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Bell to Bell: Measuring Classroom Time Usage

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This article discusses research in classroom time usage and the benefits and weaknesses of prior research in this area. The article addresses in particular how to precisely measure the use of time in classrooms and how to address the issue of partial engagement, in which only a portion of the class is academically engaged. The article defines three engagement indices that account for the range of attentiveness found in school children. A classroom observation instrument introduced in this article provides a means for education researchers and school staff to classroom timing measurements and display the results visually. Education researchers can use the tools provided in this article to measure the impact of various reform efforts on classroom effectiveness; school administrators can use these tools to monitor the efficiency of their teachers' use of classroom time. Contains 7 references and 5 figures.

Keywords: classroom observation, time on task, academic engagement time, allocated time, time on task

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1. INTRODUCTION

One person's wasted moment is another person's time well spent. With classroom time devoted to lecturing and off-topic rambling, and everything in between, classroom time usage varies widely from classroom to classroom and from one part of the school day to the next. Certainly any attempt to measure time usage in a school poses a severe challenge in accuracy and precision. Yet, without this insight the educational community will continually struggle to alter the dynamics of teaching and learning.

2. RESEARCH ON TIME AND LEARNING

Any discussion of time and learning usually begins with Carroll who, in an effort to distill a number of intersecting theories of learning into a more streamlined description of how the

learning process works, concluded that this process is ultimately organized around time. [1963]. In his view, time modulates how much any given student actually learns and can be expressed simply as a ratio of how much time a learner spends learning to the time a learner needs to achieve mastery of a particular "piece of learning." Carroll's approach might seem simplistic and obvious—who would disagree that the more students spend engaged with material the more they learn? But Berliner explained why Carroll's formulation represented then (and even perhaps today) a revolutionary concept in education:

> *[By linking learning directly to time] Carroll found a way to uncouple notions of aptitude from notions about genetic endowment and social class effects on the ability to learn. [Instead], 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. [1990, pp. 9–10]*

Carroll's reasoning certainly sounds sympathetic, but is it right? Results from controlled settings say "yes." As just one example, Gettinger [1985] found that spending or allocating less time than needed in learning a reading task negatively impacted both the initial degree of learning and retention.

One of the more precise methods of measuring time was developed by Fisher and his colleagues through their analysis of real classroom time use data supplied by the Beginning Teacher Evaluation Study. In mining the data collected from hundreds of hours of classroom observations, they discovered that Carroll's model was too unrefined for practical use. Instead, they believed it necessary to reconfigure Carroll's formulation to account for the inherent nature of classroom dynamics that act to diversify (and dilute) the way time is used, even as they still held true to Carroll's basic notion that time acts as the fundamental regulator of learning [Fisher *et al*. 1978].

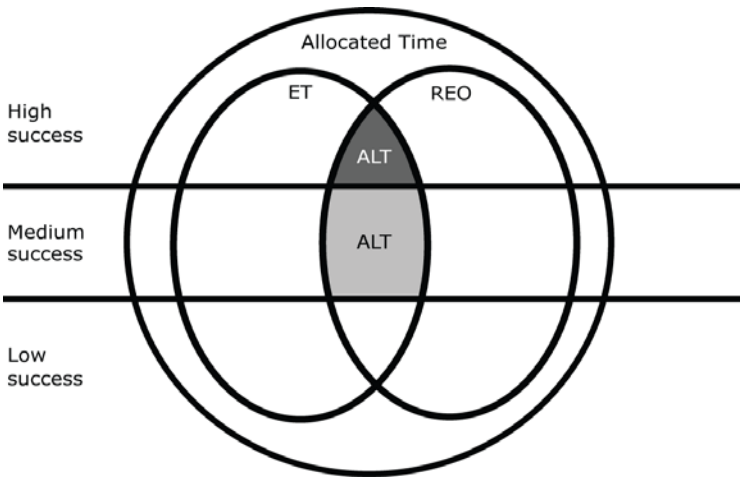

Fig. 1. The ALT model [Fisher *et al*. 1978], which relegates academic learning time to that part of the allocated time in which students are engaged (ET), working on activities related to expected outcomes (REO), and succeeding. Note that academic learning time for young children (fifth grade and below) occurs only during "high success experiences" (darkest section).

