

STUDENT IMPACT COMMITTEE: ACADEMICS

Executive Summary

| Topic: | Academic Impact | | | | | | | | | | | | |
|--------------------|---|--|---|---------------|-------------------|-----------------|--|--|---|----------------|--|---------------------|-----------------------------------|
| Description: | <p>72,000 Secondary Students enrolled in FCPS grades 7-12 includes Mason District Middle Schools include 6th grade Glasgow, Poe, Holmes)</p> <p>84,000 Elementary Students K-6th , minus 6th graders at Glasgow, Poe, and Holmes)</p> <p style="text-align: right;">(enrollment approximate: based on 12,000/grade)</p> <p style="text-align: center;"><u>ACADEMIC IMPACT SUMMARY</u></p> <table border="1" style="margin-left: auto; margin-right: auto; border-collapse: collapse; text-align: center;"> <thead> <tr> <th style="width: 25%;"></th> <th style="width: 25%;">High School</th> <th style="width: 25%;">Middle School</th> <th style="width: 25%;">Elementary School</th> </tr> </thead> <tbody> <tr> <td style="text-align: left;">Better Scenario</td> <td>2nd/3rd tier A, B, C, D, E</td> <td>2nd/3rd tier A, B, C, D,</td> <td>A, B, C, D (1st/2nd tier)</td> </tr> <tr> <td style="text-align: left;">Worse Scenario</td> <td>1st tier <i>current</i></td> <td>E <i>current</i></td> <td>E (Late tier 3) <i>current</i></td> </tr> </tbody> </table> | | High School | Middle School | Elementary School | Better Scenario | 2 nd /3 rd tier A, B, C, D, E | 2 nd /3 rd tier A, B, C, D, | A, B, C, D (1 st /2 nd tier) | Worse Scenario | 1 st tier <i>current</i> | E <i>current</i> | E (Late tier 3) <i>current</i> |
| | High School | Middle School | Elementary School | | | | | | | | | | |
| Better Scenario | 2 nd /3 rd tier A, B, C, D, E | 2 nd /3 rd tier A, B, C, D, | A, B, C, D (1 st /2 nd tier) | | | | | | | | | | |
| Worse Scenario | 1 st tier <i>current</i> | E <i>current</i> | E (Late tier 3) <i>current</i> | | | | | | | | | | |
| Potential Impacts: | <p>There is mounting medical evidence that the amount of sleep and circadian rhythms play a part in how prepared we are to learn.</p> <p>The academic benefits of bell schedules more closely aligned with student circadian rhythms include:</p> <ol style="list-style-type: none"> 1. Students more alert and ready to learn 2. Improved academic performance, including improved class participation, preparedness, concentration, mental processing, problem solving and creativity 3. Improved attendance and reduced tardiness 4. Improved enrollment/fewer dropouts 5. Improved performance for adolescents later in the day. <p>“Given that the primary focus of education is to maximize human potential, then a new task before us is to ensure that the conditions in which learning takes place address the very biology of our learners.” (Carskadon, 1999)</p> <p>FCPS Student Achievement Goals:</p> <ol style="list-style-type: none"> 1.1. Achieve their full academic potential in the core disciplines. 2.7. Develop practical life skills including but not limited to: <ol style="list-style-type: none"> 2.7.1. Problem solving/critical thinking. | | | | | | | | | | | | |

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| <p>Transition Requirements:</p> | <ol style="list-style-type: none"> 1. Inform and involve all stakeholders, including the community 2. Educate the students, teachers and community about the benefits of sleep and reasons for the change 3. Allow ample time to plan for transition 4. Support families during the transition process 5. Support teachers, school staff, and administrators during the transition process 6. Commit to providing follow-up research regarding the change and implementation process (Wrobel, 1999) |
| <p>Majority and Minority Opinions:</p> | |
| <p>TTF Student Representative Comments:</p> | <ul style="list-style-type: none"> ■ We need to have a productive workday for high school students. ■ More sleep would have a positive impact on learning. ■ I have lower grades in my first period classes. ■ Smart to put elementary school before high school. ■ Our high school has built in Learning Seminars (LS) every other day--two 45-minute blocks of time, on a rotating schedule (meaning that we will have an LS for every class during 4 days). I find them extremely helpful, since the LS program was initiated most of us (students) have not had to stay after for remedial help or to make up tests and quizzes. This has eliminated the need for after school help/make-up time. If an LS program is placed into all high school schedules, you could move up practices times. |
| <p>Research Summary</p> | <p>When adolescents increase their amount of sleep, improvements are measurable in their learning.</p> <p>In jurisdictions that have changed to later start times, students do get more sleep.</p> <p>With later start times, studies show that student academic performance has improved.</p> |
| <p>Conclusion:</p> | <p>Recommend: Option A, B, C, D</p> <p>Based on academic impact, Option A, B, C or D provide academic advantages for middle and high school students without disadvantaging elementary school students.</p> |

