and become more able to learn in formal schooling.

Finally, television can displace homework, leisure reading, and other stimulating activities; and it may dull the student's keenness for academic work. For instance, some of the average of 28 hours a week spent viewing television by high school students might usefully be added to the mere 4 or 5 weekly hours of homework they report (Walberg and Shanahan 1983).

### Psychological Theory Related to Learning Time

Educational psychologists, because of classroom findings, are strengthening their beliefs about several theoretical assertions about learning time but are changing their opinions about others. These beliefs and opinions and their underlying bases are discussed in this section.

#### Spacing

One of the most dependable and ubiquitous findings from experimental psychology holds up in classroom research: "Spaced" practice over several lessons or study periods interspersed with other activities is superior to equal amounts of time spent in "massed" (concentrated, possibly one-session) practice. Indeed, "two spaced presentations are about twice as effective as two (successive) massed pre-

sentations, and the difference between them increases as the frequency of repetitions increases. Moreover, achievement following massed presentations is often only slightly higher than that following a single shorter presentation" (Dempster 1987, p. 9). Massed presentations may, of course, be unnecessarily repetitive; and one reason for spacing's efficiency is that students may be more interested in material the second time after some delay (Dempster 1987, p. 9).

There is some validity, however, to student intuitions that "cramming" can be time-efficient for scoring well on tests, even though material may be soon forgotten. Frequent quizzes and oral questions may be effective in countering what is efficient for short-term memory but inefficient for long-term retention. Making the subject matter intrinsically interesting, however, is even more attractive.

## Critical and Creative Thinking in the Classroom

This institute gives teachers and other educational practitioners an opportunity to work with leaders in the field of teaching for critical and creative thinking. Participants will gain an understanding of the nature of critical and creative thinking, learn classroom techniques for teaching and assessing it, and develop curriculum materials and teaching strategies for infusing it into mainstream instruction; they may also earn graduate credit. The institute offers one-day practitioner seminars, week-long minicourses, and three-week curriculum-building courses, as well as a special seminar for administrators.

Residential accommodations are available for active researchers, classroom teachers, and school administrators who have made major contributions to the field. Among them are Joan Baron, Connecticut Department of Education; Arthur Costa, California State University (Sacramento); David Perkins, Harvard University; Robert Swartz, University of Massachusetts at Boston; Mary Anne Wolff, North Reading (MA) Public Schools.

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## Highlights of Research on Time and Learning

Throughout the 20th century, the amount of time invested by American students in formal education has been increasing. Nevertheless, American students are far behind high-achieving Asian students in both total study time and exposure to rigorous subject matter.

- U.S. students have plenty of slack time—28 hours per week by one measure—for additional formal schooling, outside study, hobbies, athletics, play, and other constructive activity.

- Considerable evidence contradicts the common opinion that hard, rigorous work causes psychological harm, heart disease, and suicide, especially when that hard work is intrinsically motivated and within reasonable limits.

- "Productive time" is the time spent on suitable lessons adapted to the learner—in contrast to "engaged" or "allocated" time, which may be futile if the content or method of instruction is inappropriate for individual students.

- If students at risk are not given appropriate instruction and sufficient time, the result is the "Matthew effect": the academically rich get richer, while the academically poor fall further behind.

- Direct teaching and memorization can be more time-efficient than discursive lessons and diffuse study, especially if educational purposes are clear and explicit.

- Total immersion can produce impressive results, but lessons and study interspersed with other activities are more time-efficient for long-term learning than "cramming," "massed lessons," and "crash" courses.

- Although factual and conceptual mastery, breadth and depth, basic skills and higher-order thinking, and amount and quality of instruction can be distinguished from each other, students need "both-and" rather than "either-or."

