

What's All the Fuss About Instructional Time?

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To understand, predict, and control are the fundamental goals of science. A concept reputed to help reach all three goals in an area of scientific concern would ordinarily be considered extremely useful, quite powerful in terms of its explanatory power, and certainly worth making a fuss about. The multifaceted concept of "instructional time" is such a concept.

THE CONCEPT OF INSTRUCTIONAL TIME

Some scientists and educational scholars find the concept of instructional time to be intellectually unexciting, so commonsensical, and of such obvious importance that it only leads to trivial understandings and to findings that have the status of truisms (e.g., students who spend more time studying learn more) (Jackson, 1985; Phillips, 1985). Some have dismissed the results of research on instructional time as ideology, not research (McNamara, 1981). Others have found that when the *concept* of instructional time becomes the basis for creating a *variable* with which to do research, the measurement issues prove to be vastly more complex than most scientists first believe about this (apparently) conceptually simple variable (Karweit, 1985; Karweit & Slavin, 1982). Some have argued that even when measured adequately, instructional time variables are not particularly powerful (Karweit, 1983; Levin, Glass, & Meister, 1984; Levin & Tsang, 1987). And others note, in line with the cognitive revolution that has changed the focus of contemporary research, that instructional time is really a poor proxy for examining what is going on in the heads of students, which is really where instructional research should be focused (Peterson, Swing, Braverman, & Buss, 1982). The critiques, both the uninformed and the helpful ones, have failed to persuade many scientists and reformers in the field of education. The latter group, in which I include myself, have found this rather commonsensical and quite obvious concept to possess very desirable characteristics. As with some people, its plain character and ordinariness belie its many virtues. The fact is that instructional time has the same scientific status as the concept of homeostasis in biology, reinforcement in psychology, or gravity in physics. That is, like those more admired concepts, instructional time allows for understanding, prediction, and control, thus making it a concept worthy of a great deal more attention than it is usually given in education and in educational research. But before the concept of instructional time can be discussed further, and its desirable properties explored, some clarification of what is meant by instructional time is in order. The multifaceted nature of this concept and its historical roots must first be understood.

Multifaceted Nature

Instructional time should be thought of as a superordinate concept, and in this way is no different from the concept of "mammal," which encompasses organisms as disparate as elephants, mice, platypuses, bats, and us, homo sapiens. Thus, when we speak of instructional time we refer to a family of concepts, some of which have not yet achieved the status of concepts in other, more mature scientific fields. That is, we do not always have agreement about the meaning of the concept and about the operations by which it can be reliably and validly measured. Among the many terms encompassed by the superordinate concept are the following:

- *Allocated time*, usually defined as the time that the state, district, school, or teacher provides the student for instruction. For example a school may require that reading and language arts be taught 90 minutes every day in the second grade. Allocated time is the time block set aside for that instruction—90 minutes a day, or 7.5 hours a week or 300 hours a school year. Sometimes this is called *scheduled time*, to distinguish it from the time actually allocated by teachers. This can prove an important distinction when the *concept* of allocated time is used to create a *variable* for a research study. When that is the case it has been found that measures of allocated time derived from any source other than direct observation of teachers invariably overestimate the actual time provided in schools for instruction in a curriculum area. In the original "model of school learning," the article that began contemporary research on instructional time (Carroll, 1963, 1985, 1989), allocated time was called "opportunity to learn."
- *Engaged time*, usually defined as the time that students appear to be paying attention to materials or presentations that have instructional goals. When the concept of engagement is used to create the variable of student engaged time the variable is usually measured by classroom observers or coded from videotapes of students in learning situations. Students' self-reports of engagement have also been used as a variable. Engaged time is always a subset of allocated time. A synonym for engaged time is "attention."
- *Time-on-task*, usually defined as engaged time on particular learning tasks. The concept is not synonymous with engaged time, but is often used as if it were. The term *time-on-task* has a more restricted and more complex meaning than does the term *engaged time*. It makes clear that engagement is not all that is desired of students in educational environments. Engagement in particular kinds of tasks is what is wanted. Thus, engagement may be recorded when a student is deeply involved in mathematics or a comic book during a time period allocated to science. Time-on-task, however, would not be recorded because the task in which students were to be attentive was science. Time-on-task should be thought of as a conjunctive concept, not nearly as simple a concept as engagement. This distinction, though often lost, makes clearer that time is, in a sense, a psychologically empty vessel (Gage, 1978). Time must be filled with activities

that are desirable (Carroll, 1989). Time-on-task as a variable in empirical research is usually measured in the same ways as engagement, though when the distinction noted above is kept in mind, the curriculum, instructional activities, or tasks in which the student engages are also recorded.

- *Academic learning time* (ALT), usually defined as that part of allocated time in a subject-matter area (physical education, science, or mathematics, for example) in which a student is engaged successfully in the activities or with the materials to which he or she is exposed, and in which those activities and materials are related to educational outcomes that are valued (Berliner, 1987; Fisher et al., 1980). This is a complex concept related to or made up of a number of other concepts, such as allocated time (the upper limit of ALT); time-on-task (engagement in tasks that are related to outcome measures, or, stated differently, time spent in curriculum that is aligned with the evaluation instruments that are in use); and success rate (the percent of engaged time that a student is experiencing a high, rather than low, success experience in class). Academic learning time is often and inappropriately used as a synonym for engagement, time-on-task, or some other time-based concept. Its meaning, however, is considerably more complex than that, as will be elaborated on below.
- *Transition time*, usually defined as the noninstructional time before and after some instructional activity. The occurrence of transition time would be recorded within a block of allocated time when a teacher takes roll or gives back homework at the beginning of an instructional activity; and it would be recorded when books are put away or jackets and lunches are brought out at the end of an instructional activity. The concept describes the inevitable decrease in time allocated for instruction that ordinarily accompanies mass education.
- *Waiting time*, usually defined as the time that a student must wait to receive some instructional help. The time spent waiting to receive new assignments from the teacher, on a line to have the teacher check work, or waiting for the teacher's attention after raising one's hand in class are examples of waiting time. This member of the family of instructional time concepts is concerned with instructional management and is not to be confused with wait-time the time between the end of a question asked by the teacher and beginning of a response by a student. The latter member of the family of instructional time concepts is concerned with instruction and cognition, rather than classroom management (Rowe, 1974; Tobin, 1987).
- *Aptitude*, usually defined as the amount of time that a student needs, under optimal instructional conditions to reach some criterion of learning. High aptitude for learning something is determined by fast learning; low aptitude is reflected in slow learning. This time-based definition of aptitude is unusual and will be elaborated on below. A definition of this type serves to point out how some members of the instructional time family do not, at first glance, seem to be

family members.

- *Perseverance*, usually defined as the amount of time a student is willing to spend on learning a task or unit of instruction. This is measured as engagement, or the time-on-task that the student willingly puts into learning. Perseverance is another of the instructional time concepts that do not at first appear to belong to the family. Although this concept is traditionally thought to be a motivational concept, when operationalized in a certain way, it becomes a variable that is measured in time, and thus becomes an instructional time concept as well.
- *Pace*, usually defined as the amount of content covered during some time period. For example, the number of vocabulary words covered by Christmas, or the number of mastery units covered in a semester will differ from classroom to classroom. In educational systems where standardized tests are used as outcomes, and where those tests sample items from a broad curriculum, students whose teacher exposes them to the most content ordinarily have a better chance of answering the test questions. As the pace of instruction increases, however, depth of coverage usually decreases.