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| <p>Background: All Ages</p> <p>Research</p> | <p>What does the research about sleep and learning/memory show?</p> <p>NIH: Too little sleep leaves us drowsy and unable to concentrate the next day. It also leads to impaired memory and physical performance and reduced ability to carry out math calculations. If sleep deprivation continues, hallucinations and mood swings may develop. Some experts believe sleep gives neurons used while we are awake a chance to shut down and repair themselves. Without sleep, neurons may become so depleted in energy or so polluted with byproducts of normal cellular activities that they begin to malfunction. Sleep also may give the brain a chance to exercise important neuronal connections that might otherwise deteriorate from lack of activity.</p> <p>“REM sleep stimulates the brain regions used in learning. This may be important for normal brain development during infancy, which would explain why infants spend much more time in REM sleep than adults (<i>see Sleep: A Dynamic Activity</i>). Like deep sleep, REM sleep is associated with increased production of proteins. One study found that REM sleep affects learning of certain mental skills. People taught a skill and then deprived of non-REM sleep could recall what they had learned after sleeping, while people deprived of REM sleep could not.”</p> <p>In <u>Your Guide to Healthy Sleep</u>, by the U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES, National Institutes of Health, there are many references to improved learning when a person receives adequate sleep.</p> <ul style="list-style-type: none"> ■ “While you sleep, your brain is hard at work forming the pathways necessary for learning and creating memories and new insights. Without enough sleep, you can’t focus and pay attention or respond quickly.” P1. ■ “How well rested you are and how well you function depend not just on your total sleep time but on how much of the various stages of sleep you get each night.” 1, p.4 ■ Learning, Memory, and Mood. Students who have trouble grasping new information or learning new skills are often advised to “sleep on it,” and that advice seems well founded. Recent studies reveal that people can learn a task better if they are well rested. They also can remember better what they learned if they get a good night’s sleep after learning the task than if they are sleep deprived. Volunteers had to sleep at least 6 hours to show improvement in learning, and the amount of improvement was directly tied to how much time they slept. In other words, volunteers who slept 8 hours outperformed those who slept only 6 or 7 hours. Other studies suggest that all the benefits of training for mentally challenging tasks are maximized after a good night’s sleep, rather than immediately following the training or after sleeping for a short period overnight.” 1, p12 ■ “Although it has not been shown that dreaming is the driving force behind innovation, one study suggests that sleep is needed for creative problem solving.” 1, p13 ■ “Exactly what happens during sleep to improve our learning, memory, and insight isn’t known. Experts suspect, however, that while people sleep, they form or reinforce the pathways of brain cells needed to perform these tasks.” 1, p13 ■ Not only is a good night’s sleep required to form new learning and memory pathways in the brain, but sleep is also necessary for those pathways to work up to speed. Several studies show that lack of sleep causes thinking processes to slow down. Lack of sleep also makes it harder to focus and pay attention. Lack of sleep can make you more easily confused.” 1, p13 |
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What does the research about sleep and learning/memory show? (cont.)

“Performance: We need sleep to think clearly, react quickly, and create memories. In fact, the pathways in the brain that help us learn and remember are very active when we sleep. Studies show that people who are taught mentally challenging tasks do better after a good night’s sleep.”

Creativity and problem solving are directly linked to adequate sleep. (Nature, Jan. 21, 2004)

Skimping on sleep has a price. Cutting back by even 1 hour can make it tough to focus the next day and can slow your response time. Studies also find that when you lack sleep, you are more likely to make bad decisions and take more risks. This can result in lower performance on the job or in school and a greater risk for a car crash.” (NIH: <http://www.nhlbi.nih.gov/health/public/sleep/healthysleepfs.pdf> , p.1)

In the U. of Minn. CAREI report, Vol. 1, there is a summary of empirical research that points to the connection between cognition and sleep loss:

- It has been shown that sleep deprivation is associated with memory deficits (Dinges & Kribbs, 1991; Nilsson, Backman & Karlsson, 1989), impaired performance and alertness (Carskadon & Roth, 1991; Dinges & Kribbs, 1991), as well as time-on task decrements and optimum response shifts (Dinges & Kribbs, 1991).
- The specific loss of REM sleep has also resulted in memory loss (Smith, 1995; Li, Wu, Shao & Liu, 1991).
- Dujardin, Guerrien & Leconte (1990) found that REM sleep affects information processing, while Maas (1995) listed the consequences of REM sleep loss as including: unintended sleep, increased irritability, anxiety and depression, decreased socialization and humor, hyper sexuality, mental fatigue with reduced memory concentration, and decreased ability to handle complex tasks and be creative.

