A Comparison of Achievement and Attendance in Schools Using Traditional Academic Year Calendars and Year Round Calendars

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Abstract

The purpose of this study was to compare the organizational structure of a year round calendar (distributed learning) and a traditional calendar (massed learning) on achievement and attendance. Studies of schedules have found inconclusive evidence on the effect of calendar type on school outcomes and few have controlled for extraneous variables.

Achievement data and campus attendance rates were collected from elementary schools in Texas. Year round schools (n = 28) were matched with control schools (n = 28) using traditional calendars while controlling for ethnicity, socio-economic status, and language proficiency. Confounding constructs were controlled by physically matching campuses on important variables. Because data were collected for a two year period, a functional statistical sample size (n = 56) was available.

Schools on traditional calendars had a reliable ($p < .05$), but small effect size advantage over schools on year round calendars in elementary mathematics and reading achievement. Further, campuses using traditional calendars had a large effect size ($p < .05$) attendance rate advantage over the year round counterparts. Plausible alternative hypotheses are also presented.

In the early history of American formal schooling, school calendars were tailored to satisfy the needs of local communities (Gold, 2002). Many of the nation's schools were located in farming or agricultural regions and therefore long summer breaks that released students from school to help with planting in the spring and harvest in the fall developed as the norm. Some urban schools operated under an 11 or 12 month calendar schedule; however, the common nine-month academic calendar emerged from the era when 85% of Americans were in agriculture and when climate control in schools was limited (Gold, 2002). The United States Department of Agriculture (USDA) census revealed, that in 2002 about six percent of Americans' livelihoods were tied to an agriculture base and air-conditioning enabled schools to provide comfortable learning environments year round; nevertheless, in the early part of the 21 century the nine-month school year remained the standard for the nation. The National Education Commission on Time and Learning (NECTL, 1994) urged schools to develop school calendars that acknowledge differences in student learning needs and were appropriate for the major changes in life-styles that were taking place in the nation.

Arguments for and against year round calendars for schools are numerous (Kelly,2009). However, most of the pros and cons of year round schooling highlighted by Kelly have to do with issues other than student academic achievement. Research on the impact of year round school schedules on academic achievement is often poorly designed (Education Weekly, 2004) and lacks clear advantages of one type calendar over another (Cooper, Valentine, et al., 2003; Ferguson, 1999; Kneese, 2000; McMillan, 2001; Palmer & Bernis, 1999; Stenvall & Stenvall, 2001).

The possible impact of various types of school calendars on educational outcomes is a complex issue and although the problem has been addressed, there is a lack of conclusive evidence providing definitive directions to school stakeholders regarding time structure. A meta-analysis by Cooper, Nye, Charlton, Lindsay, and Greathouse (1996) analyzed studies of school districts that had modified their calendars, but did not increase the length of the school year. An important finding from their synthesis was that the quality of evidence available on modified school calendars made it difficult to draw reliable conclusions. Consequently, the purpose of the present study was to contribute to the knowledge base of school calendar structure by comparing the presumed differential effects of two types of school calendar on educational outcomes. Or, more specifically, the study was designed to compare schools on traditional nine-month calendars with schools on year round schedules on academic achievement and attendance rates.

The theoretical underpinning for the study dates back to research conducted by Ebbinghaus (1885/1913) in which he found that learning is more effective when it is dispersed over time; a learning schedule he called distributed learning. His research also revealed that re-learning is easier than initial learning, and that it requires more time to forget material after each subsequent relearning. However, his suggestion that distributed learning is more effective than concentrated (massed) learning forms the basis for the present study. In a conceptual framework, distributed learning is more similar to year round school calendars whereas massed learning is represented in the study by traditional 180 day school calendars.

The population of year round schools in the state of Texas consists mostly of schools that distribute learning over 45 days followed by a 10 day break or a 30 day learning period followed by a 5 day break. All of the year round campuses used in the present study are single-track schools which are on a 180 day per year plan just as the traditional calendar schools; however, the school days are distributed over the entire calendar year which shortens the long summer vacation break (Ballinger and Kneese, 2006).

Review of the Literature

Schools in the United States mostly operate on a 180 day per year system. Most school systems utilize the nine month calendar that was established when the nation was largely an agrarian society. However, some schools spread teaching and learning for the 180 day system across twelve-months in a more dispersed schedule than the traditional nine-month calendar. The most frequent system is called the 45 – 15 plan (Kelly, 2009) in which students attend 45 days and then are out of classes for 15 days for three cycles throughout the year.