Many other educational and psychological concepts and variables are part of the family of instructional time concepts and variables, but I will not elaborate on them here. Suffice it to say that many areas of educational and psychological study are made more comprehensible when variables are reported in a time metric. Consider these examples: Classroom discipline can be studied through time-off-task. Student cognitions can be reported as time spent processing appropriate or relevant information, as determined from the self-reports of learners. Teacher decision making can be studied without using instructional time variables, as when a researcher reports the number of decisions of a nontrivial nature that are made during interactive teaching, as coded from a teacher's response during stimulated recall. But teacher decision making can also be studied by recording the number of decisions made per unit of time say per hour or per day; by classifying the types of decisions that are made during various parts of the lesson; by analyzing the kinds of decisions made by segment of the school day or of the school year; by measuring latency when teachers are confronted with a simulated classroom problem to solve, and so forth. Each of these ways of studying teacher decision making brings into play instructional time. Scores of important and seemingly disparate concepts and variables are sometimes members of the instructional time family, making instructional time a multifaceted concept. It is not as clean a concept as "peninsular," but much more like the concept of "game" that Wittgenstein (1968) describes in his treatise on language. That same concept is used to describe football, poker, dating, Nintendo, publishing of academic articles, and a host of other activities held together by a slim but somehow recognizable "family resemblance."

Historical Development

Concern about instructional time is not new. No adult who ever taught a child could fail

to learn that instructional time., particularly time-on-task, is an important instructional variable. Throughout the ages, in virtually all treatises on teaching and learning, the obviousness of this relationship was made apparent. In the scholarly literature of modern times we find Currie (1884) in an early teaching methods book, *The Principles and Practice of Common School Education*, informing teachers that

The art of teaching [consists] of the means by which the teacher sustains the attention of his class. By attention, we do not mean the mere absence of noise and trifling; or that inert passive state in which the class, with eye fixed on the teacher, [gives] no symptom of mental life; not that intermittent and almost unconscious attention bestowed on some casual topic which strikes their fancy; not the partial attention given by a few ... in the immediate neighborhood of the pupil addressed. The only satisfactory attention is that which is given voluntarily and steadily by all during the entire instruction and in which the mental attitude of the class is actively engaged along with the teacher in working out their own instruction. (p. 224)

In Currie we see concern for what J. B. Carroll (1963) called perseverance—the willingness to attend – and for what some call *cognitive engagement or active learning*, variables discussed in contemporary research that are part of the instructional time family of concepts. The terms cognitive engagement and active learning are used by some researchers to refer to time spent by students processing information in a nonautomatic, nonpassive way, and at a deeper level, with more genuine thought about the information that is being processed. It is worth noting that the first empirical study of classroom teaching that was used to inform arguments about the school curriculum was also a study of instructional time, with a particular concern for cognitive engagement or active learning. Joseph Mayer Rice (1897), rather than philosophizing or using moral reasoning to inform his position about schooling, as was the custom of the time, instead used modern scientific methods. He observed teachers and students in classrooms and tested learning outcomes associated with instructional time spent on spelling. His report of the "spelling grind" – the deadly, daily, extensive time spent on spelling – is a landmark study in the history of research in education, particularly in research on teaching. He examined the effects of allocated time on learning, and he discussed his observations of engaged time and learning, particularly pointing out the lack of cognitive engagement by even the most studious of the elementary school children that he observed. His research yielded a negatively accelerated, asymptotic learning curve as a description of the relationship of spelling time to achievement in spelling. This curvilinear relationship, showing first an increase in spelling achievement as time spent in spelling drill increases, and then a lack of any increase in achievement after a certain amount of time in spelling drill was spent, still is a reasonable description of a good deal of school subject-matter learning.

E. L. Thorndike (1913), in his influential writings on the "laws of learning," is best remembered for his law of effect. But of great concern to him was the law of exercise,

of practice, whereby he made clear that "duration" was a major and a powerful variable in the learning process. William James, the great philosopher, psychologist, and educator, in his talks to teachers, beginning around 1891 made similar points about the importance of attention (1904/1983). He noted that sustained time-on-task is one of the major factors in school learning and thus the control of this variable was a major means by which teachers could accomplish their work. The turn of the century also saw the works of another philosopher, psychologist, and educator – John Friedrich Herbart – rise to prominence. Part of the agenda of the Herbartians was to teach management of instructional time. An emphasis on teacher planning was designed to aid teachers in the control of attention and to help them specify lessons and content that were compatible with the goals of education. The Herbartians probably had it right. Contemporary research suggests that there probably are no effective teachers, as measured by standardized achievement test scores, who are not good at the management of instructional time, the control of attention, and the alignment of curriculum content with the desired outcomes of instruction. These simple, alterable variables are embodied in the more modern empirically derived (though hardly new) concept of ALT defined above.

At the prestigious University of Chicago, the educational psychologist Charles Judd (1918) suggested that prospective teachers learn to watch the classroom activities of students – their engagement with the curriculum – as part of their education. Judd would have a prospective teacher observe instruction and ask: How long does a child keep his or her attention fixed on one thing? What are the physical manifestations of attention and lack of attention? What are the distractions to attention in the environment? How does the teacher keep attention from flagging? Are there individual differences in attention? What is the student's rate of instruction – Is the child fast or slow? Judd's attention to the topic of attention was influential, particularly since he served as a critic and advisor to another Chicago professor, Henry C. Morrison. Morrison's (1926) brilliant high school teaching methods book showed a sophisticated understanding of instructional time. He designed and described scales for studying student attention that are still used today (see, for example, Smyth, 1979, and the Beginning Teacher Evaluation Study, Fisher et al., 1980). Morrison's interest in quality of instruction and both allocated and engaged instructional time led him to develop the mastery system of teaching and learning, now associated with Bloom (1968).

Morrison's work sparked a number of studies of attention and achievement, but this line of research was eventually dropped. Smyth (1985) reviewed that work and noted a number of reasons that the research fell out of favor: It was designed to evaluate teachers, not inquire into the learning process; attention or engaged time was measured rather than time-on-task, so that curriculum issues were not addressed in the investigations; the belief behind some of the research was that every child should be paying attention; there was no theoretical work to hold together the findings; and so forth. In a review of the topic by Jackson (1968), it was suggested that one reason for the abandonment of this line of research was an increasing distaste for any research that smacked of authoritarianism. Since many of the people doing research on this topic

were concerned with the evaluation of teachers and the control of pupil behavior, their work fell out of favor. It was a time when the "democratic classroom" (e.g., Lewin, Lippett, & White, 1939) was favored over the "controlled classroom." Although the zeitgeist determined that the attention-achievement line of research was not to be actively followed, some of the findings obtained were rather dramatic. Shannon (1942), for example, in a well-designed study, found zero-order correlations between attention and achievement to be *only* (his interpretation) .67 for boys and .34 for girls. In congruence with the zeitgeist, he concluded that the research line did not lead anywhere. Today such findings would not possibly be considered trivial and uninteresting. The instructional time research focusing on attention and its variants reappeared in the late 1950s. Bloom's (1953) study of students' thoughts during college classes, obtained through stimulated recall, sparked a series of studies of attention. Carroll's model of school learning came out in 1963 and Jackson's *Life in Classrooms* came out in 1968. Both of these influential works attended to instructional time variables, though in markedly different ways. The zeitgeist had changed. Studies by Lahaderne (1968), Cobb (1972), Ozelick (1973), and Anderson (1976), to name a few, all found positive correlations between time-on-task and achievement. The sign of the relationship cannot possibly be in doubt. Only the magnitude of the relationship is still open to dispute, with some claiming that the amount of variance accounted for by attention-like variables is only about 1-2 percent (Karweit, 1983), and others, including myself, claiming that it is considerably more (see below). This line of research continues today, in modified form, reflecting the contemporary cognitive zeitgeist (for example, Peterson, Swing, Braverman, & Buss, 1982).

