

The Relationship Between Time and Learning: A Brief Review of the Theoretical Research

For nearly three decades, educators and government leaders have called for significant reform to the nation's school calendar. Two seminal reports on American education, *A Nation at Risk* (1983), and *Prisoners of Time* (1994) called for an increase in learning time in our nation's schools. More recently, President Obama and Secretary of Education Duncan have echoed this call for change, highlighting increased learning time as a core strategy for turning around persistently low-performing schools. The U.S. Department of Education guidelines for several American Recovery and Reinvestment Act grant programs including Race to the Top and Investing in Innovation Fund(i3) as well as Title I School Improvement Grant (SIG) Funds, consider time to be a key strategy for school improvement. Indeed, "increased learning time" is a required component of the transformation and turnaround SIG models. What we know about time and learning in traditional public schools is promising, though equivocal, despite a long history of theoretical and experimental studies. This brief summarizes the theoretical framework and early research underlying the hypothesis that an important relationship exists between time and learning outcomes.

Historical Context

The assertion that time is a key component of academic success may seem so commonsensical that some might deem further investigation into the issue unnecessary, given our innate understanding of the concept (i.e. students who spend more time studying are bound to learn more.) Indeed, the cliché that "practice makes perfect" is embraced by Malcolm Gladwell in his book *Outliers* (2008), where he notes that the most successful among us, including artists, musicians, and sports players have honed their skills by spending at least 10,000 hours working at their craft.

Despite our seemingly intuitive understanding, however, a long history of attempting to study the time-learning connection (Cornman, 1902; Currie, 1884; James, 1904; Rice, 1897; Thorndike, 1921) has yielded theory and criticism, but little practical insight into how exactly time can be used effectively to improve student learning. Interest in the topic has waxed and waned since the late 1800s, with different conceptualizations and approaches to understanding the potential linkages. According to Marzano and Kendall (2000), the adoption of the Carnegie Unit in the early 1900s was the first clear articulation of the link between time spent in school and academic achievement. More specifically, it led to the question: how much time is necessary to bring about the desired academic outcomes?

As the debate around this question unfolded,

descriptive research was completed to first determine the range of instructional time variation in schools throughout the country (Holmes, 1915, Mann, 1928). In his publication, *How Schools Use Their Time* (1928), Mann painted a picture of the tremendous disparity in the length of pupils' school days. These studies began to draw distinctions between allocated and utilized time, spawning an entirely new issue in instructional time measurement: "engaged time." Engaged time, commonly defined as the time a student will attend to the materials or activities in an instructional situation, became an important component for understanding classroom-level student achievement. Ultimately, this line of inquiry was perceived as a measure of teacher evaluation instead of an inquiry into the learning process (Jackson, 1968, Smyth, 1985). With no recommendations for reallocation or "better uses" of time coming from the work, the utility of this notion of time for classroom teachers was not clear-cut and research in the area waned. It was over three decades before the topic reemerged.

The resurgence of the inquiry into the time-learning connection was begun around 1959 by educational psychologist, John B. Carroll who built upon earlier work by fitting the concept of "engaged time" into a model for school-based learning. Much of the work since that time has been built upon Carroll's theory that time acts to regulate the achievement of a particular individual. However, he cautioned that the time needed by each of his observed subjects was not

absolute. In Carroll's model, adequate time for learning is expressed simply as a ratio of how much time a learner *spends* learning to the time a learner *needs* to achieve a learning goal (1963). Further, the second half of the ratio, "time needed for learning," is composed of aptitude – the time an individual needs to reach a particular criterion in a given content area. Aptitude is then modified by the quality of the instruction and the ability of the student to understand that instruction. (Carroll differentiates "ability to understand instruction" from "aptitude" by suggesting that the former is related more to the ways in which an individual interacts with the particular method of instruction and instructor.)