Building on the earlier research by Ebbinghaus, Underwood (1974) conducted basic research comparing massed learning with distributed learning. A conclusion drawn from the study was that the difference in recall between massed and distributed learning resulted from a gradual decrease in the associative learning for the massed item without a similar effect for the distributed learning. This means that for massed stimuli, the learner essentially stops processing; the attention span is diminished because of redundancy in memorizing massed stimuli. Underwood's findings support the hypothesis that distributed learning may be superior to massed learning – in terms of the present study, there is theoretical and basic research that suggests a year round (distributed) calendar might be more effective than the traditional (massed) calendar for cognitive academic learning.

Studies have attempted to assess the impact of year round schooling, but are contradictory and indecisive. Palmer and Bemis (1999) in their review of literature concluded that achievement

of students in year round schools was at least has high as achievement of students in schools with traditional calendars. Kneese (2000) also found positive effects of year round schooling compared to traditional schedules based on overall achievement tests increases. However, Cooper, et al (2003) reviewed 39 studies and found no reliable difference in achievement for schools with modified school calendars and those on traditional school schedules. Similarly, McMillan (2001) found that achievement of North Carolina students in year round public schools achieved at the same level as students in traditional schools. Similar results showing no differences were found in a study of mathematics achievement (Ferguson, 1999). Stenvall and Stenvall (2001) analyzed Advanced Placement Index (API) scores for students in traditional and year round schools and reported that students in traditional schools outperformed their counterpart peers in year round schools. Finally, Crow (2009) concluded that mathematics achievement for fifth grade economically disadvantages students favored the schools with traditional calendars. Although some authors (Ballinger, 2007; Ballinger & Kneese, 2006; Huyvaert, 1998; Kneese, 1996; Tyack & Cuban, 1995) have noted both advantages and disadvantages of year round schedules for schools, Johnson and Spradlin (2007) opined that the perceived advantages of modified calendars are too small to justify a drastic alteration in the traditional calendar which is too entrenched in society to tear away.

Methodology

Sample

The causal-comparative design was used to examine relationships, if any, between the types of school calendar and (a) student academic achievement and (b) student attendance. Campuses included in the study were elementary with two of the three grade levels: three, four, and five. Specifically, 28 schools exhausted the number of campuses in the state using a year round schedule. Comparison school (traditional calendar) campuses (n = 28) were selected based on the matching criteria of percent of African American, percent of Hispanic, percent of White, percent of economically disadvantaged, and percent of limited English proficient (LEP) student enrollment (TEA). Because of the relatively small population of year round campuses, two years of achievement data were collected, one set from 2006-07 and the other set from 2007-08. Yielding a potential sample size of n = 56 campuses.

Data

Data collected for analysis on both year round calendar and traditional calendar campuses included the end of year state-mandated accountability test scores in reading and mathematics from the Texas Assessment of Knowledge and Skills (TAKS) for third, fourth, and fifth grade Hispanic and Caucasian students (TEA) and the over all campus attendance rates from the Academic Excellence Indicator System (AEIS) report. For both ethnic groups, 13 dependent variables were analyzed: third, fourth, and fifth grade reading and mathematics results and attendance rate for each type of school calendar.

Hypotheses

Two hypotheses were tested. The first null hypothesis stated that there would be no difference between (a) the number of instances schools with year round calendars would have higher achievement and (b) the number of instances schools with traditional calendars would have higher achievement. The second null hypothesis was that there would be no difference between schools with year round calendars and those using traditional calendars on student attendance rates.

Statistical Procedures

The criterion for significance (alpha) was set at 0.05. Two years of data were collected increasing the effective sample size to 56. However, analyses of certain subpopulations resulted in a sample size as low as 20 campuses per group in some areas, which yielded a power of 0.34 – an unacceptable level assuming a medium effect size (Cohen, 1988). Under the assumption that a random distribution of higher achieving campuses would result in an equal number of traditional calendar schools and year round calendar schools over the 12 comparisons (i.e., six traditional schools higher, six year round schools higher), a binomial probability distribution was used to test the actual distribution against the theoretical distribution (similar to a sign test) for the first hypothesis. For the second hypothesis, since 56 campuses per group were available, the null hypothesis was tested using an independent t-test with calendar type serving as the independent variable and attendance rate as the dependent variable.