—Herbert J. Walberg

### Direct Acquisition

Contrary to what many psychologists had earlier believed, elaborate "encoding" (or "meaningful" association of new chunks of learning with old) is not necessarily superior to spending equal time on direct acquisition, that is, memorization or concentration on the main points to retain. For example:

The preponderance of evidence suggests that word knowledge can be increased at least as much by a simpler, definition-only approach as it can by a contextual approach. . . . Students performed better from reading summaries than unabridged texts . . . even when main points in the unabridged text were underlined, and when the subjects subsequently were tested in a transfer task on their ability to learn new, related text material. . . . Embellishments and details, representing illustrations and extensions of main points, actually hindered the acquisition of central ideas (Dempster 1987, pp. 7-8).

Obviously, if elaborations are considered part of the required subject-matter content, then studying them is time well spent. If not, it is more time-efficient to make goals more explicit and for students to concentrate on the main points.

Which is more important—the amount of information or its connectedness? Breadth or depth? The trade-off is more a matter of philosophy than psychology. Reasonable people may

differ in the amounts of time devoted to each in various subjects; but all need to recognize that time on earth is scarce, and personal excellence requires both.

### Non-Diminishing Returns

"Diminishing returns," that is, smaller and smaller learning gains with each additional hour of instruction or practice may pertain more to physical than to cognitive attainments. Frederick and Walberg (1980) noted that athletic training often shows such returns; increasing the number of hours of swimming each week, for example, leads to diminishing gains in rate per lap. Similar diminishing gains, however, have not been consistently observed with respect to cognitive learning and academic achievement (Ericsson et al. 1980, Walberg et al. 1984. Simon's (1981) assertion that, for practical purposes, both the extent of knowledge and the storage capacity of mind are infinite may explain why memory and related skills can increase constantly with additional time.

### Matthew Effects

Students who are behind at the beginning of schooling or slow to start often learn at a slower rate; those who begin well gain at a faster rate; this results in what has been called the "Matthew

effect" of the academically rich getting richer, originally noted in the Bible (Matthew 25:29) (Walberg and Tsai 1983). That is, learners who begin well often gain at a faster rate; and as time goes on, slower learners fall increasingly behind. This notion characterizes school learning, family influences on development, and socioeconomic advantages in communication among adults (Walberg and Tsai 1983), as well as the development of reading comprehension and verbal literacy (Stanovich 1987).

Ironically, although improved instructional programs may benefit all students, they may confer greater advantages on those who are initially advantaged. For this reason, the first six years of life and the "curriculum of the home" are decisive influences on academic achievement (Walberg 1984a, 1984b; U.S. Department of Education 1986).

Stevenson, Lee, and Stigler (1986; Stevenson 1987) found a striking illustration of the Matthew effect when they observed and tested Japanese, Taiwanese, and U.S. students in elementary school mathematics classes. Cross-nationally calibrated IQ tests showed that all three groups were equally able at the start of schooling; but with each year, Asian students drew further ahead in achievement. A small achievement advantage at the end of the 1st grade grew ever larger so that by 5th grade, the worst Asian class in the sample exceeded the best American class.

The Asian students had a far more rigorous curriculum and worked at a faster pace; they studied far more at school and, with their parents' encouragement, at home, especially those who temporarily fell behind in achievement. In U.S., success was more often attributed to ability; in Asia, to hard work. Like the dangers of racial, ethnic, and special-education classifications, ability tests may encourage a belief in educational predestination rather than effort, the amount and quality of instruction, and parental involvement as keys to achievement.

### Increasing Time in School

How much time is spent in school and

## Getting the Most Out of the School Day

Ida H. Love

In many schools the amount of time lost is frightening. We spend more time getting ready to teach than teaching. In some schools, there is more movement daily than in the elevators in a public building.

Several years ago achievement at J.F. Chick Elementary School was typical of inner-city schools. Today Chick School has achieved national norms at every grade level, except 3rd grade in reading and math, where we fell short by a matter of two or three months. Much of this success is the result of our Time Awareness Program. Here are a few of the problems we addressed in our effort to get the most out of our school day.