Many of the studies of instructional time around the turn of the century used the newly developed survey method to gather information about allocated time for instruction. The American educational system was peculiar, in that local (rather than state or federal) authorities determined the length of the school year, the length of the school day, and the number of grades of instruction that they were willing to support. The data on these variables revealed enormous variation from community to community in the period 1826-1926 (Mann, 1928). At the end of the 1920s a more homogeneous national educational system developed, with increasingly less variation in the hours, days, and years of schooling that districts claimed to provide. Today, in the United States, we have more state support of schooling than ever before. With the autonomy of the local school district in decline, there is less variation across districts on these instructional time variables. Nevertheless, though the range of the number of days of schooling is now narrow (it is approximately 180 days a year in each state), there are elementary schools providing under 5 hours a day while some provide over 6.5 hours a day; some provide half-day kindergartens, some provide all-day kindergartens; some provide summer programs and after school academic programs, some do not; some have high dropout rates and high teacher and student absenteeism, some do not, and so forth. These are all instructional time issues that are monitored regularly by the research community (e.g., Association for Supervision and Curriculum Development 1985; Goodlad, 1984). They are monitored because they are believed by many people to be important indicators of instructional productivity, although they are certainly molar and more coarse indicators

of school or teacher efficiency compared with the time-on-task measures.

Many of the contemporary arguments over the role of allocated instructional time and school achievement were an outgrowth of the Coleman report (Coleman et al., 1966; Jenks et al., 1972), wherein the claim was made that quantity of schooling (measured by number of school days, absences, hours of schooling, and so forth) did not seem important. Wiley and Harnischfeger (1974) countered that claim, finding large instructional effects for quantity of schooling. But Karweit (1976) soon countered their claim, finding considerably smaller effects for quantity of schooling. Others finding effects for this molar variable include Heyns (1978) and Hyman, Wright, and Reed (1975). The latter is a particularly interesting study of the long-term effects of quantity of schooling on the overall quality of the life one leads.

It should be noted that the effects of quantity of schooling are more difficult to assess in developed countries, where the ranges of quantity and the differences in quality of schooling are actually quite restricted. The effects of quantity and quality of schooling are much clearer in lesser developed countries, where hours, days, and years of schooling, and teachers' preparation, have large effects on achievement and economic growth (Heyneman & Loxley 1983). Despite the difficulties of working with a molar variable like raw instructional time in developed countries, Walberg (1986) estimates that the effect of quantity of instruction on achievement is clear and of great relevance to policy debates about education. Looking at 31 studies of instructional quantity and achievement, across a variety of grades and subject areas, Walberg estimated their median correlation to be .40, with the range of correlations between .13 and .71. All were positive in sign. Partial correlations, controlling for social class, ability, and other factors, were similar in range and sign, with a median of .35. A substantial effect size for quantity of schooling has been established, and a substantial proportion of variance in achievement has been accounted for by this variable. It may be a weak variable to some too molar to be useful for others, and an uninteresting variable from a psychological perspective. But the historical interest in using quantity of schooling as an indicator of school productivity and of student achievement has been validated.

Another contemporary line of research on quantity of schooling is considerably less molar, focusing on the quantity of time allocated to particular curricular areas, often called opportunity to learn. While it sometimes has been difficult to show effects for the overall quantity of schooling that a person is exposed to, there has been less difficulty demonstrating that the quantity of time spent in curriculum area X or Y or Z yields large effects for individuals or nations. Allocated time in quadratics, say, is likely to be the maximum amount of time for students to have all opportunity to learn quadratics. Within reasonable limits, a teacher, school district, or nation that allocates more time to this content area of mathematics curriculum is likely to have students that perform well in this area. In the international comparisons of school achievement of recent years it has been well established that countries that allocate more time to particular topics have greater relative success in those topics (Purvis & Levine, 1975).

Understanding the concept of instructional time means understanding that it is a multifaceted concept. It is the term used for a family of other concepts and variables, some of which are clearly members of the family (time-on-task, pace), and some of which do not at first glance resemble their relatives at all (perseverance, aptitude). To understand the concept of instructional time also requires a little knowledge of its family history. Concern with the concept goes back to antiquity. In the more modern American context the turn of the century saw concerns for both engaged and allocated time. Contemporary research reveals virtually incontestable evidence of positive relationships between these historically interesting instructional time variables and student achievement, though the magnitude and the educational significance of the effects are still debated. I believe, however, that the magnitude of the effects is quite large and that instructional time concepts and variables have great educational significance because they help us to understand, predict, and control instruction.

UNDERSTANDING, PREDICTING, AND CONTROLLING INSTRUCTION

Understanding, prediction, and control are different but interdependent goals of scientific research. Sometimes we can understand phenomena well, such as earthquakes and weather, but not predict or control them. Sometimes we can predict and control well, as when we take an aspirin for a headache. But until very recently no one understood why an aspirin worked the way it did. As much as possible we want to reach all three goals through our research. Instructional time variables help to do that.

Understanding

In 1959, J. B. Carroll, in a work of enormous influence, changed the way we think about instruction and individual differences. His insights were about the nature of instructional time (Carroll, 1963). He brought forth a theory about and generated a testable, quantifiable model of school learning. He gave the concepts of aptitude, perseverance, and opportunity to learn a common metric, something previously totally lacking in educational research. His metric was time, and his theory illuminated the functional relationships between those variables and a measure of school learning.

The Carroll model. Carroll defined aptitude as the amount of time needed to learn content X to criterion Y, assuming a high level of motivation, ample opportunity to learn, and a high quality of instruction. In a moment of genius Carroll made aptitude (sometimes thought of as intelligence or ability) a nonmysterious construct. He found a way to uncouple notions of aptitude from notions about genetic endowment and social class effects on the ability to learn. He made academic/intellectual aptitude a simple time variable. If school personnel and the parents they serve had the desire, they need never again characterize students as smart or dumb, bright or dull, gifted or disabled. These common descriptions of individual differences associated with the notion of academic or intellectual aptitude no longer apply when aptitude is defined as the time it takes a student to learn something under optimal conditions. Students can then be classified only

as fast or slow – terms that describe an alterable variable, one that schools could accommodate to, if they wished. For a child and his or her parents, slowness can be overcome by perseverance, increased opportunities for learning, practice, and so forth. On the other hand, stupidity, dumbness, dullness, and the like appear to be forever! It is important to note that this alternative view about the nature of aptitude is well supported by empirical research, though it is usually ignored. Gettinger (1984) reviews a substantial body of research in which measures of time to learn a particular kind of subject matter and conventional measures of intelligence, have both been used to predict learning. The time to learn (TTL) measures are usually as good or *better* predictors than are the intelligence measures. Moreover, the variance shared by these two measures is not too large, indicating they are different, though related, measures of aptitude. For school people, however, aptitude measured as simple TTL would yield much more useful information than aptitude measured as intelligence. For example,

Using a measure of TTL one can report . . . that a student needs three times the average number of trials or repetitions as the average student to learn twelve spelling words, but only two times as many trials to learn twelve vocabulary words. For educators, these statements may be more informative . . . than saying that this student has an IQ at the 33rd percentile. (Gettinger, 1984, p. 26)