In the text used for AP Psychology at Herndon High School, the authors state the following:

- “ sleep helps us recuperate. It helps *restore* body tissues, especially those of the brain.” p255
- Without proper rest students are not at their peak: “Teenagers typically need 8 or 9 hours sleep, but they now average nearly 2 hours less sleep a night than their counterparts 80 years ago (Holden, 1993; Maas, 1999). Many fill this need by using their first class for an early siesta and after-lunch study hall for a slumber party. Even when awake, they often function below their peak.” p.252.

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| | <p>What does research show about sleep and academic performance as measured by grades or test scores?</p> <p>Some studies found a correlation between more sleep or waking up later on school days and higher grades or GPA (Wolfson, 1998, Link, 1995, Fredriksen, 2004), while others found no correlation (Eliasson, 2002 and Eliasson, 2007 Draft).</p> <p><u>Navy studies.</u> In 2002, the Navy shifted from 6-hour sleep schedule to an 8-hour sleep schedule for recruits to coincide with the adolescent/young adult circadian rhythms. The following findings are from a follow-up study:</p> <ul style="list-style-type: none"> ■ “The purpose of this study was to determine the impact of the new eight-hour sleep regimen using standardized test scores as a performance measure. One year of data with the eight-hour sleep regimen is compared to two separate years when only six hours of sleep was allowed.” ■ “There is a significant difference, $F(2, 33) = 29.82, p < .0001$, between the test scores of recruits receiving 6-hours of sleep and 8-hours of sleep. On average test scores rose by 11 percent with the additional sleep. The odds of observing such a difference by chance is less than one in ten million.” |
| <p>High School Students and Later Start Times:</p> <p>Research</p> | <p>What does research show about high school start times and learning?</p> <p>When adolescents increase their amount of sleep, improvements are measurable in their learning and in a reduction in behavior problems. (Stone, 1992)</p> <p>Sleep deprived students scored lower than their well-rested colleagues <i>even after catching up on lost sleep</i> (according to a recent study from Harvard Medical School published in <i>Nature Neuroscience</i>. www.webmd.aol.com/sleep-disorders)</p> <p>Reading scores for adolescents improve when the instruction is offered in the afternoon as opposed to first thing in the morning. (<u>The Impact of Sleep on Learning and Behavior in Adolescents</u>, <i>Teachers College Record</i>, Volume 104, Number 4, June 2002, p. 712)</p> <p>Performance improves later in the day. Researchers recommend giving standardized tests later in the day, i.e. after 10 a.m. (Hansen, 2005, Pediatrics)</p> <p><u>Navy Studies.</u> A second study by the Navy compared two 8-hour sleep regimens: 2100 to 0500 and 2200 to 0600. This study assessed the quantity and quality of sleep received by a sample cohort of recruits who shifted bedtimes from 2100 to 2200 during</p> |