Dubbing their revised conceptualization the academic learning time (ALT) model, Fisher and his colleagues recast Carroll's formula in terms of the three intersecting circles shown in Figure 1. According to this visual rendition of the ALT model, the "time spent learning" introduced by Carroll corresponds to the overlap of (a) the time when students are paying attention (denoted *engaged time*, ET) and (b) that portion of teaching time focused on the content teachers expect their students to learn (denoted *related to outcomes*, RTO). The ALT model further assumes that true learning occurs only when students perceive that they have acquired a new piece of knowledge or skill (a high- or middle-success experience). After taking all these elements of the teaching and learning process into consideration, the ALT model offered not only a framework through which to analyze data but also revealed just how small a slice academic learning time occupies within the overall allocated instructional time.

When Berliner [1990] used the model to parse student outcomes, he found that ALT variables accounted for 8–9% of variance in achievement scores. Rossmiller [1986] revealed the true power of the model to predict outcomes by tracking student performance against a similar set of time variables. For students in the top three quartiles of performance, he similarly found that academic learning time factors accounted for

about 10% of the variance in achievement test scores in both reading and mathematics. But within the bottom quartile, the time variables correlated to a much stronger effect—the ALT variables predicted roughly 36% of the effects of test score variance. Simply put, *the more students struggle, the more time matters*.

Unfortunately, the ALT model offers little practical use as an education reform instrument. More time does lead to more learning or, put another way, quantity of time controls how much students will learn. However, researchers also need ways to measure the different slices of time so that teachers and school administrators can understand and appreciate how time usage relates to their own schools and classrooms.

3. ACADEMIC ENGAGEMENT TIME

Finding a suitable method through which to identify, collect and analyze data related to academic learning time would lead educators to a much deeper understanding of how they are spending time and, in turn, how time usage correlates to their students' academic achievement. Unfortunately, the qualitative factors expressed in Carroll's formula present a formidable barrier to establishing its use as a practical measure of classroom time on a daily basis. The ALT model is too subjective and hints at a self-fulfilling prophecy because time usage is credited more when students are performing activities with a high degree of success.

In this article, we adopt an approach that shifts the focus toward the behavior of the student. The process of observing classroom time usage by both teachers and students therefore begins by considering how to measure the time in which students appear *academically engaged*. Walker and his colleagues [1998] provided two simple steps to measure the academic engagement of students in the classroom:

1. Define what behaviors constitute academic engagement.
2. Track the time the student appears to be academically engaged using a stopwatch.

They did not provide a definitive list of academic engagement behaviors, however, and designed their approach to time the academic engagement of individual students, rather than whole classrooms. The behaviors we use in this article that satisfy Item 1 rely on the answer to a single question that appears obvious at first glance:

> *Do the students in the classroom appear mentally engaged in activities or content that is academic in nature?*

Academic engagement would then apply to situations when the teacher scores homework assignments while students complete an exam. On the other extreme, academic engagement does not apply in situations when the teacher is lecturing but students pay no attention. Also, academic engagement does apply when students listen to a public address system announcing birthdays—students are engaged, but not academically.

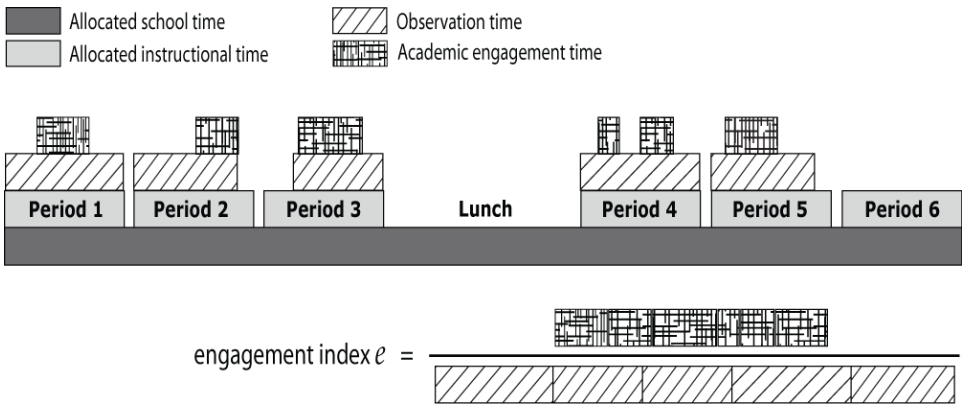

Fig. 2. Four commonly used categories of time for a typical six-period school day, laid out as a timeline from the beginning of the school day to the end. Here, the variable *academic engagement time* of Walker and colleagues [1998] replaces the traditional (yet less well-defined) variable *academic learning time*. A pictorial representation of the resulting engagement index is shown at the bottom, which indicates the depicted engagement index is roughly $e = 0.50 = 50\%$.