Results

Table 1 shows summary statistics disaggregated by ethnicity, grade level, and subject area. The number of campuses, mean achievement scores by grade level, and Cohen's *d* effect size (Cohen, 1988) are displayed.

Table 1 Achievement Summary by Calendar Schedule

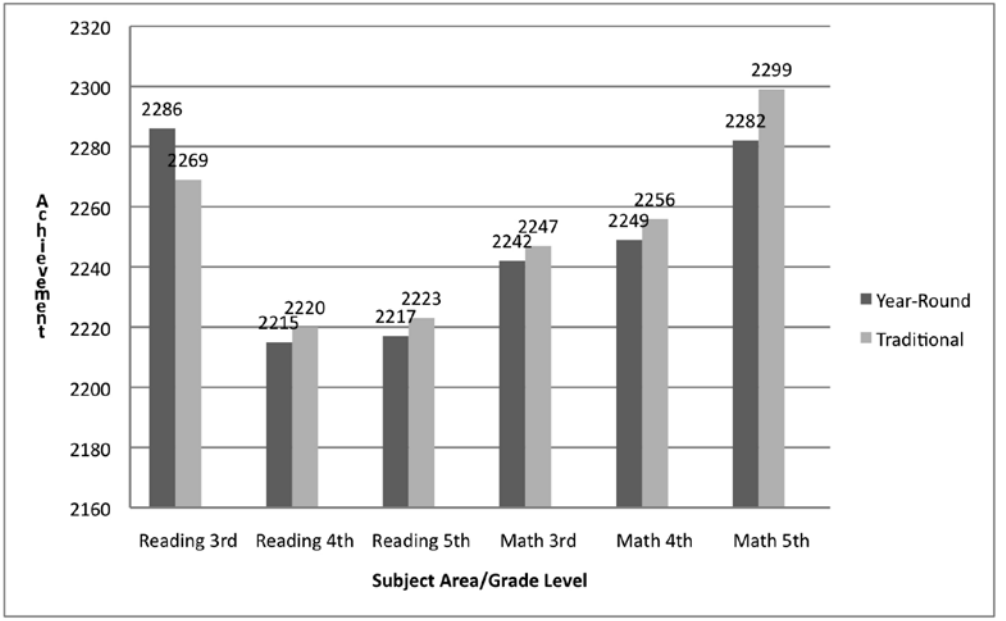
Group	Year-Round		Traditional		Effect Size
	N	Mean	N	Mean	(Cohen's *d*)
Hispanic					
3rd grade reading	56	2286	56	2269	.2^{YR}
4th grade reading	56	2215	56	2220	.1^{T}
5th grade reading	52	2217	48	2223	.1^{T}
3rd grade math	56	2242	56	2247	.1^{T}
4th grade math	56	2249	56	2256	.1^{T}
5th grade math	49	2282	48	2299	.3^{T}
Caucasian					
3rd grade reading	20	2275	27	2290	.2^{T}
4th grade reading	21	2271	24	2298	.3^{T}
5th grade reading	20	2305	20	2322	.2^{T}
3rd grade math	20	2275	27	2290	.2^{T}
4th grade math	21	2276	24	2315	.4^{T}
5th grade math	23	2321	20	2351	.3^{T}

Note: ^{T} indicates traditional calendar schools scored higher on achievement test;
^{YR} indicates year round calendar schools scored higher on achievement test

As shown in Table 1, schools operating on the traditional calendar schedule scored higher on 12 of the 13 comparisons. Cohen's *d* indicates that the effect sizes were small to moderate; however, the directions of the differences were fairly reliable.

The subject by grade comparisons for Hispanic students are visually displayed in Figure 1.