The significance of Carroll's model came not only from the unconventional construct of learning time, but also from its implications for student achievement. The impact of Carroll's work was described by fellow researcher, Benjamin Bloom. Bloom explained that although time had been a fundamental variable in laboratory studies of human learning for over a century, only after Carroll did it become an important variable in school-based studies of learning. Bloom speculated that measures of time spent in school provided only a rough indicator of student achievement (Bloom, 1956; Bloom and Statler, 1957). He was convinced that teachers had a potentially strong influence on the effective use of time, and by extension, on the learning outcomes of their students. He conducted a series of classroom observations in the early 1960s to analyze the role of educators in the achievement of their students, finding that teachers displayed very little variation in their instructional practices (1968). Bloom concluded that students for whom the instructional methods and time allotments were ideal learned successfully. In contrast those students for whom the instruction and amount of time were inappropriate due to differences in background or learning style, tended to learn very little. Thus, little variation in teaching methods and time allocation resulted in great variation in student learning.

Bloom extended Carroll's model by making a distinction between allocated and utilized time (1974). Bloom deduced that if all students are provided with the same opportunity to learn and the same quality of instruction, educators will find that it is effective for some students, but not for others. However, Bloom explained that if aptitude was an indicator of the time a student would require to learn, but not necessarily a student's capacity to learn, it should be possible to set the degree of learning expected of each child at some mastery performance level. Essentially, if the instruction

could be structured to provide more appropriate opportunities to learn (i.e. varying lengths of time) and a more appropriate quality of instruction (i.e. "different" use of time) for each student, then a majority of students, perhaps as many as 95 percent, could be expected to learn very well and attain mastery.

Both Carroll and Bloom's models for learning went largely unchallenged in the years immediately following their publication. However, these models received increased scrutiny in the 1970s as debate over the efficacy of schools emerged. Throughout this decade, a wave of research, including the controversial Coleman report on *Equality of Educational Opportunity* (EEO) (1966) and Christopher Jencks' *Inequality* (1972), claimed that quantity of schooling did not seem to have a substantial impact on academic achievement of students. Coleman's report made the claim that quantity of schooling (e.g. number of school days, absences, hours of schooling, etc.) was not an important indicator of student achievement. Both Coleman and Jencks' findings challenged the core of the educational theories put forth by Carroll and Bloom, causing many to wonder what effect, if any, time in school had on student learning.

In "*Explosion of a Myth: Quantity of Schooling and Exposure to Instruction*", David Wiley and Annagret Harnischfeger (1974) pointed out that neither Coleman nor Jencks implied that schooling had *no* effect on students, but instead ask the more imperative question, *how much of an effect does schooling have on achievement?* Wiley and Harnischfeger conducted a secondary analysis of the EEO dataset, creating a new variable of allocated time. Their findings on the relationship between "quantity of schooling" and achievement, suggest that the amount of schooling that a student received was a powerful determinant of academic achievement. A similar conclusion was reached by Walberg (1986) who found a sizeable correlation (0.40) between quantity of instruction and achievement in his reexamination of 31 studies across a variety of grades and content areas. These findings provided substantial support to the notion that allocated time is an important factor in determining student achievement.

These results led Wiley and Harnischfeger to propose their own model of school-based learning. Like Carroll and Bloom, Wiley and Harnischfeger considered time to be a central variable in the teaching-learning process. Thus, in the Wiley-Harnischfeger (W-H) model, student achievement (i.e. learning as it relates to content curriculum) is determined by only two variables: the

total time needed by a student to learn a concept and the total time that student actually spends on that task. The defining characteristic of the W-H model is the explicit recognition that all student outcomes, though influenced by outside factors such as student and teacher background characteristics and curricular and institutional factors, are only directly mediated through each student's own pursuits. Thus, regardless of biasing agents such as teacher or student aptitude, as described by Carroll, the W-H model claimed that increased exposure to learning results in greater academic gains.

Despite the model's reliance on conventional learning theory, many within the field questioned the reliability of the W-H model (e.g., Hallinan, 1976, Karweit, 1976) suggesting that the measure used for quantity of schooling failed to examine actual time spent learning. This prompted Karweit, in conjunction with her colleague, Robert Slavin, to examine several sources of data in an attempt to replicate the W-H findings. However, in none of these subsequent analyses was the W-H effect of quantity of schooling observed. Rather, they found little to no correlation between quantity of schooling and academic achievement.