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| <p>High School Students and Later Start Times:</p> <p>Research (cont)</p> | <p>Boot Camp. “This research involved the analysis of sleep patterns and activity levels collected by wrist activity monitors.”</p> <ul style="list-style-type: none"> ■ “The results showed that the majority of recruits received more sleep when following the 2200 to 0600 sleep regimen than when following the 2100 to 0500 sleep regimen. On average, the 2200 bedtime resulted in 22 more minutes of sleep per night per recruit. This finding coincides with the predictable shift in young adult circadian rhythms, which favors later bedtimes.” |
| <p>High School Students and Later Start Times:</p> <p>Other Jurisdictions:</p> | <p>In jurisdictions that changed to later HS start times, what was the change in student alertness and ability to learn?</p> <p>Arlington (June 2005 Impacts Study, Summary) Old: HS, 7:30 am; MS 8:10 am; ES, 8:50 am New: MS, 7:50 am, HS, 8:19 am; ES, 8 am/8:25 am/9 am</p> <ul style="list-style-type: none"> ■ Excerpt: 2. What changes happened for the intended recipients? Survey data from students suggest that high school students were more ready to start school, were more alert, and participated in class discussions and activities more frequently after the change in start time than in the year prior to the change. This trend was especially apparent with regard to class participation. Forty-two percent of the high school students reported that they participated in discussions or activities during their first period class “all of the time” during the 2001-02 school year. In contrast, only 31% of these students responded in the same manner when they were asked about the 2000-01 school year. Likewise, high school teachers reported dramatic increases in the number of first period students who were alert, prepared, and participatory. <p>The school start time change was made upon the recommendation of the ACI [<i>Note: Instruction staff</i>] and after considerable deliberation by the School Board and senior officials of the Arlington Public Schools. Research on the impact of school start times and adolescent behavior guided the decisions about changing the schedules, and this study concludes that the change had its desired impact on the main beneficiaries, high school students. On the other hand, the compromises that went into the switch, especially vis-à-vis middle school students [<i>Note: switching MS to an earlier time</i>], seem to have kept adverse consequences within acceptable limits.</p> <p>Summary: Start Time’s Impact on Academic Achievement as Measured by Grades, Absences, Times Tardy and Perceptions</p> <ul style="list-style-type: none"> ● The first period grades of both cohorts of high school students—that is, the classes of 2003 and 2004—improved slightly after the start time change in 2001. The change, however, was so slight that it did not represent a change in letter grades for the students. ● In addition to students’ grades and rates of absenteeism and tardiness, students’ and teachers’ perceptions of factors that may influence academic performance also were examined. In general, more high school students reported feeling ready to start school and alert during their first period class after the school start time change ● These student responses seem to be reinforced by the high school teachers’ perceptions. Higher percentages of teachers agreed that their students were more alert, prepared, and participatory after the start time change than before. |

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| <p>High School Students and Later Start Times:</p> <p>Other Jurisdictions: (cont)</p> | <p>Edina, Minn: Old: HS, 7:20 am New: HS, 8:30 am; MS, 7:45 am; ES, 9:20 am</p> <ul style="list-style-type: none"> ■ <i>Excerpt</i> (Edina Later Start Time Summary): Parents, students and staff all agree it has been a good change. It is unusual to have so much agreement about an issue in education today. Teachers report more alert students and improved learning beginning at 8:30 as compared to the 7:25 start. ■ <i>Excerpt:</i> (CAREI Case Study on Edina: There seemed to be a general agreement among all eight [teachers] who said that, during first hour, they don't have "people with their heads down on the desk, they seem to be more engaged in what they're doing; they seem to be more focused." <p>A few students said they are doing better academically because they are more awake. One student shared, "I have only fallen asleep once in school this whole year, and last year I fell asleep about three times a week." Another student added that she's "more alert and doesn't 'zone out' as much." On a similar note, a student said, "I feel I pay better attention because my sleep schedule is closer to my normal sleep pattern." Two students added that it feels a lot better now that they leave for school when it is light out, whereas last year during the winter it was dark when they left for school.</p> |
| <p>High School Students and Later Start Times:</p> <p>Other Jurisdictions:</p> | <p>What changes in academic performance have been shown by jurisdictions changing to later HS start times?</p> <p>Arlington: (High school moved from 7:30 to 8:19 a.m.)</p> <ul style="list-style-type: none"> ■ Arlington County posted higher increases in SAT scores following the change than Virginia as a whole (2001 to 2004 Arlington Math scores rose 19 points, 523 to 542, compared with 5 points for Va; 2001-2004 Arlington Verbal rose 35 points, 518 to 543, versus 8 points for Va. (For Black students, math increase was +28 points compared with +14 for Blacks in Va., verbal was +16 point compared with flat for Va. For Hispanic students, was +13, compared with flat for Va. and +12 compared with +2 for Virginia.) <p>Minnesota: found slight grade improvement but not statistically significant. Kids more alert, prepared for first class.</p> <ul style="list-style-type: none"> ■ <i>Excerpt (Changing Times: Findings From the First Longitudinal Study of Later High School Start Times</i> Kyla Wahlstrom NASSP Bulletin _ Vol. 86 No. 633 December 2002) <p>Given the numerous obstacles to obtaining "clean" data, the analysis took nearly a year. In the and, the comparison of students' letter grades for 3 years prior to the change (starting time of 7:15 a.m.) and 3 years after revealed a slight improvement in grades earned overall, but the differences were not statistically significant. The trend lines for letter grades earned for all grade levels 9 through 12 for the years of the later start time are on an upward (positive) slope. Students' self-report from a written survey on their grades earned corroborate this finding.</p> |