**Starting the day.** When the first bell sounds, students often take five minutes to get to their classrooms. Once inside, they can lose another 15 minutes hanging up coats, looking for pencils, sharpening pencils, turning in money for fund-raising, and looking for homework assignments. Ten more minutes are lost when teachers start asking for lunch money and taking attendance, usually calling the name of every child. Finally, everyone is asked to stand for the Pledge of Allegiance and the opening song. After this, directions for starting the morning activities often consume another 5 or 10 minutes. By then, 30 to 40 minutes have been spent doing what could have been done in 15 minutes or less.

Children can be trained to enter the classroom and start to work on morning practice activities immediately. They can also learn to check their presence on a chart, which the teacher can see at a glance. This is not a time to sharpen pencils or visit with other students. Teachers can schedule a special time during the day to sharpen pencils and save early morning time for concentrating on learning.

**Changing subjects.** When finishing one subject and starting another, a teacher can lose 10 minutes without meaning to. Often students use this time to open and close desks, disturb each other, or call the teacher's attention to some unrelated topic.

This loss of time can be reduced by giving the students something to think about to bridge the gap between subjects. Teachers can use an idea related to the objective in the next subject to capture students' attention. They can motivate the children to look forward to "coming attractions."

**Recess and restroom.** Recess is important, but if we are not careful, this block of 20 minutes can turn into 30 or 40. Just putting away classwork and getting in line can take five minutes. Then, getting to the restroom at the end of the hall and finally arriving outside can take an additional 10 minutes. That leaves only five minutes to do organized games, line up to come inside, find a seat, take out work for the next subject, and listen for directions.

There is a remedy to this situation, too. Children can be trained to take out books for the next subject when opening their desks to put away materials from the previous subject. This allows for a smooth start when the class returns from recess. Carefully taught routines are necessary, if the teacher intends to get the students to the restroom, outside, and back into the classroom within the allotted time.

**Assemblies and programs.** Assemblies and programs are necessary, but only within limits. When the excitement starts building, classroom management becomes difficult; additional time is spent just settling down. Some programs become detailed and involved, including making decorations and costumes, learning speeches, and rehearsing frequently. The disruption can be devastating in the instructional plans of every teacher in the building.

The principal must give direction as to what assemblies and programs will be held during the year. It is not wise to allow every activity proposed by every teacher; we must set limits and stand firm. It's urgent that we stress the relationship of these activities to subjects being taught in the classrooms.

Other ways to lose instructional time include too many fund-raising activities, classroom visits from parents, emergency personal calls, late arrivals, intercom calls, poor attendance, and late buses; the list goes on. Even when these are not daily occurrences, together they result in the loss of substantial amounts of time.

The key to successful learning is to allow the teacher to teach all day without breaking the teaching/learning cycle. When we use time well, we see happiness in the faces of students who are learning to read their books and master their lessons.

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**“Learners who begin well often gain at a faster rate; and, as time goes on, slower learners fall increasingly behind.”**

learning? Kemmerer's (1978-79) compilation of various U.S. indexes 1890-1974 appears to be the most extensive for the 20th century. The compilation for the 84-year period shows that all indexes rose substantially:

- the number of days per year, from 135 to 178;
- average days attended by those enrolled, from 81 to 160;
- percentage of 5- to 17-year-olds enrolled, from 69 to 88;
- percentage of 14- to 17-year-olds enrolled, from 7 to 92;
- percentage graduated from high school, from 4 to 75.

Moreover, the median number of school years completed by the adult population rose from about 8 to 12. These gains are impressive; but Japan currently graduates about 96 percent of its students from high school in contrast to the 75 percent rate in the U.S.; Japanese schools have 240 days per year in contrast to 180 in the U.S.; and Japanese students engage in far more extramural study (National Commission on Excellence in Education 1983, U.S. Department of Education 1987).