Since observation sessions vary in duration, we express the academic engagement time in proportion to the total observation time, thus defining the engagement index e as

$$e = \frac{\text{Academic Engagement Time}}{\text{Observation Time}} \quad .$$

Figure 2 visually depicts the relationship between the categories of time use in this article as well as the definition of the engagement index in the previous equation.

5. PARTIAL STUDENT ENGAGEMENT

During any portion of the allocated instructional time, any number of students can be either academically engaged or not. Some students remain focused on academic content despite many interruptions; others disengage no matter how intently the rest of the class is academically engaged. Intrator (2004) outlined what he termed “flavors of disengagement,” which included slow time, lost time, fake time, worry time, and play time — all of which create a barrier to academic learning.

Because of the variables involved in sampling individual students and because we are interested in determining how classroom organization and management affect engaged time, we advocate observing the entire class rather than only a few students. Therefore, the following discussion of partial engagement refers to portions of the classroom as a whole, rather than the varying degrees of engagement exhibited in an individual student.

We define the engagement index *e* (and in so doing the academic engagement time) as a range of values between two idealized groups of students: *attentive* and *non-attentive*. (The populations of both groups are dynamic because the students that engage or disengage the academic content can change at any given time.) Rather than relying solely on one measure of engagement, we define three engagement indices:

- The largest index e_A is reflective of the attentive group of students, which are imagined to be academically engaged at any time in which they are expected to be academically engaged. Therefore, the attentive group of students is credited with being academically engaged at any time during observations in which *any students are academically engaged*. In this sense, e_A establishes the upper bound on academic engagement for an observation period.
- The smallest index e_{NA} is reflective of the most non-attentive students who are credited with being academically engaged *only when the entire class is academically engaged*. The non-attentive index e_{NA} establishes the lower bound on academic engagement for an observation period.
- The effective engagement index e_{eff} accounts for the proportion of students that typically appeared engaged at any time during the observation. This index is calculated by weighting each instance of engagement for attentive students by the approximate proportion of students perceived to be engaged at that instant. A value e_{eff} close to e_A indicates that only a small number of students accounted for the partial disengagement encountered during observations. Conversely, a value of e_{eff} close to e_{NA} indicates that classroom sessions featured large proportions of disengaged students.

The set of indices can be further clarified using an example: $e_A = 0.8$; $e_{eff} = 0.7$; $e_{NA} = 0.4$. A school leader could translate this set of indices according to the following:

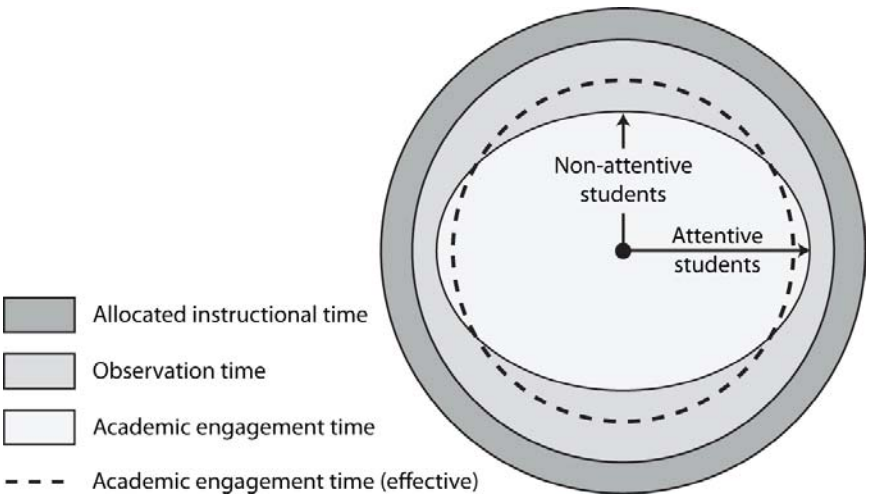

Fig. 3: A pictorial representation of typical classroom timing results. The academic engagement time is depicted as an ellipse, with the length of the major axis proportional to e_A and the minor axis proportional to e_{NA}. The radius of the dashed circle represents the effective academic engagement time e_{eff}. The observation time will completely overlap the allocated instructional time if observations are conducted "bell to bell."