Aptitude in Carroll's model was defined simply as a rate of learning variable. This definition helps us understand how major changes in school philosophy and school organization could occur. From Carroll's view of aptitude we would want to promote more multi-age classroom groupings and ungraded schools, so that children can proceed through school at the rates their aptitude in different subject areas allows them to proceed. While not denying the importance of some general factor of intelligence, Carroll's definition of aptitude promotes a more differentiated view of learning. Aptitude is defined as the time to reach criterion in a particular area of instruction. It is not expected that students will ordinarily display the same aptitude (i.e., have the same needs for TTL) in mathematics reading, science, and physical education. Thus, multi-age classroom groupings, ungraded schools, and the ability to place a student at *any* level in *any* subject area are implications that can be derived from this theory. Mastery orientations, where time is open-ended, and reteach cycles, which are used for students who do not attain criterion on the first try, are also compatible with this theory, as Bloom (1968) cleverly noted when he melded Carroll's theory with Morrison's (1926) unit method of instruction. The assignment of incomplete grades, rather than failures, for work that is not satisfactory is also derived from a time-based definition of aptitude. In a world of smart and dull humans, those who do not meet criterion are failures or unsatisfactory individuals. In a world of fast and slow humans those who do not reach criterion receive nothing more than an incomplete notice until they do pass., It is both sensible and humane to view instruction in this manner.

The transformation of aptitude from a mysterious and hard-to-modify quality of the individual into an instructional time variable, and an alterable one at that, is an important contribution to our thinking about students and about schools. The increased

understanding of instructional processes through this insight may itself be worth all the contemporary fuss about the importance of instructional time for our thinking about schooling.

But Carroll took the equally mysterious concept of motivation and made that into a time-based concept as well. At the time Carroll was writing, the behaviorists would not even use the word *motivation* because it connoted mentalistic processes. They recommended that operations like "time since last feeding" be their only "motivational" construct. Carroll used a similar form of operationalism for his motivational construct. He defined perseverance as the time a student was willing to be engaged in instruction. Engagement, attention, or time-on-task, a behavioral and quantifiable instructional time measure, became the way to gauge the previously mysterious concept of motivation in schoolchildren.

Carroll also turned opportunity to learn into an instructional time concept. It had been clear that unless a student was provided with the opportunity to learn some things – a foreign language, physics, quadratic equations, the use of knife and fork – he or she might not learn them. Opportunity to learn some aspects of social studies, reading, and simple mathematics may sometimes be provided informally, in one's family, through television, and on the streets. But other curriculum content is only learned in schools. School subjects are deliberate, not informal attempts to teach particular things. They always result in a determination of time for that teaching. Thus, opportunity to learn is quantifiable as duration of time allocated for instruction, or allocated time as described above.

School learning in some particular content area is defined by Carroll as time spent learning in that content area divided by the time needed to learn that kind of content.

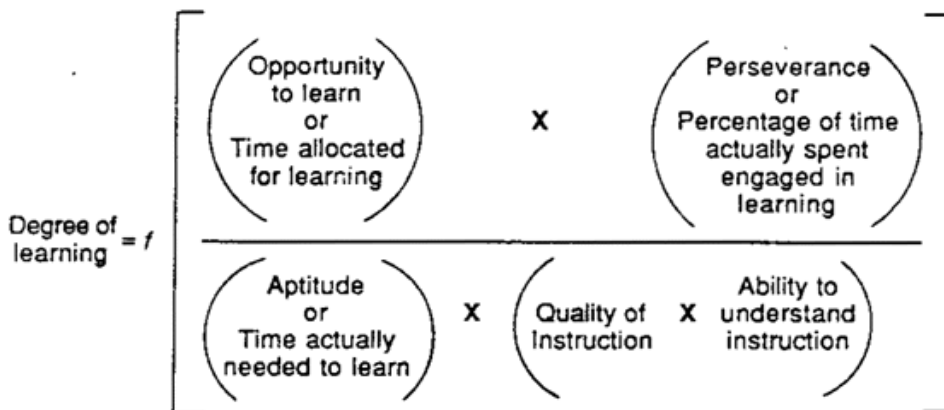
$$\text{Degree of learning} = \frac{\text{Time spent learning}}{\text{Time needed to learn}}$$

Time needed to learn

The numerator is composed of the smaller value of perseverance and opportunity to learn, that is, the smaller value for the total time, allocated for learning, or the time the student actually is willing to spend learning. The denominator is composed of aptitude, the time needed to learn, modified by some other factors. One of these factors is the quality of instruction (when quality is high, learning for an individual of a particular aptitude level is faster; when quality is low, learning for that individual is slower). Mastery learning, for example, is designed to increase the quality of instruction as well as attend to the time actually spent by students. Thus it takes into account both the numerator and the denominator and, perhaps, that is why it is quite effective in some circumstances. Another factor affecting the individual's aptitude for learning (time needed) is ability to understand instruction. With this construct Carroll attempts to point out that people will learn relatively quickly or slowly depending on their previous learning in the subject-matter area and its degree of intellectuality or abstractness. That is, one's ability to understand instruction in an area is determined by the aptitude one has for learning in that

area (a time measure), modified by the quality of instruction and one's ability to make sense of that instruction. Quality of instruction may be high, but if very abstract subject matter is involved or one is unfamiliar with the topic, then increased time may still be needed. Conversely, quality of instruction can be low, but if one knows the subject and it is not terribly abstract, one can learn on one's own, and time needed to learn will be less. The full Carroll model is shown in Figure 1.1

FIGURE 1.1 The Carroll Model



The three major variables that would be used in a test of the model, the predictors or independent variables in a research study, are in the same metric-time. That is a scientific achievement of some note. When obviously important instructional concepts such as perseverance, aptitude, and opportunity to learn can be put into a common metric, one that has an absolute zero and equal intervals (i.e., a metric that has the properties of a ratio scale), quantification and formal modeling are possible. It is unlikely, for example, that there would be much of a scientific field of economics without a common metric such as money. A common metric such as 1970 constant dollars can allow the development of comparisons of productivity and efficiency across different settings and time periods; it allows the formulation of input-output models; and it provides an accounting system for keeping track of scarce resources. In the same way a common metric in education enhances our understanding of instruction immeasurably. It also allows for comparisons of productivity and efficiency and provides an accounting system for keeping track of scarce resources such as the teacher's planning time or the time devoted to one-on-one instruction. Although some educators resist the attempts to investigate education by means of economic production functions, with instructional variables put into a time metric, input-output models of great sophistication are at least possible to use (see Brown & Sachs, 1985, for example). Should someone find it desirable to do so, a degree of scientific rationality can be brought to bear on the educational system.