Despite the lack of a ministry of education in the U.S., Kemmerer's state indexes varied only moderately: For a dozen states on which data were available, the school year in 1970-71 varied from 175 to 180 days, attendance varied from 86 to 97 percent, and days attended varied from 155 to 173. These aggregate statistics, however, conceal large differences that can be found within states and districts. Kemmerer's compilations show, for example, that time allocated for specific subject matter varied widely across communities. Ratios of highest to low-

est hourly time allocations per year varied from 144 and 109 to 1 in science and literature to 12 and 4 to 1 in reading and mathematics. Within one district, students' exposure to schooling varied from 710 to 1,150 hours per year. Kemmerer also noted that absence rates are often higher in urban than in suburban schools, increasing the variability.

Berliner (1979) and Rosenshine (1980) showed wide variations in classroom time allocations and engaged time. More recently, Dreeben and Barr (1987) also noted similarly wide variations in classes with respect to time allocated to reading and also the amount of subject matter covered. Coverage was positively related to the amount of time allocated, difficulty of the material, and average student aptitude in the group. (A subsequent section of this review deals with the generally positive effect of content coverage on learning.)

How much time is needed to learn? This question cannot be answered in absolute terms because it depends on what is to be learned, how it is taught, and the student's aptitude. But Maribeth Gettinger (1987) provided some interesting estimates of time required by fastest and slowest learners in various settings. For a seven-month period, for example, the number of prob-

**“Quality of instruction . . . can be understood as providing optimal cues, correctives, and reinforcement to ensure the fruitfulness of engaged time.”**

lems completed in computer-assisted instruction varied from about 1,000 to 5,000. Programmed-instruction research showed that students varied from 1 to 60 days in the amount of time they needed to complete a unit. When ratios of elapsed time by fastest and slowest learners to reach criterion performance in ordinary classrooms are calculated (Frederick and Walberg 1980), different studies show variations from 1:7 to 7:1 (Gettinger 1987).

***Productive Time: A New Conception***

Substantial variations in time needed to learn suggest that the same instructional content and pace will not be optimal for typical classes of students since some students may already know what is taught, and some may be incapable of learning it until they master prerequisite skills. A number of programs such as mastery learning, cooperative learning, acceleration, tutoring, computer-assisted instruction, adaptive instruction, and diagnostic-prescriptive instruction have a good record of accommodating such individual differences (Walberg 1984b). Because of Matthew effects, such programs are appropriate both in elementary schools to help prevent slower students from falling behind and in high schools when students are likely to need more time and remedial instruction to catch up with their peers.

The evolving psychological theory of individual differences suggests a new insight with educational implications for instructional improvement efforts. First, recall that only about 13 percent of students' waking time in the first 18 years of life is spent in school (Walberg 1984b), and that the National Commission for Excellence in Education urged that such "allocated time" be increased. Second, such scholars as Berliner (1979) and Rosenshine (1980) showed that only a fraction of allocated time is "engaged time" or "time-on-task," when students are studying or attending to lessons.

We can now recognize, however, that still more rare and precious is "productive time," when students are

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actually learning, either from lessons or individual study. Productive time is only a fraction of engaged time since conventional lessons relying on explanation, recitation, and discussion can rarely be suitable to all and since whole-class methods are often inappropriate for given individuals in heterogeneous groups.

Productive time can be increased by suiting instruction to individual differences and by teaching small-group and individually managed study skills

so that students themselves can concentrate more fully on what they require. Thus, other things being equal, increases in allocated and engaged time, as suggested by education reform reports and time theorists, are generally effective; but expansion of productive time is both effective and efficient since it increases accomplishments while conserving scarce human time.

**Effects of Time on Learning**

Since reviews of time are in consensus

about its generally positive effect on learning, research on this question deserves only brief summary in this section. However, several new areas of interest to policymakers neglected in past reviews are worth more extended discussion.

