Research Brief

Learning Time and Student Achievement

Question: What is the optimal teaching time for various subjects?
            Are there optimal times of the day for teaching specific subjects?

Summary of Findings:

In a Nutshell

(A) The body of research does not suggest optimal amounts of time for individual subjects. Student learning is much more dependent upon the use of mastery learning approaches, which may require additional time to provide additional help for students who are struggling with the content.   Subjects that benefit most from additional time are those that are more structured (e.g., mathematics, foreign languages), those that require laboratory experiences (such as sciences), and the more structured tasks associated with language arts and social studies (such as writing and reading skills instruction). Students who benefit most from additional time are those who are struggling to master the content or skills, those who have learning disabilities, English language learners, and highly anxious learners.

(B) The optimum time of day for learning appears to be highly idiosyncratic, although a small body of research has identified correlations between certain cultural and gender factors and both school attendance and achievement. It does not appear that specific subjects can be reliably scheduled at optimum times to maximize the performance of all students in the class.   However, sleep deprivation is a serious problem among adolescents, and the early start times for most high schools may contribute to lower school performance and higher levels of truancy and tardiness. Some high schools have succeeded in reducing attendance problems and raising achievement by starting later in the day.

Classroom time and its use is one of the most often-studied variables in the student achievement puzzle.   As a result of this long history that includes literally hundreds of research studies, it is one of the few fields in education that provides fairly explicit guidance to teachers and administrators seeking to improve student learning.   Unfortunately, the research is pretty conclusive that the easiest solution – simply extending the amount of time that students are exposed to teaching – is probably the least effective one for improving achievement. The much more effective (and somewhat more complicated) approach is to view time as a resource, much like instructional staff, money, facilities and instructional materials, that can be adjusted and manipulated to support high quality instruction – the school variable that is ultimately most closely related to student achievement.

Key Concepts Regarding Time and Learning

- *Allocated time* is 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… 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. In earlier studies, allocated time was called "opportunity to learn."

- *Engaged time* is usually defined as the time that students appear to be paying attention to materials or presentations that have instructional goals. An approximate synonym for engaged time is "attention."

- *Time-on-task* is engaged time on particular learning tasks. The concept is not synonymous with engaged time, because it deals with engagement in planned learning experiences. A student may be deeply engaged in math homework or reading a comic book during a time period allocated to science, but that is not time on the desired task.

- *Academic learning time* (ALT) is 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 for which those activities and materials are related to valued educational outcomes. This is a complex concept made up of a number of other concepts, such as allocated time (the amount of time provided for the task); time-on-task (engagement in tasks that are related to outcome measures or evaluation instruments in use); and success rate (the percent of engaged time that a student is experiencing a high success experience in class).

- *Transition time* is the non-instructional time before and after some instructional activity, such as when a teacher takes role or gives back homework at the beginning of an instructional activity.

Research on Time and Learning

Research Reported by Kathleen Cotton (1989) summarizes the major findings on time use and its effects on overall student achievement and in student performance in specific content areas. Although this review is somewhat older than other studies, and actually predates some instructional innovations, such as the widespread use of interactive technology, the fundamental principles are sound and can be applied to contemporary classrooms.

1. There is a small positive relationship between allocated time (however measured) and student achievement.
2. There is a positive relationship between time on task and student achievement. This relationship is stronger than the allocated time-student achievement link, but is still modest.
3. There is a strong positive relationship between academic learning time (ALT) and both student achievement and attitudes.
4. Time on Task, engaged in interactive activities with a teacher, produces greater achievement and better attitudes than time on task in seatwork.

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5. Seatwork is most beneficial to students when teachers prepare activities carefully, manage seatwork efficiently, supervise it actively, and give students help and feedback in such a way that other students are not disturbed.
6. Time on task in seatwork activities is most beneficial when students' thoughts are focused on specific cognitive strategies and cognitive ideas.
7. Mastery learning (with emphasis on specific objectives, careful teaching of those objectives, and provision for additional time allotments to those students who fail to meet criteria on formative tests) has been found to be superior to non-mastery learning in fostering achievement gains.
8. The success of mastery learning programs in promoting learning gains is due largely to the extra amounts of quality time-on-task expended by students in these programs, and particularly by middle- and lower- ability students.
9. Appropriate kinds and amounts of homework raise achievement levels for students above the primary grades. The attributes of effective homework assignments are:
    a. Relevant to specific learning objectives
    b. Appropriate to students' ability and maturity levels
    c. Assigned regularly (e.g., daily)
    d. Assigned in reasonable amounts (e.g., 30 minutes per subject per day)
    e. Well-explained and motivational
    f. Collected and reviewed during class time
    g. Used as an occasion to give feedback to students
    h. Supported by parents (e.g., arranging for study space, signing off on assignments)
10. Increasing allocated or engaged time is more beneficial for lower-ability than higher-ability students.
11. Higher ability students benefit from increases in allocated and/or engaged time very slightly, if at all.
12. Increasing time on task reduces the anxiety and enhances the achievement of highly anxious students.
13. Increasing time on task is more beneficial in the more highly structured subjects, such as mathematics and foreign languages, than in the less structured ones, such as language arts and social studies, unless the content in those areas is largely skill-based (e.g., writing, reading) and, therefore, more structured.
14. Significant increases in the quantity of schooling would be required to bring about even modest increases in achievement. The costs associated with extending the school day or year are, therefore, generally not justifiable.
15. Increasing time allocations for particular subjects within classrooms can be beneficial to students needing additional help if that time is devoted to the use of effective instructional strategies.
16. Achievement benefits result when teachers work with their students in such a way as to reduce the time needed for learning. (Some of the strategies for this include using rewards for passing tests on the first try, communicating so much enthusiasm about learning tasks that students apply themselves more fully than they normally would, or using approaches that are inherently engaging and appealing to adolescents.)