Mastery learning. The mastery model of instruction proposed by Bloom (1968) and

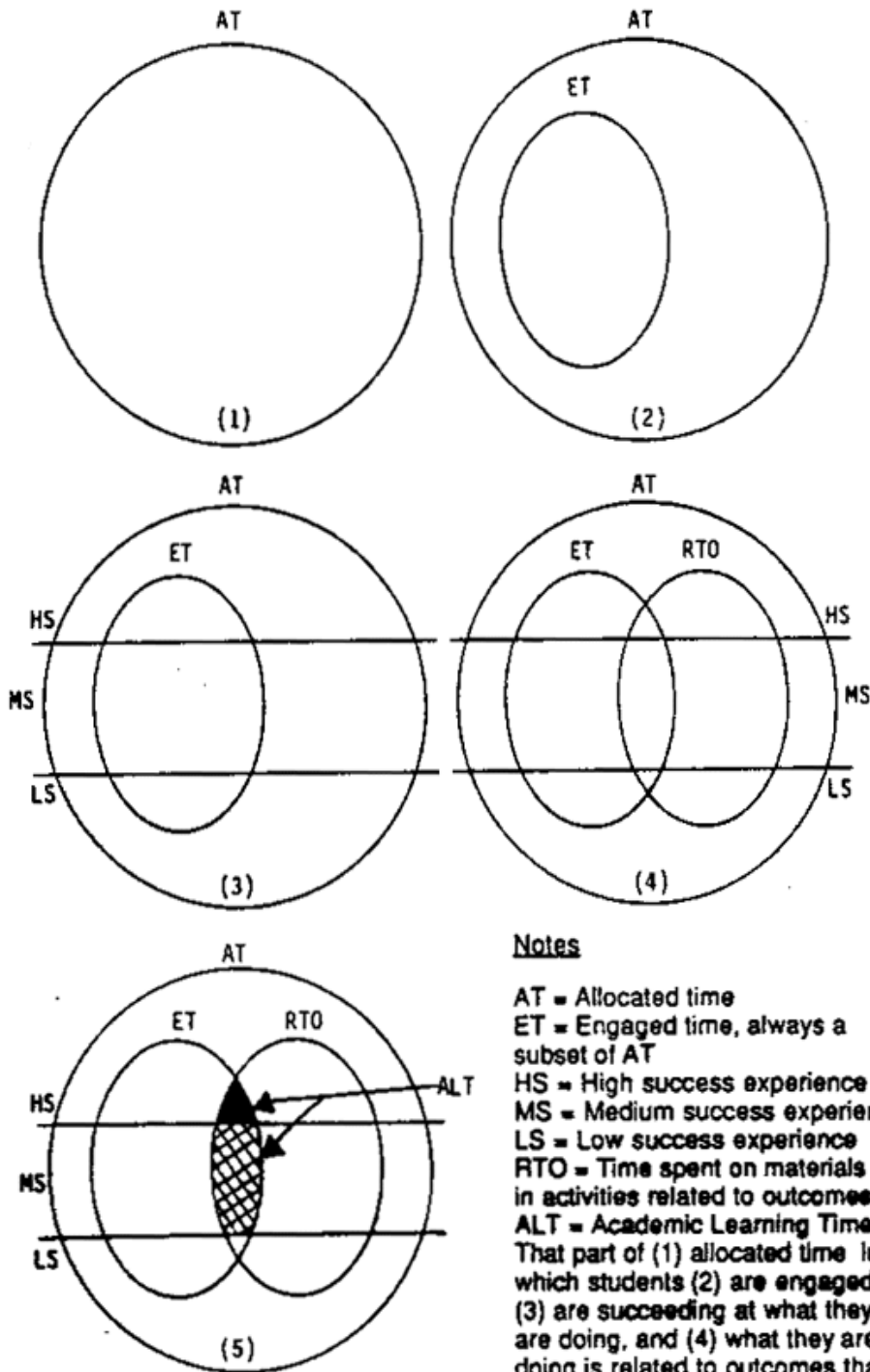
expanded upon by his students has already been noted. At the heart of mastery is the belief that with sufficient time to learn and with high quality instruction, virtually all students can learn what only a small number were able to learn under traditional instruction. This is so radical a view of human potential that mastery approaches have been dubbed a plot to teach "Russian values" to children by a member of the Arizona state board of education and have been labeled "therapy education" by the influential conservative spokesperson Phyllis Schlafly (Burns & Kojimoto, 1989). Mastery models of instruction contrast with traditional (FIGURE 1.1 HERE) models of schooling, and therefore they enrich our understanding of the instructional process by providing us with variation in the *means* of instruction. This is an important point. An impoverishment in the means of instruction is a problem that experimentalists in education have had to deal with for a long time. Genuine variation in treatment, the comparative method, can enhance a research design regardless of whether it is experimental or naturalistic. The observational, experimental design and the statistical skills of our research community are often put to their finest use when there is genuine variation in the means of instruction. Mastery is different enough from traditional instruction to provide that kind of variation.

The Harnischfeger-Wiley model of learning. Combining some of the ideas of Carroll and Bloom, Harnischfeger and Wiley (1985) made a strong case for understanding schooling from the students' perspective. All the things we want students to know and do, they said, must be mediated through the students' pursuits. District or state policy, teacher behaviors, and instructional materials all affect student achievement in some way, and that way is *not* direct. Achievement comes from the active behavior of students – their involvement in their own learning – and this is the only proximal causal factor of achievement in their model. All the variables that are interesting to study from an educational perspective (teachers' skill, intelligence of teachers and students, teachers' plans, curriculum material, texts, computers, allocated time policies, and anything else that can be thought of as worth studying) have their effect on students through the students' active involvement in learning. The most important concept for these investigators is active learning time or time-on-task. They note as well that achievement results not only from active learning time but from active learning time with particular content. Thus, the primary way to understand how schools manage to accomplish their instructional goals is to study *what* students attend to and the *duration* of that attention. Direct links between educational variables and achievement cannot be found in this theory. Those that are reported in the literature have masked the real learning relationship, which is between the educational variables and student active learning on the one hand, and between active learning and achievement on the other hand (Harnischfeger & Wiley, 1985).

Some of the developmental work on the Harnischfeger-Wiley model was done in conjunction with the project staff of the Beginning Teacher Evaluation Study (Fisher et al., 1980), who developed their own model of academic learning time to help them understand classroom instruction (Berliner, 1987; Denham & Lieberman, 1980).

The Academic Learning Time model. In the ALT model, learning in a particular content area, say, two-column addition with regrouping, comprehension in reading, or map reading in geography, is seen as a direct result of minutes accrued during ALT. As defined earlier, the concept and variable of ALT is that part of allocated time during which a student is engaged with materials and activities in which a high level of success is attained, and in which the materials and activities are related to outcomes that are valued. Four variables make up ALT-allocated time, engaged time, success rate, and the degree of alignment of the curriculum with the outcome measure. A visual representation of this concept is provided in Figure 1.2

FIGURE 1.2 A Visual Representation of ALT



Notes

AT = Allocated time
 ET = Engaged time, always a subset of AT
 HS = High success experience
 MS = Medium success experience
 LS = Low success experience
 RTO = Time spent on materials or in activities related to outcomes
 ALT = Academic Learning Time: That part of (1) allocated time in which students (2) are engaged, (3) are succeeding at what they are doing, and (4) what they are doing is related to outcomes that are desirable. (5) ALT for young children (5th grade and below) is the small dark section; ALT for older students is both the dark and the cross-hatched sections.

The four variables that make up ALT when combined, yield a complex variable that is in a time metric. A rate of accrual for ALT can be determined in any curriculum content area, and this rate has both logical and empirical relationships with outcome measures in that content area. The ALT model of school learning is distinguished from Carroll's model in two ways. First, following the lead of Harnischfeger and Wiley, the ALT model is more explicit about content. It includes directly in the model the curriculum content areas and the outcome measures to assess that curriculum content. It recognizes that even time-on-task is not quite the most desirable measure to study about a student's behavior. What really is wanted is a measure of time-on-the-right-tasks. Using outcome measures as a way to assess whether the "right" task is engaged in is a way to attend to this issue. The variable defined as the percent of time that students are engaged in activities or with materials that are related to the outcome measures that are used is a means to bring into the instructional time model important concerns about curriculum and curriculum assessment. It is very hard to demonstrate learning if the curriculum and the outcome measures used to assess learning are not aligned, as so often is the case in schools (Schwillie et al 1983).