**Time Effects Are Consistent but Modest**

In an extensive review, Frederick and Walberg (1980) concluded that, other things being equal, the amount learned is generally proportional to the time spent in learning. Thirty out of 35 of the studies reviewed showed a positive association. Several of the few that showed no association concerned the number of days in the school year, which varies little across the U.S. (Kemmerer 1978-79), and which is a crude indicator given that takes no account of hours in the school day, absences, and “time on task” (Berliner 1979). Thus, discounting these few studies, and focusing on those that examined years, hours, and minutes of lesson time, it can be said that the association of learning with time is among the most consistent that educational research reveals.

On the other hand, as Frederick and Walberg noted, “Time devoted to school learning appears to be a modest predictor of school achievement” (p. 193). More recent reviews come to the same conclusion (Karweit 1983, Dempster 1987, Heyns 1986, Leinhardt and Bickel, 1987, Pintrich 1986, and Rosenshine 1980). As discussed earlier, the reasons for the consistent (though modest) association is that eight factors other than time affect learning; these include student aptitude, quality of instruction, the classroom learning morale, and environments outside the school. If these were all constant, time alone would appear to be a powerful determinant of learning. But since students normally differ considerably in aptitude and knowledge, as well as in the quality of instruction they receive, the association of time and learning on average is moderate.

If students vary substantially in the amount of time they spend in learn-

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ing—say, a semester vs. four years of high school French or a few years of living in Paris with a French family—then time will appear as a large determinant of learning. But time could also be negatively correlated with achievement if, for example, students were pressed beyond exhaustion, or a school imposed a rigorous standard of achievement and slower students studied more but attained less. Thus, time is but one of several alterable determinants of learning.

### A New Focus of Educational Reform

By several indexes, the amount of time devoted to schooling in the U.S. has increased substantially during the 20th century, but it is difficult to argue that the time allocated is yet sufficient given the increasing cognitive demands of the job market, poor achievement scores of U.S. students by international standards, and the average of 28 hours per week they spend watching television. Requiring typical students to study longer, moreover, hardly seems a threat to their well-being.

Raising time allocations and engaging students for a greater fraction of allocated time are likely to help learning. But increases in "productive time," that fraction of lesson and study time that students spend on suitable lessons adapted to their needs, are also in order. Ordinarily, only a fraction of "engaged time" or "time-on-task" is productive since conventional "whole-group" instruction cannot accommodate the known vast differences in student learning rates and prior knowledge and since students with weak study skills can engage in study and drill without learning.

To accommodate such differences and to reduce Matthew effects (the tendencies of poor students to fall increasingly behind), lessons can be made more suitable to individual learners, and students can be taught to concentrate more fully on what they individually require rather than merely engaging in more study.

Such productive time is both effective and efficient since it increases human values and conserves scarce human time. Further, matching educa-