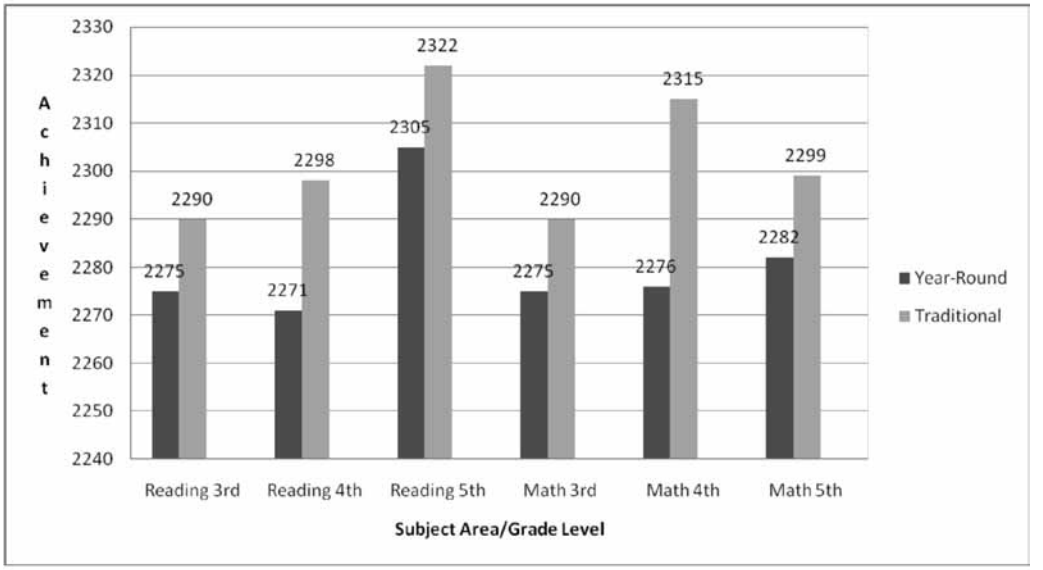
Figure 1: Hispanic achievement mean scores in reading and math



Except for 3rd grade reading, scores for the schools on traditional schedules were higher than mean scores for the schools on year round schedules.

Information is provided for Caucasian students in Figure 2. The grouped-bar graph shows a direct comparison of mean achievement scores for schools on traditional calendars and schools on year round schedules. For Caucasian students, achievement for the schools on traditional calendars was higher than the mean achievement for the schools on year round calendars in each of the 12 comparisons.

Figure 2: Caucasian achievement mean scores in reading and math

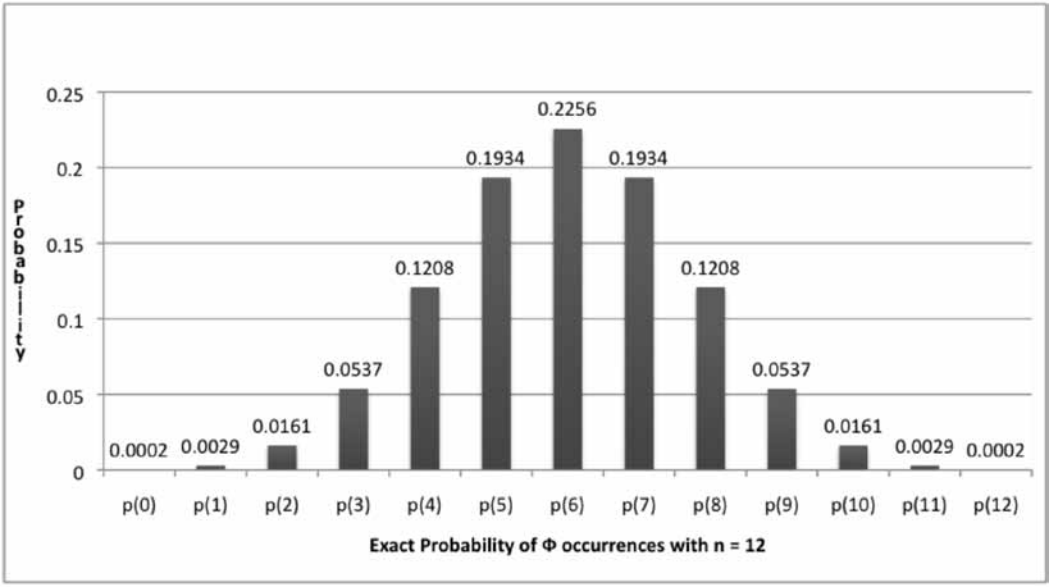


The descriptive data presented in Table 1, Figure 1 and Figure 2 show that 11 of 12 comparisons of mean achievement between schools on year round calendars and on traditional calendars were in a consistent direction. The consistency of direction of mean score differences indicates the traditional schedules resulted in small achievement score effect size advantages.

The first null hypothesis states that there would be no difference in (a) the number of instances in which achievement of schools with year round calendars would exceed achievement of schools with traditional calendars and (b) the number of instances in which achievement in schools with traditional calendars would exceed achievement in year round schools. The expectation under the null hypothesis is that instances of higher achievement for traditional schools and for year round schools would not be different -- i.e., six in favor of traditional calendar schools and six in favor of year round schools. Under the assumption that the probability is .5 that one type of calendar would be superior to the other for any particular comparison just on the basis of chance, the binomial probability distribution was appropriate for testing the null hypothesis.