A second distinction to be noted is the inclusion of success rate in the ALT model. The variable of high success is coded when observers have evidence that the time-on-task spent by students is resulting in very high success for the students, say, around 70% or 80% or 90%, as determined from actual workbook problems completed, responses to teacher's questions, or participation in discussions. Low success could be defined as around 30% or 20% or less correct responses. It is likely that high success is a crucial variable for young children, and so high success is featured prominently in the ALT model of instruction. With older children, however very high levels of success are probably less crucial. Thus the definition of ALT might be modified to include high and medium levels of success when thinking about instruction for children above the fifth grade. At all ages, however, low success experiences with the school curriculum always appear to predict low performance on outcome measures for students.

The use of success rate in the ALT model is of particular significance because it attempts to provide a time metric for the two nontime variables in the Carroll model – quality of instruction and ability to understand instruction. The use of success rate is an attempt to transform these concepts into a single instructional time variable, using the following logic: If a student's success rate is high, then either the quality of instruction or the ability to understand instruction, or both, must be high. If success rate for a student is low, then either the quality of instruction or the student's ability to understand instruction, or both, must be low. Although success rate was created to operationalize Carroll's concepts of quality of instruction and ability to understand instruction, it is also a way to assess a teacher's ability to take into account individual differences among students (Marliave & Filby, 1985). Competency in matching curriculum to students should result in a high level of success for the students. Conversely, a lack of such competency should result in low success. This teaching characteristic may be part of what Carroll meant by "quality," but it is an important characteristic of teaching for

which the research staff working on the Beginning Teacher Evaluation Study wanted to find an indicator.

These special features of ALT – explicit concerns with curriculum and the use of success rate as an indicator of a teacher's skill in matching curriculum materials to a student's ability, as well as having success rate provide a measure of the quality of instruction being offered – give ALT capabilities for helping us understand instruction. The predictive qualities of ALT are discussed in the next section. Here we note the improvement in our understanding of instruction in classrooms and schools when we refer to the ALT model.

In studies of teaching in the process-product research tradition, many raw empirical findings have been produced. But these reliable findings have not been well understood, and they have not been tied together by any theoretical system. For example, we have correlational or predictive information that teachers who structure their lessons, use fast pacing, monitor student production during seatwork, provide a safe and orderly environment, or communicate high expectations have students that achieve the most (see, for example, Gage & Berliner, 1988). By offering reasonable explanations about why those empirical relations occur, the ALT model of instruction helps us to reach our scientific goal of understanding instruction (Berliner, 1987). For example, structuring by a teacher (announcing where students should be, what they should be doing, and what they are responsible for; giving directions; providing advance organizers; and so forth) helps students understand their responsibility in a learning task, increasing their perseverance and thus their academic engaged time (the measure of perseverance). Structuring also is a safeguard against students working on the wrong task, thus increasing the likelihood that what they work on is related to the outcomes that are likely to be assessed. And structuring is likely to increase success rate by reducing confusion about the learning task. Because three of the ALT factors could be affected by appropriate structuring behavior on the part of teachers, such teachers are likely to have higher levels of ALT. In a particular curriculum content area, high rather than low levels of this instructional time variable are positively associated with student achievement.

We may similarly hypothesize that increased pace results in greater opportunity to learn, since fast pacing through the curriculum allows a teacher to make some (perhaps only a small) allocation of time to a particular topic or task that is scheduled to be learned. The likelihood of higher performance on an outcome measure that is aligned with the curriculum is greater if at least some exposure to that curriculum has taken place. Thus pace is related to achievement because of its connection with allocation of time. But a brisk pace can also contribute to increased engaged time because students may not get bored with the topics they are working on if they are moving along at a snappy rate. Many contemporary critics of schools note the incredible boredom of students in the schools and the amount of repetition of material that students face, grade after grade (Goodlad, 1984). Thus a fast pace may influence two of the variables making up the concept of ALT. The ALT concept is also sensitive should a teacher go too fast, since the success rate variable is likely to go down if the pace is beyond the capabilities of

students to keep up. And boredom due to such lack of success would also appear. In these circumstances the total accrual of ALT would be diminished. Theoretically ALT should be at a maximum in a class that has a brisk, but not too brisk, pace through the prescribed curriculum. That is, among other things, ALT may be regarded as a measure of the appropriateness of decisions about the pace of instruction.

Teachers who monitor their classes during seatwork usually have students that achieve higher than teachers who do not engage in such monitoring. The ALT model, as well as common sense, would attribute this to the fact that students are likely to attend at greater rates when their teacher is walking around the classroom than when their teacher is not. A teacher that is monitoring his or her class is also likely to catch a mismatch between a pupil and the curriculum materials assigned, by spotting in unusually high error rate. Correcting that problem results in higher success rates. Attention and success rates are two of the instructional time variables affecting ALT, so it is no wonder that higher levels of monitoring appears to be an effective teaching behavior. We may hypothesize, too, that a classroom management system that is safe and orderly provides for greater allocations of time to the academic curriculum areas and promotes high engagement rates during instruction, thereby maximizing the accrual of ALT. And the communication of high expectations to students, rather than low expectations, probably increases their perseverance and their success rate, thus leading to the accrual of more ALT.

To generalize, any proposal to change instructional materials or teaching practices in the classroom that does not affect allocated time, engaged time, the rate of success, or the alignment of the curriculum with the outcome measure that is used to assess learning is likely not to affect student achievement. The strongest statement derived from the ALT model of instruction is that Unless ALT is affected in some way, there will be no changes in student achievement at all. The point of using the concept of ALT to interpret the extant data in research on teaching is simple: Instructional time variables that are observable and relatively simple to measure can provide an understanding of instructional processes that reasonably account for the effects that have been found in scores of empirical research studies. That is precisely what a theory is supposed to do. A scientific theory should not be judged on its truthfulness, its completeness, its elegance, or its complexity, although these would, indeed, be nice qualities for a theory to exhibit. Rather, a scientific theory should be judged on its usefulness. Theories of instruction that are associated with the Carroll model or its derivatives such as the ALT model of instruction, incorporate some unglamorous and unsophisticated instructional time variables. But they have passed the test of usefulness with flying colors. Instructional time concepts and variables, in one manifestation or another, appear to serve well one of the three goals of science, namely, understanding. Let us now examine how well they serve another of those goals.

Prediction

As noted above, in the brief history of research on instructional time, evidence and

common sense inform us that the sign of the relationship between instructional time measures and measures of achievement is positive. The different instructional time measures, however, have different characteristics, and these affect the magnitude of the relationship. In general a weaker relationship is found between allocated time and achievement than between engaged time and achievement. The relationship is stronger for time-on-task or ALT than it is for engagement alone. And self-report measures of students' cognitions, assessing moment-to-moment attention during lessons, may provide even stronger relationships (Peterson, Swing, Braverman, & Buss, 1982).

The predictive powers of the complex instructional time variable of ALI' were assessed under a number of conditions. Those data are presented in Tables 1.1 and 1.2. The tables show that the average residual variance in reading and mathematics achievement that could be accounted for by ALT variables (allocated time engagement, success rate) was quite substantial. This is the variance in achievement that can be accounted for after the relationship of student pretest data and the effects of error in the regression equations have been statistically removed. When the variable of ALT was used to predict the variance in achievement that is still unaccounted for in the equation, for a group of low to average ability students in grades 2 and 5, an average of about 8 or 9 percent of the residual variance in a large set of outcome measures could be accounted for.