Karweit and Slavin (1981) continued to pursue the link between time and learning, examining four "time" measures: scheduled time (or allocated time), actual instructional time, engaged time and engaged rate (engaged time/instructional time.) Karweit and Slavin found substantial variation across students in all four measures of time. For instance, scheduled time was often much larger than instructional time due to interruptions and logistical duties performed by the teachers. With an understanding of time "lost" to both schedule intrusions and student inattention, Karweit and Slavin estimated that an increase in achievement from a score of 3.4 to 3.8 grade equivalents would require a daily increase of 13 minutes of instructional time. However, given their estimation that students are only engaged between 50 and 75 percent of the instructional time, a school's effort to increase time by 13 minutes would be insufficient. A school would likely need to double their instructional time and by extension greatly increase their scheduled time in order to achieve these results. These findings effectively shifted the focus within the field from Wiley and Harnischfeger's emphasis on allocated time back to "time spent" measures described decades earlier by Carroll.

Much of the work on the Wiley-Harnischfeger model was done in association with the staff of the Beginning Teacher Evaluation Study (BTES) (Fisher et al., 1980.)

This six-year study, which evaluated four separate samples of teachers and students, began as a project on identifying desirable competencies for beginning teachers. However, as the research progressed the goals shifted to focus on identifying and describing teaching skills of veteran teachers and their impact on student outcomes. The BTES team refined a measure of student classroom learning for the study which relied upon observable student behavior. This measure, called Academic Learning Time (ALT) was defined as the amount of time a student spends engaged in an academic task that s/he can perform with medium to high success. In line with this definition, the BTES team hypothesized that the more ALT a student accumulates, the more the student would be learning.

These studies indicate that increases in allocated time were only as valuable as the increases in engaged time that they produced. The ALT model represents an advancement over earlier work in two major ways. First, the ALT model is more explicit about content. Instead of focusing on the larger content areas such as reading or mathematics, the ALT model focused on more discrete skills such as decoding multisyllabic words or two-digit multiplication. The second defining feature of this model is the inclusion of "success rate" in the metric. This is of particular significance because it attempts to provide a time metric for the two non-time variables in the Carroll model – quality of instruction and the ability to understand instruction.

Despite its attempts to consider the importance of instructional quality, the BTES study has been criticized for methodological weaknesses (Karweit, 1985; Brown and Saks 1986). Brown and Saks (1986) conducted a secondary analysis of the BTES data to examine whether the reported achievement rates varied across student populations, across teachers and across subject matter as a function of allocated instructional time. In their reanalysis, particular attention was paid to how a student's beginning achievement level affected the rate of learning as a function of time. While controlling for all fixed student characteristics, Brown and Saks found that allocated time had positive effects on achievement in both reading and mathematics in grade 2 and in grade 5. Brown and Saks claimed that there is an important interaction between time allocated to instruction and a student's initial ability, finding that increased time benefits lower-ability students more than their higher-ability counterparts.

The BTES was not the only study to examine how engaged time might relate to student learning. Both Lahaderne (1967) and Cobb (1976) examined the effect

of student attention on student achievement, with both studies finding a positive relationship. Given the fairly large effect sizes observed in these correlational studies, it is easy to assume that increasing student attention is a reasonable strategy for raising student achievement. But increasing student attention is easier said than done.

Several researchers explored this concept by using a restrictive definition of time-on-task (TOT) to further investigate the relationship between attention and achievement (Bell and Davidson, 1976; Everston, Emmer and Clements 1980; Karweit and Slavin, 1981). Noting inconsistent findings in both her own work and the work of others, Nancy Karweit conducted a secondary analysis of many of the studies on time-on-task and achievement to date. Karweit found that the correlation between engagement and achievement in these studies ranged from 0.25 to 0.58. Moreover, when she controlled for initial student ability, the partial correlation ranged from 0.09 to 0.43. Karweit noted “In terms of the proportion of variance explained, the engagement variables were found to explain between 1 and 10% of the unique variance in achievement outcomes.” (1985, p.13). Karweit’s finding was supported by another review of 23 TOT studies by Stuck in 1980. Stuck found that all but one of the studies reported a significant relationship between time on task and achievement. He also noted that one of

the most convincing features of the identified intervention research is that, despite marked differences in the methodologies, all of the interventions were able to significantly increase pupil time on task.