tional opportunities to personal skills is rewarding and fulfilling in itself. □

### References

- Argyle, M. *The Psychology of Happiness*. London: Methuen, 1987.
- Abramson, L.Y., M.E.P. Seligman, and J. D. Teasdale. "Learned Helplessness in Humans." *Journal of Abnormal Psychology* 87 (1978): 49-74.
- Berliner, D.C. "Tempus Educare." In *Research on Teaching*, edited by P.L. Peterson and H.J. Walberg. Berkeley, Calif.: McCutchan Publishing, 1979.
- Booth-Kewley, S., and H. S. Friedman. "Psychological Predictors of Heart Disease: A Quantitative Review." *Psychological Bulletin* 101 (1987): 343-362.
- Csikszentmihalyi, M. "Toward a Psychology of Optimal Experience." *Review of Personality and Social Psychology* 45 (1982): 317-318.
- Dempster, F. N. "Time and the Production of Classroom Learning: Discerning Implications from Basic Research." *Educational Psychologist* 22, 1 (1987): 1-21.
- Dreeben, R., and R. Barr. "An Organizational Analysis of Curriculum and Instruction." In *The Social Organization of Schools*, edited by M. T. Hallinan. New York: Plenum Press, 1987.
- Ericsson, D. A., W. G. Chase, and S. Faloon. "Acquisition of a Memory Skill." *Science* 208 (1980): 1181-1182.
- Frederick, W. C., and H. J. Walberg. "Learning as a Function of Time." *Journal of Educational Research* 73 (1980): 183-194.
- Gettinger, M. "Individual Differences in Time Needed for Learning: A Review of Literature." *Educational Psychologist* 19, 1 (1987): 15-29.
- Heyns, B. "Educational Effects: Issues in Conceptualization and Measurement." In *Handbook of Theory and Research for the Sociology of Education*, edited by J. G. Richardson. Westport, Conn.: Greenwood Press, 1986.
- Karweit, N. L. *Time on Task: A Research Review*. Baltimore, Md.: The Johns Hopkins University Center for Social Organization of Schools, 1983.
- Kemmerer, F. "The Allocation of Student Time." *Administrator's Notebook* 27, 8 (1978-79): 1-4.
- Leinhardt, G., and W. Bickel. "Instruction's the Thing Wherein to Catch the Mind That Falls Behind." *Educational Psychologist* 22 (1987): 177-207.
- National Commission for Excellence in Education. *A Nation at Risk: The Imperative for School Reform*. Washington, D.C.: U.S. Government Printing Office, 1983.
- National Governors' Association. *A Time for Results*. Washington, D.C.: NGA, 1986.
- Pintrich, P. R. "Instructional Psychology." *Annual Review of Psychology* 37 (1986): 611-651.
- Rosenshine, B. "How Time Is Spent in Elementary School Classrooms." In *Time to Learn*, edited by C. Denham and Ann Lieberman. Washington, D.C.: U.S. Department of Education, 1980.
- Shekelle, R. B. "The MRFIT Behavior Pattern Study." *American Journal of Epidemiology* 122 (1985): 559-570.
- Simon, H. A. *Sciences of the Artificial*. Cambridge, Mass.: MIT Press, 1981.
- Stanovich, K. E. "Matthew Effects in Reading: Some Consequences of Individual Differences in the Acquisitions of Literacy." *Reading Research Quarterly*, 21 (1987): 360-407.
- Stevenson, H. W. "America's Math Problems." *Educational Leadership* 45 (October 1987): 4-10.
- Stevenson, H. W., S.-Y. Lee, and J. W. Stigler. "Mathematics Achievement of Chinese, Japanese, and American Children." *Science* 231 (1986): 693-699.
- U.S. Department of Education. *Japanese Education Today*. Washington, D.C.: U.S. Department of Education, 1987.
- U.S. Department of Education. *What Works: Research About Teaching and Learning*. Washington, D.C.: U.S. Department of Education, 1986.
- Walberg, H. J. *Synthesis of Research on Teaching*, edited by M. C. Wittrock. New York: Macmillan, 1986.
- Walberg, H. J. "Families as Partners in Educational Productivity." *Pbi Delta Kappan*, 84, 6 (1984a): 397-400.
- Walberg, H. J. "Improving the Productivity of America's Schools." *Educational Leadership* 41 (May 1984b): 19-27.
- Walberg, H. J. "Talent as Learning." In *The Nature of Creativity*, edited by R. L. Sternberg. New York: Oxford University Press, in press.
- Walberg, H. J., and T. Shanahan. "High School Effects on Individual Students." *Educational Researcher* 12, 7 (1983): 4-9.
- Walberg, H. J., B. F. Strykowski, F. Rovai, and S. Hung. "Exceptional Performance." *Review of Educational Research* 54 (1984): 87-112.
- Walberg, H. J., and S.-L. Tsai. "Matthew Effects in Education." *American Educational Research Journal* 20 (1983): 359-373.
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