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| <p>High School Students and Later Start Times:</p> <p>Other Jurisdictions: (cont)</p> | <ul style="list-style-type: none"> ■ <i>Excerpt (A Survey of Factors Influencing High School Start Times, NASSP Bulletin Vol. 89 No. 642 March 2005 Amy R. Wolfson and Mary A. Carskadon)</i> Our data indicate that at least as far back as 1986, the majority of the high schools started too early in the morning for most adolescents’ sleep needs and schedule, as well as daytime functioning. Many high school and middle level students cannot get to sleep early due to a combination of biological and psychosocial factors, such as homework hours, after-school activities, and family schedules. In addition, starting school early in the morning interferes with learning, particularly during the first few classes of the day. School administrators note that many factors prevent adjusting start times later for adolescents, putting the onus for coping with the start time entirely on the students and their families. ■ Increase in SAT scores in Edina: “The actual numbers did show an increase in the SAT outcomes for Edina students after the later start time was initiated” (email correspondence with Kyla Wahlstrom—waiting for data). |
| <p>High School Students and Later Start Times:</p> <p>Other Jurisdictions:</p> | <p>How has attendance improved in districts that changed to later HS bell times?</p> <p>Summary: Three of four jurisdictions reported improved attendance with later start times, including less tardies, fewer sick days, and significant positive impact on at risk students. Another study comparing late and early starting schools found significantly fewer sick days and lower rate of tardies due to oversleeping at the school that started at 8:30 compared to the other two (7:25 and 7:15).</p> <p>Minnesota:</p> <ul style="list-style-type: none"> ■ Days home sick in past two weeks significantly lower for 8:30 am start time school (0.28) compared with 7:25 or 7:15 am opening school. ■ <i>Excerpt:</i>Second, after the change in start time, attendance improved for Asian, Hispanic, Black, and White students in grades 9 to 11. ...Attendance rates for all ethnic groups in grade 12 were the same before and after the change in start time. ■ <i>From Summary:</i> ... attendance rates for all students in grades 9, 10, and 11 improved in the years from 1995 to 2000, with the greatest rate of improvement for grade 9 students. ■ Minnesota study compared tardies at three similar jurisdictions with different HS start times (8:30 am, 7:25 am and 7:15 am) and found a significantly lower rate of tardies due to oversleeping at 8:30 am starting school. ■ <p>Edina, Minn: (high school start times moved from 7:20 to 8:30)</p> <ul style="list-style-type: none"> ■ We have measured fewer absences and fewer students arriving late (Edina later start time summary) <p>Wilton, Conn.: (high school start times moved from 7:35-8:15)</p> <ul style="list-style-type: none"> ●Did not see any change in attendance or tardiness. <p>Brevard County, Fla.: (high school start times changed from 7:30 to 8:30 a.m.)</p> <ul style="list-style-type: none"> ■ Significant amount of tardies and absences were reduced from first periods. |

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| <p>High School Students and Later Start Times:</p> <p>Other Jurisdictions:</p> | <p>What changes in continuous enrollment (graduation rates) and dropout rates have been found in districts that changed to later HS bell times?</p> <p>Continuous enrollment increased, graduation rates improved, and there were fewer dropouts.</p> <p>Minnesota: (measured by “continuous enrollment”)</p> <ul style="list-style-type: none"> ■ <i>Excerpt: (U. of Minn. CAREI study)</i> A key finding of this study is that the percentage of high school students who were continuously enrolled in the same district or in the same school had statistically significantly risen since the 1995–1996 school year. Concurrently, the percentage of students who were not continuously enrolled had decreased significantly. This means that an increasing number of students were staying in the same district or in the same school for 2 or more years, and the number of students who moved in and out of the district or moved from school to school declined steadily. ■ The initial findings from this longitudinal study lead to important considerations for school administrators. Addressing the needs of students who are at-risk learners, at risk for dropping out of school, or both is a universal concern. These are often students who have insufficient credits for graduation because they have missed too many first and second hour classes. The study reveals that attendance rates improved significantly when the high schools initiated the later start time; this suggests that changing start times is one way to recapture those students who might otherwise not complete high school. <p>(no data from other jurisdictions)</p> |
| <p>High School Students and Later Start Times:</p> <p>Anecdote:</p> | <p>From a former Fairfax County student:</p> <ul style="list-style-type: none"> ■ He dropped out of school b/c he had a series of tardies leading to failures. He explained that he was not a “bad” kid. He was NOT out partying all night or even staying up too late, but that he still could not manage to get up early enough to get to school on time every day. He did get his GED and is now working and doing well in college courses. He explained that being able to get enough sleep is making all the difference. He was very happy to hear that FCPS is considering later start times for high school. |
| <p>Elementary Students</p> <p>Summary</p> | <p>Academic impacts of earlier start times for Elementary School Students</p> <ul style="list-style-type: none"> ■ According to research, all school age children need approximately 9hours of sleep per night. <u>Your Guide to Healthy Sleep, by the U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES, National Institutes of Health.</u> Other sources suggest that elementary students need 9-10 hours of sleep per night. ■ Elementary school children differ from teens because their biological clocks have not shifted; therefore, they are able to go to sleep earlier and naturally wake up earlier. ■ As a result, placing elementary schools in the first tier for school start times should not have a negative effect on the amount of sleep that elementary children are able to get, therefore, elementary children should not experience negative effects in their academic performance, purely due to a shift to earlier start times. |