Implications

While informative and suggestive, the mostly theoretical research reviewed here has yielded few practical implications for schools on engaging students or using time in specific ways to increase student achievement. Further, in the decades since these studies have been completed there have been substantial advances in educational research methods and in the attitudes and beliefs about school reform and learning theory. In more recent years, there have been very few rigorous studies designed to measure the effects of intentional increases in time on student performance. Most research to date has been descriptive or correlational.

These studies are reviewed in a separate research brief and are also suggestive of a strong time-learning connection, especially when teacher quality is considered. But, we need considerably more careful and rigorous research that systematically examines the effects of various time-related instructional and organizational strategies on student performance and well-being.

References

- Bell, M. L., & Davidson, C. S. (1976). Relationship between pupil-on-task performance and pupil achievement. *The Journal of Educational Research*, 69, pps. 172-176.
- Bloom, B. S. (1956). The 1955 normative study of the tests of general educational development. *The School Review*. 64, 3, pps. 110-124.
- Bloom, B. S. (1968). Learning for mastery. *Evaluation Comment*, 1(2), University of California at Los Angeles, Center for the Study of Evaluation. Reprinted in C. W. Fisher & D. C. Berliner (Eds.). (1985). *Perspectives on instructional time* (pp. 73-93). New York, NY: Longman.
- Bloom, B. S. (1974). An introduction to mastery learning theory. In J. H. Block (Ed.), *Schools, society and mastery learning* (pp. 3-14). New York, NY: Holt, Rinehart & Winston.
- Bloom, B. S. & Statler, C. R. (1957). Changes in the states on the tests of general educational development from 1943 to 1955. *The School Review*. 65, 2, pps. 204-221.
- Bowles-Therriault, S. and Ghandi, A. (2010). *Out of the Debate and Into the Schools. Comparing Practices and Strategies in Traditional, Pilot and Charter Schools in the City of Boston*. Boston, MA: The Boston Foundation.
- Brown, B., & Saks, D., (1986). Measuring the effects of instructional time on student learning: Evidence from the beginning teacher evaluation study. *American Journal of Education*, 94, 4, pps. 480-500.
- Carroll, J. (1963). A model of school learning. *Teachers College Record*, 64, pps.723-733.
- Clark Tuttle, C. The, B., Nichols-Barrer, I., Gill,B.P., and Gleason, P. (2010). *Student Characteristics and Achievement in 22 KIPP Middle Schools*. Washington, DC. Mathematica Policy Research.
- Cobb, J. A. (1976). Relationships of discrete classroom behaviors to 4th grade academic growth. *Journal of Educational Psychology*, 63, pps. 74-80.
- Coleman, J. S., Campbell, E. Q., Hobson, C. J., McPartland, J., Mood, A. M., Weinfeld, F. D., & York, R. L. (1966). *Equality of educational opportunity*. Washington, DC: Government Printing Office.
- Corman, O. P. (1902) *Spelling in the elementary school: An experimental and statistical investigation*. Boston, MA: Ginn & Company.