TABLE 1.1 Residual Variance Accounted for When ALT Is Used to Predict Achievement in Reading

Grade	Time Period	Criterion Measures	Variance Accounted for by ALT	
			Residual	Average Residual
2	Oct-Dec	1 Comprehension	.09	.06
		2 Decoding	.02	
		3 Word structure	.12	
		4 Total reading	.03	
2	Jan-May	1 Comprehension	.03	.12
		2 Decoding blends	.17	
		3 Decoding variant consonents	.13	
		4 Spelling	.21	
		5 Word structure	.03	
		6 Syllables	.14	
		7 Total Reading	.11	
5	Oct-Dec	1 Word meaning	.03	.06
		2 Comprehension	.06	
		3 Word structure	.02	
		4 Total reading	.15	
5	Jan-May	1 Word meaning	.15	.13 ^a
		2 Comprehension	.21	
		3 Word structure	.05	
		4 Total reading	.11	

Sources: Fisher et al., 1980; Borg, 1980.

^a Average over 19 equations, two grades, and two time periods = .09

TABLE 1.2 Residual Variance Accounted for When ALT Is Used to Predict Achievement in Mathematics

Grade	Time Period	Criterion Measures	Variance Accounted for by ALT	
			Residual	Average Residual
2	Oct-Dec	1 Addition and subtraction	.04	.04
		2 Speed of operations	.05	
		3 Transfer	.11	
		4 Place value	.02	
		5 Word problems	.02	
		6 Money	.02	
		7 Total mathematics	.04	
2	Jan-May	1 Add/subt no regrouping	.04	.08
		2 Add/subt with regrouping	.06	
		3 Speed of operations	.22	
		4 Transfer	.06	
		5 Place value	.01	
		6 Word problems	.07	
		7 Linear measurement	.04	
		8 Fractions	.11	
		9 Money	.12	
		10 Total mathematics	.06	
5	Oct-Dec	1 Geometry	.15	.09
		2 Multiplication	.16	
		3 Speed of operations	.02	
		4 Division	.05	
		5 Fractions	.23	
		6 Transfer	.04	
		7 Word problems	.07	
		8 Total mathematics	.02	
5	Jan-May	1 Geometry	.07	.11 ^a
		2 Multiplication	.11	
		3 Speed of operations	.13	
		4 Division	.09	
		5 Fractions	.30	
		6 Transfer	.10	
		7 Word problems	.01	

In interpreting these figures, it is important to emphasize that very few alterable variables in education can be found to account for this much of the residual variance in achievement measures. As Gage (1978) and Berliner (1987) argue, the data from medical research are often far less powerful than these data and yet are declared to be of greater significance. For example, the first studies associating smoking and longevity yielded correlations of about $-.14$, accounting for only around 2% of the variance in longevity. Yet such data were strong enough for the surgeon general to issue warnings about cigarette smoking and to start campaigns to change social policy. The famous study of propranolol, one of the betablockers that were found to help prevent heart attacks, was heralded as a monumental breakthrough in pharmacology. The phi coefficient of correlation from the 2 by 2 table (drug treatment/placebo treatment vs. heart attack/no heart attack) was estimated at about $.05$, and the variance accounted for in that study was less than 1%. When the variance accounted for in an educational outcome measure, say, months of high school attendance, or reading achievement, is 1% or 2%, it is usually considered trivial in educational policy circles. In medicine such findings often precipitate major changes in public health policy and in the practice of medicine by physicians. Thus, when 8% or 9% of the variance in achievement test scores that is unaccounted for does become accounted for by ALT variables, those findings should have minor significance. Instructional time variables and achievement variables are related in significant ways, though somehow the press and public do not find the evidence compelling.

Another way to assess the potency of the ALT variables in predicting achievement was used by the research team that created the ALT Concept (Fisher et al., 1980). They took the actual data on a posttest in reading, regressed them on a pretest in reading, and used the actual values of ALT obtained in the study to estimate smartest reading scores for students at particular pretest levels and with particular ALT levels. Table 1.3 shows one set of such estimates. Three students are identified that are all at the 50th percentile at pretest. Each of them, in different classes, receives different amounts of ALT in reading over the subsequent five weeks. The values of ALT used in this table were actually obtained in the research study. The estimated relative standing of the students at the end of the five weeks is what is important to note. In the overall sample of students, these three were determined to be average in reading ability at the start of the study. But they would no longer be average students in this sample after their teachers treated them differently, that is, after their teachers exposed them to different amounts of ALT. The student with the least amount of ALT accrued over the five weeks is predicted to be at the 39th percentile on the smartest given to this sample, while the student that had accrued the largest amount of ALT is predicted to achieve on the posttest at the Ruth percentile. The predictions were well supported by the data from this study. The amount of ALT accrued appears to be a powerful determiner of school performance. Moreover, the variance accounted for in these studies of time and achievement is often 50-100 times greater than the variance accounted for in medical research studies that have been declared to be monumental in their significance. That is a fact worth pondering.

Researchers in the Beginning Teacher Evaluation Study had defined the concept of ALT and created the variable that was found to be a strong predictor of student achievement for students that were low to average in ability. The study was not designed to examine the interaction of instructional time variables such as ALT with levels of ability. Kidder, O'Reilly, & Kiesling (1975) cautioned that interactions of this type could be expected, and data on that point are provided by Rossmiller (1986). Rossmiller followed a group of students through grades 3, 4, and 5. He studied the relationship between a set of time variables and achievement test performance each year. For the students in the highest quartile of ability, the set of instructional time variables predicted achievement well, accounting for around 10% of the variance in achievement test scores in each of the three years and in both reading and mathematics. The variance accounted for in achievement among the middle quartile of students in each year and in both reading and mathematics was about the same. Thus, the data from the highest and the middle quartiles in the sample studied by Rossmiller resembles the data reported by my colleagues and me in the Beginning Teacher Evaluation Study. Across a number of elementary grades, in both reading and mathematics, around 10% of the variance in achievement could be predicted by instructional time variables. But among the least able students, the bottom quartile in his sample, Rossmiller found a more remarkable phenomenon. The time variables predicted achievement much more powerfully. In reading for grades 3, 4, and 5, the variance in standardized achievement test scores that was accounted for by the time variables was .56, .27, and .73, respectively. In mathematics across those three grades, the variance in achievement accounted for by instructional time variables was .30, .18, and .12. Over the three years and the two subject areas, among students in the lowest quartile, 36% of the variance in achievement measures could be accounted for by instructional time variables! While the instructional time variables may be important for prediction at all levels of ability, an interaction is apparent. Among the lowest ability students these variables seem to be of markedly greater importance. The accommodation of the school to slower students, by modifying the way time is allocated and spent, would probably do a great deal to eliminate failures in our schools, as is predicted in the instructional time models of Carroll and Bloom. Time is, after all, one of the few powerful alterable variables we have to work with.

TABLE 1.3 ALT and Predicted Outcomes over 25 Days of Reading Instruction

Student	Pretest		ALT In Minutes		Posttest	
	Raw Score	Percentile Rank	Total	Average Daily Accrual	Predicted Raw Score	Predicted Percentile Rank
A	36	50th	100	4	37	39th
B	36	50th	573	23	43	50th
C	36	50th	1300	52	52	66th

Note: Predicted scores based on the regression of posttest on pretest for selected combinations of pretest score and ALT. The ALT figures are actual values obtained over the 25 days of the study.

