Impact of Summer Recess on Mathematics Learning Retention

This manuscript has been peer-reviewed, accepted, and endorsed by the National Council of Professors of Educational Administration (NCPEA) as a significant contribution to the scholarship and practice of school administration and K-12 education.

2016 Morphet Dissertation Award Winner

As the Morphet Award Winner this manuscript is being formatted in the manner in which it was submitted for consideration.

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School administrators across the nation are actively searching for solutions to increase student achievement due in part to the significant amount of knowledge that is lost annually each summer. Mathematical computation skills are especially at-risk. This quantitative research study was designed to investigate the impact of summer recess also known as summer vacation on mathematical computation skills. Assessing children in second and third grade from two different school calendars accomplished this on two separate occasions. First, children from a traditional calendar school and a balanced calendar school were assessed the last week of school respectively using a standardized benchmark assessment called the M-COMP. The same children were then post-tested using the same test following the summer recess. For the traditional calendar children the length of time between each assessment was 12-weeks. Participants from the balanced school calendar were posted·tested following a six-week summer recess. Dramatic results were revealed.

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State the purpose of the research, the justification for it, and why it was done this particular way:

The Purpose of this empirical study was to investigate the relationship between the length of summer recess and mathematical learning retention with second and third grade students in a Midwestern state. Previous research regarding the balanced school calendar and its effects on the summer learning loss has been somewhat inconclusive and dated. In the majority of cases, previous research focused on state assessment data. While working with a secondary data set such as state assessment data has benefits, there are flaws to using a secondary data set to study the impact that summer recess has on mathematics learning retention. Two common concerns include the fact that state assessment questions and the participants change annually. By using a pre-test/post-test comparison study, the participants and the test remain constant, thus this study was designed to mitigate the concern of many previous studies.

State how the research may contribute to knowledge and/or practice in educational administration:

When seeking ways to mitigate the impact of summer recess on mathematics, this study gives policy makers, educational leaders, and interested stakeholders the statistical data needed to advocate for a shorter summer recess based on empirical evidence.

Theory/Rationale: State the explicit theoretical basis or rationale for the research, referring to the relevant literature:

Proponents of the balanced school calendar use Faucet Theory to support their position (Entwisle, Alexander, & Olson, 2001). Faucet theory developed by Entwisle, Alexander, and Olson {1997) is the belief that during the academic school year, the faucet of resources flows for all children; during the summer intermission the faucet of resources is turned off (Rozelle & Mackenzie, 2011). Faucet theory, as it relates to education, rests upon two dominant assumptions: 1) When children are in session, all children can access the curriculum and learn, however, during the summer recess, the learning resources are turned off, and 2) The amount of resources available to a middle class child compared to an at-risk child may contribute to further summer learning loss gaps (Borman, Benson, & Overman, 2005; Gershenson, 2013; Miller, 2007; Rozelle & Mackenzie, 2011; Zvoch & Stevens, 2013). A typical 12-week summer produces a loss of 2.6 months of previous learning in mathematics (Entwisle et al., 2001). Without investigating alternatives to minimizing the loss that occurs during the summer recess, teachers and administrators will continue to be required to close the gaps created each summer.

State the problems/questions/hypotheses that were proposed to be answered and/or tested in the research as derived from the theory/rationale.

The quantitative study was designed to answer the following questions:

1) To what extent does the length of summer recess impact student mathematical learning retention?
2) Is there a relationship between student mathematical learning retention and economic

status of students, gender, intersession attendance, and academic calendar?

Research Procedures: Describe the population studies, including any sample.

The population in this study included second and third grade children that attended school in the spring and fall of 2014. Half of the sample attended school on the traditional school calendar with a 12-week summer recess and the other half attended school on a balanced school calendar with a six-week summer recess. The selected schools had similar free and reduced lunch percentages and similar achievement levels based on the state education assessment. Each school had a similar teaching staff and each selected classroom was at or near capacity with limits of 25-27 children.

Describe the instruments/procedures used in data collecting, including any sampling procedures.

Purposeful sampling was used to identify and select the schools. Only second and third grade students with parental consent participated. In this study, approximately 200 second and third graders from a traditional calendar school and approximately 175 students from a balanced calendar school were invited to make up the sample. The actual total sample size (N=237) included 120 female students and 117 male students.

Give the dates during which the data were collected.

- Balanced Calendar Data Collection: June 2014 & August 2014 (Six-weeks between each collection)
- Traditional Calendar Data Collection: June 2014 & September 2014 (12-weeks between each collection)

Describe the techniques used for data analysis, including any scaling forms and statistical procedures.