Effective Instructional Practices and the Use of Time

In order to maximize the usefulness of available time, Cotton distills from the research effective instructional practices linked to student achievement. They include:

1. Begin and end lessons on time.
2. Reduce transition time between tasks.
3. Closely monitor student learning and behavior, including placing students in seating arrangements that allow teacher and students to see one another well from different points in the room.
4. Establish and follow simple, consistent rules regarding student behavior in the classroom.
5. Make certain that students know what is expected of them and how to measure its accomplishment.
6. Select learning tasks resulting in high levels of success.
7. Employ objective feedback abou the correctness of responses and assignments and provide suggestions for revision of work products or thought processes.
8. Require frequent responses and samples of work, including assigning, collecting, and grading homework regularly.
9. Cover content as fully as possible, using very concrete examples.
10. Pay attention to the match between curriculum and testing (both classroom assessment and high stakes tests).
11. Reduce non-instructional activities as much as possible by creating management routines and procedures.

Administrators can play an important role in the effective use of instructional time as well.

1. Make certain that the amounts of time allocated to various curricular subjects truly reflect the relative values placed on these subjects by school staff and community members.
2. Encourage inservice activities to help teachers learn to use time more effectively.
3. Encourage parents to teach respect for teachers and for schooling as a means to reducing time-consuming disciplinary actions.
4. Establish clear school policies about tardies and absenteeism and make certain these are enforced.
5. Keep loudspeaker announcements and other interruptions of class time to a minimum.

Optimum Time of Day for Learning

A good summary of research on this topic is provided by Price Systems, Inc. (2004), much of which focuses on students' self-reported preferences for learning at specific times of the day. Early research of low achieving middle schools students showed that many female low achievers preferred learning in the evening, while their male counterparts preferred the afternoon. Over the next few years, a series of studies concluded that there may be cultural patterns to these preferences as well:

* Asian college students preferred early morning learning significantly more than did Caucasians.
* Mexican Americans shared the preference for early morning learning, but disliked afternoon learning sessions.

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- Later in the day was preferred by Caucasian, African-American and Greek elementary students.

Other international studies showed that among gifted and talented students, less than 10% preferred morning learning; most preferred late morning and afternoons for rigorous study. Some also expressed a strong preference for the evening.

Fewer studies examine the effects of time of day on achievement or attendance, but several investigations reveal weak to moderate relationships among these variables. In one study, Lynch found:
- The matching of individuals' schedules on the basis of learning style preferences affected attendance more significantly than the matching of teachers (to student learning styles);
- Mismatched, rather than matched, teacher assignments significantly reduced truancy among chronic truants; and
- A correlation did exist between academic achievement and the number of days of partial or full truancy.

Other studies have shown stronger relationships between student achievement in math and reading and matching instructional delivery to preferred times of the day among elementary students. At the high school level, a Texas curriculum coordinator obtained significantly higher test scores from students who took state tests at their preferred time of day.

Learning Preferences or Fatigue

Both logic and a growing body of evidence suggest that individuals learn new and difficult academic material at times that may be determined by their biological circadian rhythms. However, some critics believe that, at the secondary level, because the social and work life of the students occurs largely in the afternoon and evening, students simply do not have enough sleep before attempting to master complex material at the early starting times of most high schools.

More recently, attention has focused on sleep deprivation among adolescents, who actually require more sleep than either younger or older individuals. Carpenter reported that "insufficient sleep has also been shown to cause difficulties in school, including disciplinary problems, sleepiness in class and poor concentration." Other studies (Carskadan, 1999; Holloway, 1999) on later start times for high schools showed that when school starts later, students not only get more sleep but also contribute more to class discussions, doze in class less often, arrive tardy less often, miss fewer days, visit nurses less often, and achieve at somewhat higher levels.

So while it is clear that time of day has an impact on student learning, it is less clear whether the variations occur because of specific learning preferences among high school students or because high school starting times tend to be too early and kids are just not getting enough sleep.

The Bottom Line

Simply adding minutes, or even hours, to the amount of time students spend in contact with a given subject is unlikely to improve their achievement in that content field <u>unless</u> the additional time is used to promote mastery learning and provide additional help for struggling students. In other words, using research-based instructional approaches, some of which take more time than is normally available in a segmented school day, is more likely to bring about improved achievement than the simple manipulation of available time. If time is used as a resource to support high quality instruction, it is much more likely to result in improved learning.

Resources:

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