> *"Our students are academically engaged anywhere from 40% to 80% of the time they are in class. Even our most attentive student could be expected to be engaged only 80% of the time at best. On the other hand, even the most inattentive students could be expected to be engaged at least 40% of the time. The effective engagement index of 70% lies relatively close to 80%, indicating that the students who are disengaged at any particular time are usually relatively small in number."*

Figure 3 visually displays the impact of academic engagement time in regards to attentive and non-attentive students. The goal of schools would be to "swell" the inner ellipse toward the boundary defined by the observational time. (The extent to which the academic engagement time circle should overlap the observation time circle will likely provoke some disagreement among educators.) However, partial disengagement "flattens" the ellipse, diminishing the staff's ability to meet this goal. Figure 4 provides a comparison using the visual aid for different observation sessions.

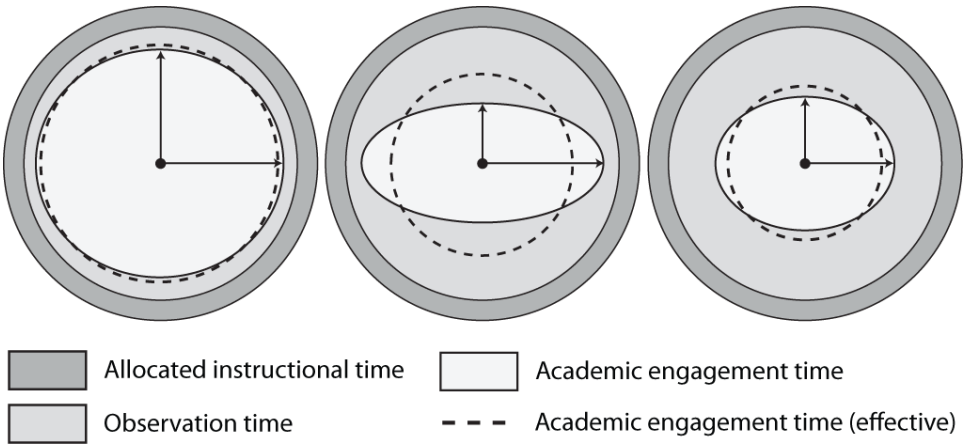

Figure 4: A comparison of academic engagement time for three different observation sessions. (left) Nearly all students engaged academic content during most of the observation time, producing a relatively large e_{eff} (radius of the dashed circle); (center) the long major axis indicates that some students were academically engaged in nearly every instant of the classroom session, but also a large number of students disengaged during this time; (right) the small, mostly circular ellipse indicates that the observation session featured considerable time in which none of the students engaged academic content.

7. MEASURING THE ENGAGEMENT INDICES

Measuring all three indices during a classroom observation poses less difficulty than one would imagine when using the instrument shown in Figure 5: For every minute of time that elapses during a classroom observation, the classroom observer simply shades in the proportion of students that appear academically engaged, with the proportion broken into fifths. According to the lower half of Figure 5, in the first three minutes all students were disengaged. The following two minutes featured 3/5 of students engaged and 2/5 disengaged, and so on. Note that for each minute of elapsed time the observer should always mark five boxes in the associated column.