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Elementary
Students:
Research

Some research does suggest that among very young children, morning appears to be the best time of day to engage in learning activities.

- Staff surveyed by Wheeler (1995) at a child development center reported that children who attended preschool in the morning were better adjusted to school than children who attended in the afternoon.
- In another study, 154 preschool teachers in a survey conducted in Greece reported twice as many behavior problems in the afternoon than in the morning (Papatheodorou & Ramasut, 1993). It is possible that very young children do better in the morning because they need naps in the afternoon.

<http://ceep.crc.uiuc.edu/poptopics/timeofday.html#school>

Matching teaching time to student learning preferences. A number of studies suggest that matching time of day to student preference can raise grades, improve test scores, improve behavior, and reduce truancy and tardiness. However, identifying a "best time of day" to teach is difficult because research on preferred time of day shows considerable variation in preference, no matter what the age group.

- Callan (1998) reported that, based on his research with high school students, less than 10% preferred the early morning, less than 10% preferred late morning, 15% preferred afternoon, 15% preferred evening, and 33% reported no time-of-day preference. The remaining students had two or even three time preferences.
- Dunn (1985) summarized her time-of-day preference work with elementary school students and reported that 20% preferred early morning, 33% preferred late morning, and 33% preferred afternoon.

Comparing Dunn and Callan's statistics on the time-of-day preferences of elementary school students with preferences of high school students suggests that more than twice as many elementary school students as high school students prefer mornings. The data also suggest that throughout childhood and adolescence, children have a wide range of preferred times of day, and there is no one time of day that is good for everyone in any particular age group.

After determining their students' preferred learning styles across a variety of factors (e.g., time-of-day preferences, lighting, kinesthetic hands-on learning preferences), teachers in a North Carolina school scheduled more academically challenging subjects at times when the majority of students said they were most alert. There was a vast improvement in teacher reports of overall behavior of the 264 students involved in the study, and test scores gradually improved as well (Klavas, 1994).

Gadwa and Griggs (1985) studied learning style preferences of 103 high school dropouts and compared the results with time-of-day preferences of 213 randomly selected high school students from five area high schools and 214 alternative education students. These researchers reported that, among other learning style variables, high school dropouts in Washington preferred evening as their optimal time for learning and had difficulty learning in the morning.

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| <p>Elementary Students: Research</p> | <p>Overall, few studies have shown conclusively that, for example, elementary students progress in reading better in the morning or math better in the afternoon. <u>Rather, studies appear to suggest that students do best with any academic subject at their individual preferred time of day.</u></p> <p>However, some research has been conducted that indicates that elementary students working below grade level do better on reading tasks in the afternoon.</p> <ul style="list-style-type: none"> ■ Barron, Henderson, and Spurgeon (1994) discovered that below-grade-level first- through fourth-graders at one elementary school (number of subjects not reported) significantly increased their reading achievement scores when instructed in the afternoon as compared to the control group that received morning instruction. Davis (1987) found similar results for 100 first-grade beginning readers (both low-ability and high-ability readers); greater gains were achieved when instruction occurred in the afternoon. ■ In one small study (<i>n</i> = 36), Ammons, Booker, and Killmon (1995) administered the Learning Style Inventory (Dunn, Dunn, & Price, 1990) to fifth-grade students to determine their preferred time of day for learning. The students were then split into two groups and given a science lesson in the morning or afternoon. When tested, students whose preferred time of day matched when they were taught and tested scored significantly higher than students whose time-of-day preference was not matched. Although the authors stress that individual differences preclude saying that all students of a certain grade/age learn best at a certain time, in this study, 24 of the students preferred an afternoon time, 2 a morning time, and 10 had no preference. The authors suggest that schools might consider scheduling more demanding courses in the students' preferred time of day. If this kind of scheduling is not possible for all students, some form of class rotation might be attempted so that all students could have a chance to learn at their preferred times. <p>In other research, Virostko (1983) conducted a study with 286 third- through sixth-graders at one elementary school where either reading or mathematics was offered at the student's preferred time of day for one year. Based on the New York State PEPS test, the students scored significantly higher in the subject that was held at their preferred time of day for learning. In the second year, when the course times were reversed, the results were reversed, and 98% scored higher in the subject that was held at the preferred time of day. Finally, Lynch (1981) studied 136 chronically truant 11th- and 12th-graders and discovered that their attendance and grades in an English class improved dramatically when the scheduled time for the class matched their preferred learning time.</p> |
| <p>Access to remediation:</p> <p>Comments</p> | <p>How will the various scenarios impact student access to remedial help (teachers outside of the regular school day, time in the library, and SOL help)?</p> <ul style="list-style-type: none"> ■ Teachers will still have the same number of contract hours regardless of bell schedule and will be available for student help outside of the regular school day regardless of bell schedule and/or sports schedules. |