It is interesting to note that Rossmiller and his colleagues appear not to find the remarkable amounts of variance accounted for in their study to be particularly useful. This may be a classic case of ignoring the commonplace, the obvious, the banal, in a search for some grand sophisticated variable that is associated with achievement and touched with elegance, like "metacognition" or "schema" or "scaffolded instruction." Some of the concepts in the instructional time family of concepts and variables have no particular elegance about them but they do predict performance quite well accounting for moderate to large amounts of the variance found in a wide range of achievement measures (Gettinger, 1984; Walberg, 1986). The instructional time variables meet the second goal of science, that of prediction. Let us now see how they fare in controlled studies.

Control

The logic of explanation and the empirical findings establishing prediction are not usually as convincing as a case of control, as seen in a true experimental design. In education we have many more observational, predictive, correlational studies of time and achievement than we have controlled experiments. Nevertheless, virtually every experimental study of homework is an experimental study of instructional time variables. In the upper grades, at least, certain forms of homework appear to be significantly and causally related to achievement (Cooper, 1989). Cooper's meta-analysis of the many studies of homework demonstrates, once again, the power of the instructional time variables and the need to fill time with the right tasks. Not all homework was found to be effective, so mere time spent in educational activities will not in itself cause achievement.

The voluminous mastery learning literature often includes randomized experiments in which traditional instruction and mastery forms of instruction are compared. Mastery learning has a good record in such comparisons, in part because of its emphasis on time variables, in part because of its concern for alignment of the curriculum and the outcome measures (two of the ALT variables), and also because of its concern for other

aspects of instruction (Block & Burns, 1976). The controlled studies are quite supportive and consistent (Walberg, 1986). Peer and cross-age experimental studies of tutoring are also teaching methods with remarkably consistent effects on achievement (Walberg, 1986). These effects are usually attributable to increased allocations and particularly to increased engaged time in the subject area.

Gettinger (1985), among others, has directly tested the Carroll model under true experimental conditions and found it to hold up quite well. She found, as predicted, that the Carroll model is generally accurate in specifying that as the time spent learning decreases in proportion to the time needed to learn, the degree of learning is reduced proportionally. In single-subject designs in the behavioral psychology journals, and in research in the field of special education, the controlled studies of time variables regularly confirm the effects of time variables on achievement (see, for example, Sulzer-Azaroff & Mayer, 1986). In the field of teacher education teachers trained in time management techniques, versus those not trained in such techniques, have had positive effects on the achievement of their students (Borg & Ascione, 1982; Stallings, Needles, & Stayrook, 1979). And one big city school district in California that adopted the thinking associated with the ALT model of instruction and combined it with extensive staff development in instructional effectiveness apparently stopped its drop in test scores and brought the entire district up to a markedly higher level of performance on standardized achievement tests (described by Stallings, 1985). So the family of instructional time variables would seem to control as well as to help us understand and predict behavior. The concepts and variables in this family have high status as scientific concepts and variables because they can help us reach all three of the goals that science pursues.

CONCLUSION

Different instructional time variables are useful for particular research purposes. A researcher might do an instructional audit to determine whether state requirements for reading or mathematics instruction, or for special educational services, are being met. In that case simple allocated time measures – the raw number of minutes of instruction – may be the variable of interest. Mitman, Mergandoller, Marchman & Packer (1987), for example, inquired whether aspects of scientific literacy and the understanding of science in society were being taught, as was recommended, or whether only the disembodied facts of science were emphasized in classrooms. They used time allocated to the different content areas of science to conduct their audit. In no uncertain manner, they demonstrated an overwhelming preference by teachers to teach the cold facts of science and not other aspects of science such as its history, the reasoning processes of scientists, the impact of science on society, and so forth.

Within a school district, one might evaluate a teacher inservice education program designed to teach Madelaine Hunter's Elements of Effective Instruction (a very popular program designed to help teachers teach better lessons, increase student involvement during learning,

and increase achievement). The observation of engagement of the students, by trained data collectors, might be the appropriate way to detect variation in an important dependent variable for assessing the effectiveness of this inservice program. That was precisely what Stallings and Robbins did, discovering with their sample of teachers and students that no lasting effects could be attributed to this popular teacher training program (Stallings, 1986).

If one is consulting in a classroom, trying to improve classroom management and organization, then the instructional time concepts one holds and the instructional time variables one measures might include transition time, success rate, opportunity to learn, waiting time, and academic engagement. These alterable and easy-to-measure variables are also understandable by teachers. Changes in them are not hard to make, and those changes affect classroom functioning rather rapidly (see Berliner, 1985).

Policy analysts may find greater interest in the variable of allocated time than that of engagement rate, since the former is manipulable by legislators and the latter variable is not, despite the fact that the former is by far a weaker predictor of achievement than is the latter. The point here is that research, evaluation, audit, consultation, and policy analysis for school improvement each require the use of different instructional time variables for their different purposes. In one form or another, however, instructional time variables are clearly playing an important role in understanding predicting, and controlling instructional processes across a broad range of activities.

It is true that instructional time concepts are quite obvious, commonsensical, and uninteresting to many practitioners and researchers, particularly in comparison with some "sexy" contemporary concepts such as "critical thinking" or "learned helplessness." But the fact remains that trustworthy and informative evaluations, instructional audits, classroom consultations, and research can take place using instructional time variables just because they are rather easy to define and simple to understand. They are also much easier to measure than say, "student schemata." And because the time variables are reported in the same metric, findings across nations, districts, and classrooms can be compared. Findings across research studies are easier to combine, compare, and understand when the metric used in measurement is the same. It may be that the most important understanding we have gleaned from the instructional time literature of recent years is that it is a terrific metric for educators to use (Earnhardt, 1985).

There are those that argue that the instructional time variables may have their use but that they can never capture any of the really important aspects of instruction. That is not true. Both a person's philosophy of education and commonsense understandings about the meaning of

"quality instruction" can be examined using time variables. For example, it would seem impossible to have a personal philosophy of instruction that does not include duration as one of its characteristics. If a teacher has a belief in the importance of whole language approaches to reading instruction, instead of reliance primarily on a decoding approach to teaching reading, that teacher should demonstrate a different expenditure of time spent in

doing actual reading rather than in doing worksheets. Similarly, a teacher with a belief in the preeminence of the counseling role of teachers should expend different amounts of time in interpersonal and emotional interactions with students than someone subscribing to the information transmittal role of teachers. The expression of educational attitudes, opinions, and beliefs – one's personal philosophy derived from normative conceptions of teaching or from experience – *must* result in duration of some kind in the classroom. If not, that philosophy is doomed to remain merely a verbal expression of belief, unrelated to behavior. Actions not only speak louder than words, they can be timed.

Furthermore, there may not be a more sensible example of "quality instruction" than the one derived from the ALT conception of learning. For example, on entering a classroom, an observer discovers that the students are *attending* to academic work *related to the outcomes* for that subject matter, and that the work is being *successfully* completed, and that enough time was allocated to that subject matter to be of some value to students of that particular age. These components of ALT are what every citizen and school board member wants to see when they enter the classroom. Thus, for most people, ALT is not only an instructional time variable to be used in research, evaluation, auditing, and classroom consultation, it is a measure of that elusive characteristic we call "quality of instruction." As ALT is accrued, quality instruction may be seen to take place.

Instructional time concepts can address issues of philosophy and quality, while simultaneously retaining their obvious simple and apparently pedestrian character. They also help us to understand, predict, and control, the three goals of scientific work. With these characteristics now so evident, it seems unfortunate that many educators and scholars continue to misjudge the usefulness of this family of important instructional variables. Perhaps this is why, every now and again, someone wants to make a fuss about the importance of instructional time.

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