- Currie, J. (1884). *The principles and practice of common school education*. Washington, DC: Department of Education, National Institute of Education.
- Fisher, C. W., Berliner, D.C., Fully, N. N., Marliave, R. S., Cahen, L. S., & Dishaw, M. M. (1980). *Teaching behaviors, academic learning time and student achievement: An overview*. In C. Denham & A. Lieberman (Eds.), *Time to learn* (pp.7-32). Washington, DC: National Institute of Education.
- Florian, J. (1999). *Teacher survey of standards-based instruction: Addressing time*. Aurora, CO: Mid-continent Research for Education and Learning.
- Gladwell, M. (2008). *Outliers: The Story of Success*. New York, NY: Little, Brown and Company.
- Hallinan, M. (1976). Salient features of the Harnischfeger-Wiley model. *Curriculum Inquiry*, 6, 1, pps. 45-59.
- Holmes, H.W. (1915). Time distributions by subjects and grades in representative cities. In S.C. Parker, ed., *The fourteenth yearbook of the national society for the study of education, Part I, Minimum essentials in elementary-school subjects – standards and current practices*. Chicago, IL: University of Chicago Press.
- Jackson, P. W. (1968). *Life in classrooms*. New York, NY: Holt, Rinehart & Winston.
- James, W. (1904/1983). *Talks to teachers on psychology and to students on some of life's ideals*. Cambridge, MA: Harvard University Press. (Original work published in 1904)
- Jenks, D., Smith, M. Acklund, H., Bane, M. J., Cohen, D., Ginitis, H., Heyns, B., & Michaelson, S. (1972). *Inequality: A reassessment of family and schooling in America*. New York, NY: Basic Books.
- Karweit (1976) Quantity of schooling: A major educational factor? *Education Researcher*. 5, 2, pps. 15-17.
- Karweit, N. L. (1983). *Time-on-task: A research review*. Report No. 332. Baltimore, MD: Johns Hopkins University, Center for Social Organization of Schools.
- Karweit, N.L. (1985). Should we lengthen the school term? *Education Researcher*. 14, 6, pps. 9-15.
- Karweit, N. L., & Slavin, R. E. (1981). Measurement and modeling choices in studies of time and learning. *American Educational Research Journal*. 18, 2, pps. 157-171.
- Karweit, N. L., & Slavin, R. E. (1982). Measuring Time-on-task: Issues of timing, sampling, and definition. *Journal of Educational Psychology*. 74, pps. 844-51.
- Lahaderne, H. W. (1967). *Adaptation to school settings: A study of children's attitudes and classroom behavior*. Unpublished Ph.D. dissertation, University of Chicago.
- Mann, C. (1928). *How schools use their time: Time allotment practice in 444 cities including a study of trends from 1826 to 1926*. New York: Columbia University.
- Marzano, R. J., and J. S. Kendall. (2000). *A comprehensive guide to designing standards-based districts, schools and classrooms*. Alexandria, VA: ASCD.
- The National Commission on Excellence in Education, (1983). *A Nation at Risk: The Imperative for Educational Reform. A Report to the Nation and the Secretary of Education*. <http://www2.ed.gov/pubs/NatAtRisk/index.html>
- The National Education Commission on Time and Learning (1994). *Prisoners of Time Report*, <http://www2.ed.gov/pubs/PrisonersOfTime/index.html>
- Rice, J. M. (1897). *Scientific management in education*. New York, NY and Philadelphia, PA: Hinds, Noble & Eldredge.
- Smyth, W. J. (1985). A context for the study of time and instruction. In C. W. Fisher & D. C. Berliner (Eds.), *Perspectives on instructional time* (pp. 3-27). New York and London: Longman.
- Stuck, G. B. (1980). *Time-on-Task and School Achievement: Classroom Intervention Research*. Paper presented at the annual meeting of the American Educational Research Association, Boston.
- Thorndike, E. L. (1913). *Educational psychology: The psychology of learning* (vol. 2). New York, NY: Teachers College.
- Walberg, H. J. (1986). *Syntheses of research on teaching*. In M. C. Wittrock (Ed.), *Handbook of research on teaching* (3rd ed., pps.214-239). New York, NY: Macmillan.

The National Center on Time & Learning (NCTL) is dedicated to expanding learning time to eliminate the achievement gap and provide a well-rounded education for children in high-poverty schools. NCTL conducts research and advances public policy at the federal, state and local levels and provides direct technical assistance to states, districts and schools that add significantly more school time for academic and enrichment opportunities to help children meet the demands of the 21st century.

For more information contact research@timeandlearning.org.