Descriptive statistics were used to provide a summary. The analysis included a paired- samples T-test to determine if there was a significant relationship between the independent variable, the type of school in which a child is enrolled, and the dependent variable, student mathematical learning retention. In this case, AIMSweb M-COMP scores for students enrolled in a school with a six-week summer recess (balanced calendar) and a school with a 12-week summer recess (traditional calendar school) were compared. Participants took the M-COMP test at the end of the school year. The students from both groups took the same assessment approximately 42-84 days later.

SPSS® software, version 22 was used to analyze the data. While analyzing the relationship between the variables, a multiple regression was conducted to determine ifthere is a significant relationship between the independent variables, economic status, gender, attendance in summer intersession, and academic calendar and the dependent variable, student post-test results. In this study, the M-COMP post-test scores for each student were compared with the economic status of the sample, the gender of the selected students, whether or not a student received remediation or enrichment over the summer, and the academic calendar for each participant.

State the validity/reliability standards used to establish the credibility of the date and analytic procedures used in the study.

Pearson's AIMSweb received the highest possible rating for predictive validity and reliability from the National Center on Response to Intervention (NCRTI, 2009). To determine if the instrument was valid, mathematical experts were engaged in analyzing the assessment and when all data were aggregated, the assessment was deemed standardized. In both cases, reliability and validation were consistently being scrutinized. Table 1 in the appendix describes the validity of the M-COMP benchmark assessment.

Findings and Interpretations: State the findings for the study. State any delimitations to be placed on the findings.

The analysis included a paired-samples t-test and the results indicated that there was a decline in test scores from the pre-test to the post-test as the result of summer recess for all children. Overall losses occurred regardless of the school a participant attended, however, when comparing the two academic calendars, the participants who attended school on the balanced calendar scored on average 5.527 points better than their counterparts on the traditional school calendar when comparing mean scores as shown in Table 2. Traditional calendar participants regressed on average of 7.913 points on the M-COMP due to the 12-week summer recess as compared to participants who attended the balanced calendar school that only regressed an average of 2.773 points on the pre-test/post-test assessment. These results demonstrated that children attending the balanced calendar school lose fewer mathematical computation skills over the summer.

A multiple regression was conducted to determine if there was a relationship between student mathematical learning retention and economic status of students, gender, intersession attendance, and academic calendar. Table 3 describes the results of the multiple regression. A result that achieved a level less than $p<0.05$ was interpreted as significant. In this case, the data do not demonstrate statistical significance for economic status as the result of the regression $p<0.062$. Therefore table 3 i11ustrates that children who received tree or reduced lunch (economic status) had similar results regardless of which academic calendar they attended.

Relevant to this study, gender and attendance in summer intersession were also analyzed. In the case of the type of calendar, gender is not a significant factor when considering the type of school a student attends. The significance level for gender were $p<0.654$, which is not considered significant.

Only 16 students in the entire population attended a mathematical remediation or enrichment opportunity over the summer, also known as summer intersession. Although the number of participants was low, children who participated in mathematical summer intersession scored better than their counterparts who did not. The significance level for children attending a summer intersession opportunity over the summer was $p<0.000$. A case can be made that mathematical instruction in the summer regardless of the type; remediation or enrichment reduces the impact of summer recess.

The multiple regression analysis demonstrated a significance level of $p<0.000$ for the type of calendar the participants attended. As a result of the significance demonstrated, all children who attended the balanced calendar scored better on the M-COMP than their counterparts attending the traditional calendar school.

With a significance level of $p<0.000$ for the pre-test, the multiple regression analysis demonstrated that all participants scored better on their pre-test on average than on their post- test. Reducing the summer recess should be a priority for administrators and policy makers, and community members interested in increasing student achievement.

Three delimitations potentially jeopardizing the external validity of this study include: 1) only results from two schools were included in this study; 2) the size of the population of this study may prevent it from being transferable or generalizable due to the ongoing changes at the federal, state and local levels; and 3) this study was limited to the impact the length of summer recess has on mathematics learning retention for second and third graders.

For statistical studies, include relevant descriptive and inferential statistics, summary tables and graphs.