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| <p>Access to remediation:</p> <p>Comments: (cont)</p> | <ul style="list-style-type: none"> ■ Given the current stress on the transportation system, both in terms of dollars and bus availability, all non-mandated busing is at risk – this includes late buses, especially those that are not directly supporting SOL and NCLB remediation. Under any change in bell schedule, the same stresses will affect the number of buses available for late runs. ■ In the TTF materials on the website, in the questions and answers section, the staff provided the following information in response to a 10/22/07 question: “3. Today, we have 1,143 sets of runs requiring drivers. We have an additional 457 buses used by supervisors, by substitutes, for activity runs at the schools, and for spares. ■ The MPS 2 Report provides data that suggests that more buses would be available for remediation and SOL help if that help were made available in the mornings. This is practical for any schools in the third tier. The MPS charts for all options considered used fewer buses in the morning than in the afternoon. These additional buses could be made available for before school help. Switching to before school remediation and SOL help for schools in the third tier would also allow students to arrive home earlier than if such help were provided after school. |
| <p>Access to remediation:</p> <p>Other jurisdictions</p> | <p>What is the experience of school systems that have changed to later start times with regard to students having access to remedial help?</p> <p>In Arlington the majority of teachers reported either the same or more students requesting help before school and almost half of the teachers reported the same or more students requesting help after school.</p> <ul style="list-style-type: none"> ■ About half of the high school teachers who responded to the teacher survey indicated that they saw about the same number of students before school in 2001-02 as they did in 2000-01. About 13% indicated that they saw more students before school and about 13% indicated they saw fewer students before school in 2001-02. Twenty-five percent of the teachers reported “no opinion” on this item. <i>Excerpt:</i> (June 2005 Impact Study) ■ When asked about the number of students they help after school, about 35% of the high school teachers responded “about the same number of students” compared with “last year.” About 13% reported helping more students after school whereas about 38% reported seeing fewer students after school during the 2001-2002. About 12% of the teachers selected the “no opinion” response option on this item. <i>Excerpt:</i> (June 2005 Impact Study) |

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Research for Student Academic Impact Report

SOURCES:

- Your Guide to Healthy Sleep, U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES, National Institutes of Health, National Heart, Lung, and Blood Institute, NIH Publication No. 06-5271, November 2005
- Wagner U, Gais S, Haider H, Verleger R, Born J (2004). Sleep inspires insight. *Nature*, 427:352-355.
- The Center for Applied Research and Educational Improvement (CAREI) at the University of Minnesota, **School Start Time Study (1998-2001)**. <http://cehd.umn.edu/CAREI/default.html>.
Effective with the 1997-98 school year, the Minneapolis School District changed the starting time of its seven comprehensive high schools to 8:40 AM. and the dismissal time to 3:20 PM. Prior to the change, classes began at the high schools at 7:15 AM and dismissed at 1:45 PM. In the 1997-98 school year, the Center for Applied Research (CAREI) in the College of Education and Human Development at the University of Minnesota was asked by the Minneapolis School Board to examine the impact of the later start upon its students, staff, families, and community members. The information from that study can be found in "Start Time Study Report of Findings," November 1998, as a bound report provided to Minneapolis School District administrators.