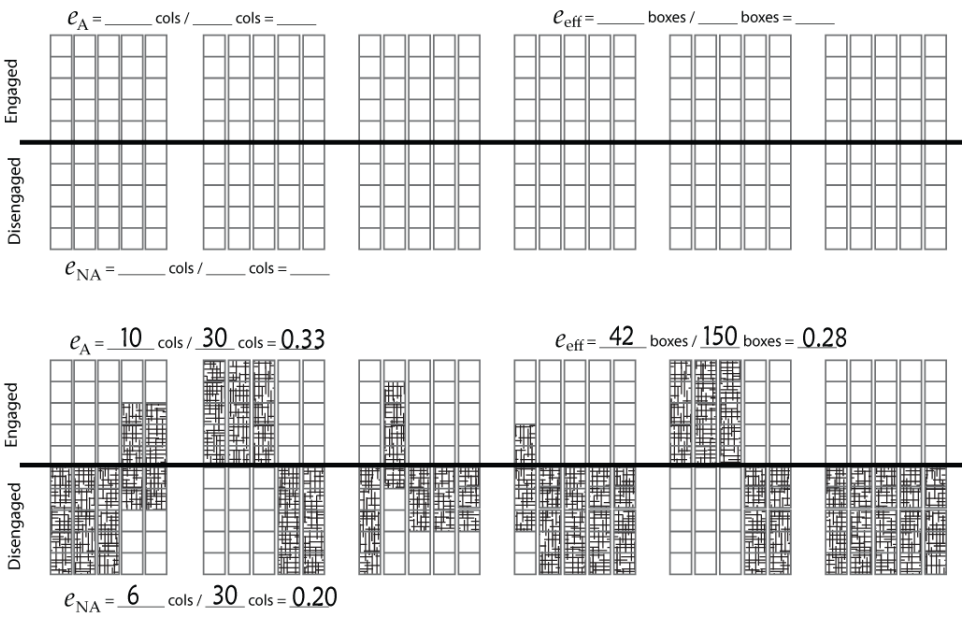

Figure 5. (upper) An instrument for marking 30-minute classroom observations. Each column of boxes corresponds to a one-minute duration of classroom time and each box corresponds to one-fifth of the class population. (lower) The instrument filled in for a hypothetical classroom timing session. Extending the instrument for longer observation times is straightforward.

Once the observation concludes, researchers can perform the following analysis:

- The academic engagement time for attentive students corresponds to the number of columns that feature *at least one* shaded box above the horizontal rule. (The academic engagement time shown in Figure 5, for example, is therefore 10 minutes.) Dividing by the total number of columns produces the attentive engagement index e_A (0.33 in Figure 5).
- The academic engagement time for non-attentive students corresponds to the number of columns featuring *all five* boxes above the horizontal rule shaded. Dividing this result by the total number of columns produces the non-attentive engagement index e_{NA} (0.20 in Figure 5).
- Researchers can calculate the effective engagement index e_{eff} (0.28 in Figure 5) by dividing the total number of shaded boxes above the horizontal rule by the total number of boxes (shaded or unshaded) above the horizontal rule.

Armed with such results, educators can then begin to look hard at what is takes place inside their classrooms and, in turn, identify which practices may yield an improved

engagement/disengagement ratio. Taking the example shown at the bottom of Figure 5, a researcher can question why so much time was lost during the first five minutes of the observation and what the teacher did at the five-minute mark to engage the entire class. Whole-school observations can focus on patterns appearing at specific times during the day, or comparisons between (say) traditional scheduling and block scheduling.

8. DISCUSSION

With myriad factors influencing student achievement, school reform often boils down to the ability to separate ``big potatoes'' from 'little potatoes,'' that is, distinguishing the most important factors from the inconsequential. Research suggests that insufficient use of classroom time and, specifically, too much time where individual students are disengaged from the learning activity is indeed a "big potato." Therefore, a methodical effort to measure time use in class is the necessary first step in correcting the misuse of time. Large-scale measurements involving thousands of classroom observation hours can then begin to settle long outstanding questions in education research.

- Does block scheduling provide a better use of the allocated school time?
- Does academic engagement diminish over the course of a day?
- Do low-performing schools feature proportionally more academic engagement?
- Does the socio-economic status of the school correlate to academic engagement?
- What effect does the subject matter (e.g., mathematics, history) have on academic engagement?
- How does academic engagement compare between schools, districts, states, and even countries?

Naturally, the research methods described in this article cannot eliminate subjectivity completely and such student behaviors as daydreaming will complicate observations, but regular use of the classroom timing instrument provided in this article* and reliance on a sound, systematic observation protocol will allow educational leaders over time to gauge the overall health of the educational environment their students experience on a daily basis. In turn, educators will be able to use the data (and, indeed, the act of collecting the data) to think more deeply about their own methods of engaging students in learning and perhaps modifying those practices for optimal learning.

*Free software for timing classroom sessions can be downloaded at http://standardsco.com/mobile_sapphire. Unlike the instrument in Figure 5, this software can time classroom processes (including partial engagement) down to the individual second, provide a visual display of results in real time, and disaggregate results according to the type of activities performed by the students.

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