This study was conducted to test the significance of summer recess on the retention of mathematical computation skills. Participants (N"""237) completed both the pre-test and the post- test. The population included 120 girls and 117 boys. All of the participants were in either second (n=l 17) or third grade (n=120) during the pre-test and were promoted to the next grade following summer recess. A brief survey was conducted prior to the post-test to determine whether or not a participant received remediation or enrichment over the summer in mathematics. Of the total N=237 participants in the study, 54% *(n-127)* attended a traditional calendar school, while the remaining 46% *(n=J JO)* attended a balanced calendar school. In a determination of socioeconomic status, 42% *(n=99)* of the participants were full paying lunch students, while 58% *(n=/ 38)* of the students were eligible for free and reduced lunch. Further defining the at-risk population, 54% *(n=75)* of the students attended a traditional calendar while 46% *(n=63)* of the students attended a balanced calendar.

Conclusion and Recommendations: State the conclusion from the findings.

The results of this study demonstrate that regardless of economic status and gender, children who attend a balanced school calendar with a summer recess of six-weeks retain more mathematical knowledge than their counterparts who attend school on the traditional school calendar with a 12-week summer recess. Furthermore, children who received some mathematical instruction while on summer recess retained more mathematical knowledge as compared to their peers who did not receive instruction during summer recess. Finally the length of summer recess has a significant impact on mathematical retention. All children in this study who attended the balanced school calendar outperformed their counterparts on the traditional school calendar. These results give policy makers and educational leaders empirical evidence to support the balanced school calendar.

Relate the conclusions to the original theory/rationale. State what has been learned for the field of educational administration from this research.

The results of this study have implications for the achievement gap and substantiate that the balanced school calendar is good for all children, it has been determined that the length of summer recess has a significant impact on mathematical retention for all children. It can be assumed that an alternative school calendar such as the balanced school calendar where the longest consecutive summer break must be no longer than six-weeks long has a positive impact on mathematical computation skills. It can also be assumed that when students receive some instruction in the summer regardless of remediation or enrichment, their ability to retain mathematical computational skills increases.

Various stakeholder groups will benefit from the results of this study. The intended purpose of this quantitative study was to provide policy makers, school board members, school administrators, teachers, and community members data about the relationship between the length of summer recess and student mathematics achievement. The results of this study have produced recommendations, future research, and should help change current perceptions of the impact of summer recess on mathematics skills retention. "Summer vacation is a grand thing. But in the twenty-first century, for many children, it may also be an anachronism" (Hess, 2006, p.5).

Suggest improvements on this research study and new questions that should be investigated.

1. In light of the reported results, this study should be replicated in other districts, as the sample size was relatively small.
2. Despite the confounding research supporting the benefits of the balanced school calendar for at-risk students, future investigations into mathematical computation skills is recommended as the results of this study did not find statistical significance with this population.
3. Due to the fact that the results of this research are not generalizable to a similar population, more research is needed to validate the results of this study.
4. This study was specific to the impact summer recess has on the learning retention of mathematical computation skills. As a result, testing other subject matter should be considered.

Based on this study, future research is needed to further explore the relationship between the at-risk status of a student and mathematical learning retention over summer recess. In addition, future researchers should consider replicating this study using other academic subjects. Although previous research by Kneese and Knight (1995) has identified that summer recess as most detrimental on mathematical computation skills, follow-up studies are warranted.

APPENDIX

Table 1. Descriptive and Reliability Statistics by Grade (Pearson, n.d.)

Grade	Mean*	SD[b]	SEM[c]	r[d]	Split-Half	Alpha[d]
1	36.0	12.8	4.02	.86	.89	.87
2	37.9	11.4	4.04	.82	.85	.82
3	51.2	17.6	4.67	.89	.90	.89

* Weighted average.
b Pooled standard deviation
c Average correlation coefficient and the actual standard deviation of the raw score for the probe
d The average reliability coefficients were calculated by using Fisher's z transformation.