2001 Executive Summary, <http://cehd.umn.edu/CAREI/Reports/docs/SST-2001ES.pdf>
1998 Executive Summary, <http://cehd.umn.edu/CAREI/Reports/docs/SST-1998ES.pdf>
Full Report Volume I, <http://cehd.umn.edu/CAREI/Reports/docs/SST-1998VI.pdf>
Full Report Volume II, <http://cehd.umn.edu/CAREI/Reports/docs/SST-1998VII.pdf>
- David G. Meyers, Psychology, 6th edition. Worth publishers, 2001.
- Crown, 2005
- Baldus, Brian R., *Sleep Patterns in U.S. Navy Recruits: An Assessment of the Impact of Changing Sleep Regimens*. Naval Postgraduate School, Monterey, CA 93943-5000, September 2002
- Andrews, Charles H., *The Relationship Between Sleep Regimen And Performance In United States Navy Recruits*. Naval Postgraduate School, Monterey, CA 93943-5000, September 2004.
- Arlington Office of Planning and Evaluation, 2005, *Arlington Public Schools Impact of 2001 Adjustments to High School and Middle School Start Times*, <http://www.fcps.edu/fts/taskforce07/documents/arlington605.pdf>
- Changing School Start Times: Arlington, Virginia. National Sleep Foundation Summary. <http://sleepin Fairfax.org/CS.Arlington.pdf>
- National Sleep Foundation.
http://www.sleepfoundation.org/site/c.huIXKjM0Ix/b.2511711/k.C3F0/Backgrounder_Research_Advocacy_Later_Start_Times.htm,
http://www.sleepfoundation.org/site/c.huIXKjM0Ix/b.2512767/k.6F87/Suggested_Further_Reading.htm
- Banks, Ron and Atkinson, Beth, **What is the Best Time of Day for Student Learning?**. The Clearinghouse on Early Education and Parenting, University of Illinois, 2002 (Last updated August 2004)
<http://ceep.crc.uiuc.edu/poptopics/timeofday.html#school>
- Callahan, Roger John, Early Morning Challenge: The Potential Effects of Chronobiology on Taking the Scholastic Aptitude Test. *Clearinghouse*, V68 n3 p174-76 Jan – Feb 1995.
- Carskadon, M. (1999). When worlds collide: Adolescent need for sleep versus societal demands. *Phi Delta Kappan*, p. 348-353.

STUDENT IMPACT COMMITTEE : ACADEMICS

Research for Student Academic Impact Report

SOURCES: (cont)

- Dawson, P. (2005). More Proof Sleepy Teens Learn Less. *The Education Digest*, 70(8), 43-48.
- Eliasson, A., King, J., Gould, B., & Eliasson, A. (2002). Association of sleep and academic performance. *Sleep Breath*, 6(1), 45-48.
- Eliasson, A., Lettieri, C., (2007) Sleep and Academic Performance in a Community College, (*Oral Presentation*) ASAPAbstract 12-17-07-1, Control ID 450738, Status: Draft.
- Fredriksen, K., Rhodes, J., Reddy, R., & N., W. (2004). Sleepless in Chicago: tracking the effects of adolescent sleep loss during the middle school years. *Child development*, 75(1), 84-95.
- Hansen, M., et.al. (2005). The impact of school daily schedule on adolescent sleep. *Pediatrics*, 115; 1555-1561.
- Link, SC, Ancoli-Israel, S. (1995). Sleep and the teenager. *Sleep Res*, 24A: 184.
- Mitru, G., Millrood, D. L., & Mateika, J. H. (2002). The impact of sleep on learning and behavior in adolescents. *Teachers College Record*, 104(4), 704-726.
- Taras, H., & Potts-Datema, W. (2005). Sleep and Student Performance at School. *Journal of School Health*, 75(7), 248.
- Wahlstrom, K., (2002). Changing Times: Findings From the First Longitudinal Study of Later High School Start Times. *NASSP Bulletin*, Vol. 86 No. 633.
- Wolfson, A. R., & Carskadon, M. A. (2005). A Survey of Factors Influencing High School Start Times, *NASSP Bulletin* Vol. 89 No. 642.
- Wolfson, A. R., & Carskadon, M. A. (2003). Understanding adolescents' sleep patterns and school performance: a critical appraisal. *Sleep Med Rev*, 7(6), 491-506.
- Wolfson AR, Carskadon MA. (1998). Sleep schedules and daytime functioning in adolescents. *Child Dev*, 69:875-887.
- Wrobel, G. (1999). The impact of school starting time on family life. *Phi Delta Kappa*, p. 360-364.