Figure 3 shows the possible outcomes of the binomial distribution with N = 12 and $p = q = .5$ where p is the probability that traditional schools have higher achievement and q is the probability that year round schools have higher achievement. Each outcome $p(\Phi)$ is the probability that exactly Φ instances in which achievement in year around schools is superior to achievement in traditional schools.

Figure 3: Binomial probability distribution



Note: p(Φ) probability of obtaining exactly " Φ" cases of Year-Round Schools outperforming Traditional Calendar Schools

The probability that, *at most* one case out of 12, the year round schools would outperform traditional calendar schools = p(0) + p(1) = .0002 + .0029 = .0031; thus, $p < 0.05$. The null hypothesis was therefore rejected; hence, instances of achievement of traditional schools exceeding achievement of year round schools was statistically significant ($p < .05$).

The second null hypothesis was that there would be no difference in attendance rates between schools with year round schedules and schools with traditional calendars. Table 3 shows the descriptive summary statistics as well as t-test results for inferential analysis of the null hypothesis.

Table 3 Descriptive and t-Test Results for Attendance Rates by Calendar Type

Type	Mean Rate	Std. Dev.	df	t-value	*p*-value	Effect Size (*d*)
Year Round	96.55	0.54	110	4.00	<.001	0.82
Traditional	97.03	0.73				

As shown in Table 3, the mean attendance rate at campuses using a traditional calendar was higher ($p < .05$) than the rate at campuses on year round schedules. Not only was the difference between the two attendance rates statistically significant, Cohen's *d* of 0.82 indicates a large effect size in favor of the campuses on a traditional schedule.

Conclusions

As reported in *The Use of Time for Teaching and Learning* (1996), the study of any impact of a school calendar on academic learning is a complex and subtle issue. Definitive answers are elusive in the literature and the present study offers only tentative evidence regarding school calendars and their influence on academic achievement. Evidence provided in this investigation tends to give traditional schedules a slight edge over year round schedules in the academic achievement domain and shows stronger tendencies in the same direction with attendance rates.

A preponderance of literature confirms that learning loss over the inactive summer months in the traditional calendar is substantial and reliable. The present study sought to provide evidence that the continuous learning provided by the distributed calendar would enable students to overcome summer losses. However, this study supports the hypothesis that traditional calendars are not inferior to year round calendars in elementary grades with respect to core academic areas and, in fact, may be advantageous. One alternative explanation may have a solid foundation based on *when* achievement is assessed. In examining the sequence of activities during the study leading up to the achievement tests being administered at the conclusion of the academic year, it was noted that students under the traditional calendar actually had a longer *sustained* period of continuous academic instruction immediately prior to the testing than the year round students. So, the contiguous nature between assessment and more lengthy sustained instruction represents a plausible alternative explanation to the slight advantage of the traditional calendar. In addition, because of frequent breaks in schooling, year round students may experience mini-losses during vacation periods, especially when a break occurs in the latter part of the academic year near the time period when state-mandated tests are administered.

Thus, relevant questions remain about academic performance and school calendar type. For example, what would happen if the assessment of achievement were made at the beginning of an academic year? If achievement under a traditional schedule suffers a decline during the long summer months as verified in the literature and year round students begin the academic year with less academic loss, then results different from the findings of this study would be expected. In turn, at what point during the school year do traditional calendar students catch and match year round calendar students on achievement?

Also, could the fact that students under a traditional schedule had a higher attendance rate account for slightly enhanced achievement scores? Time on task is a well known correlate of academic achievement (Slavin, 2003) and higher attendance rates would translate into more time for learning. Thus, students with more time in school would be expected to achieve at a higher rate. A post-hoc serendipitous analysis revealed that the product-moment correlation between attendance rate and achievement was indeed positive for reading (0.48; $p < 0.01$) and mathematics (0.37; $p < 0.01$). Such a relationship is consistent with an alternate hypothesis that it was time-on-task rather than type of curriculum that contributed to the small but positive advantage for traditional curricula.

Since the present study raised a number of such questions, perhaps the decision about whether a particular district should adopt one specific type of calendar should rest on important constructs other than academic achievement. Maybe there are advantages from financial, sociological, developmental, psychological, familial or other perspectives outside of the factors considered in the present study that might give a decided advantage to one type calendar over the other.

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