Table 2. Mean Test Results

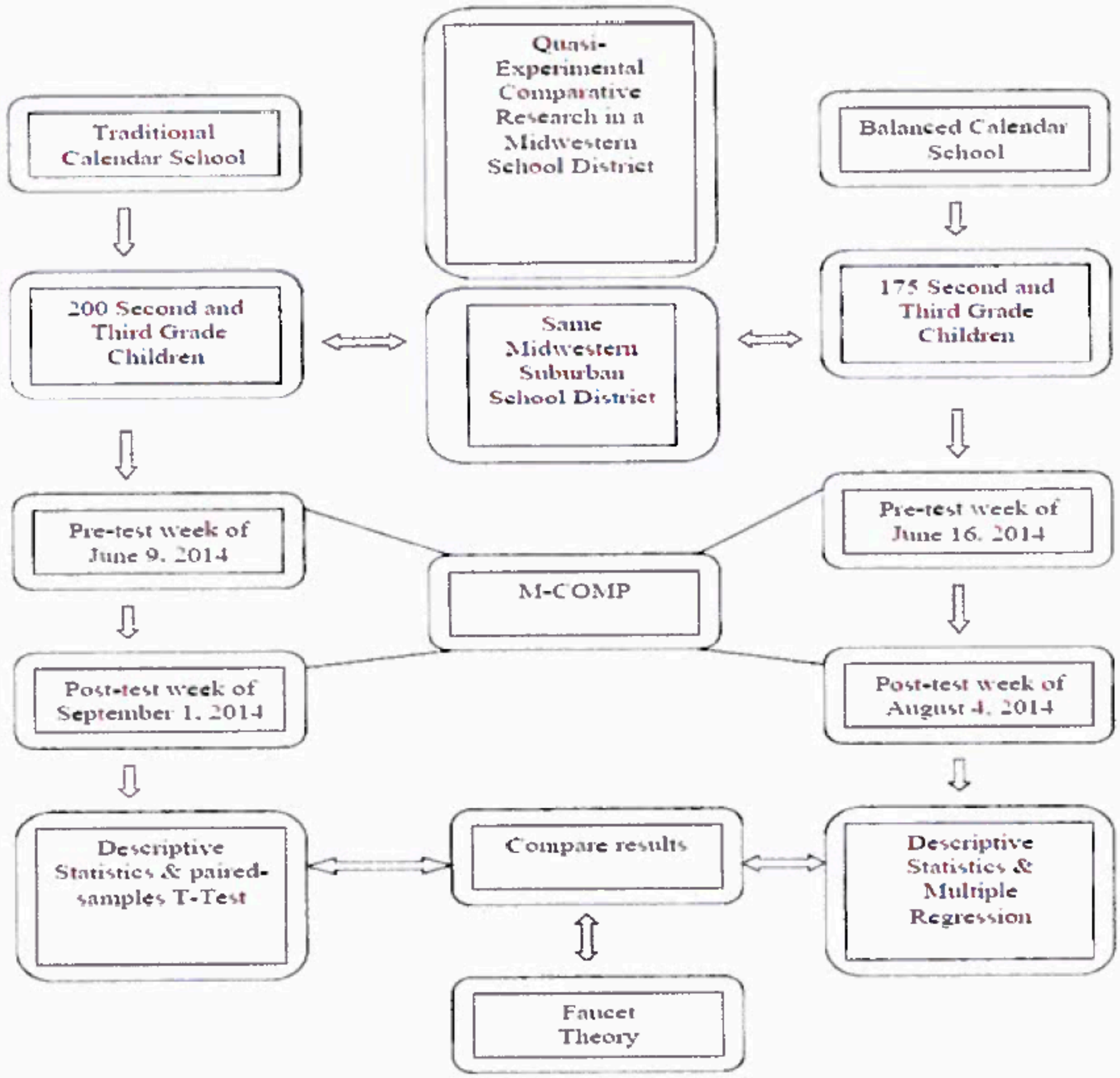
School	Pre-test Mean (Spring)	Post-test Mean (Fall)	Mean Difference
(Traditional)	41.94	34.03	7.913
(Balanced)	42.88	40.11	2.773
Overall			5.527

Table 3. Multi.me Regression Results of Research_Question #2

Model	Unstandardized Coefficients (a)		Sig
	B	Std. Error	
(Constant)	-3.947	1.247	0.002
Gender:Male	0.308	0.685	0.654
South School_(Balanced)	5.082	0.683	0.000***
Economic Status	-1.308	0.699	0.062
Pre-test	0.910	0.024	0.000***
Participation in Summer Intersession	6.935	1.353	0.000***

***$p<0.05$
(a) Dependent Variable: Mathematical Learning Retention (post-test results)

FRAMEWORK


Quasi-Experimental Comparative Research in a Midwestern School District
Traditional Calendar School
Balanced Calendar School
200 Second and Third Grade Children
Same Midwestern Suburban School District
175 Second and Third Grade Children
Pre-test week of June 9, 2014
M-COMP
Pre-test week of June 16, 2014
Post-test week of September 1, 2014
Post-test week of August 4, 2014
Descriptive Statistics & paired-samples T-Test
Compare results
Descriptive Statistics & Multiple Regression
Faucet Theory

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