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Mathematics Learning and Retention Through a Summer Program for Underserved Elementary Children

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Abstract: *Many are concerned with potential learning loss that can occur during the summer break. This is of particular concern for underserved populations of elementary school children. This paper describes a summer school program that was designed to serve one of these populations as well as its effects on the retention and learning of mathematics knowledge. The researchers found that, on average, students in each grade level were able to maintain or improve their performance on mathematics tests that assessed knowledge related to the number and operation concepts that were designated by the state core standards for their corresponding grades.*
Keywords: *Summer Programs, Mathematics Learning Retention, Mathematics Education*

Introduction

Summer learning loss, especially among elementary students, is an ongoing concern to many educators. The potential loss of knowledge that was gained during the previous elementary school year is of particular worry with regards to the children of those who are in a low socio-economic class. This is partly because their parents may not have time or money to provide experiences that might help mitigate that loss. Fortunately, many educators have developed and provided summer programs that have been successful in lessening the loss of student achievement. Knowing the potential of these types of programs, a group of university professors from a School of Education; the school, community, and university partnership at that university; and the United Way collaborated to submit a proposal for a grant to provide a summer school opportunity for elementary students in an underserved section of a moderately large city. This proposal was submitted in response to an RFP from the state's Department of Workforce Services. This proposal was funded to conduct the program for three years.

Description of Program

This summer school program was held for eight weeks in a small community center that was situated in the part of the city where the target population lived. Classes were held Monday through Thursday from 8:00 until 1:00. The students were served both breakfast and lunch. Each student had classes daily in mathematics, literacy, arts enrichment, and physical education. An employee from the local library also came and did story time with them once a week. In addition, they went on three field trips during the program to various local interactive museums.

The students were divided into three groups based on the grade they had just finished, and they rotated through each class as a group. The youngest group consisted of students who had just finished kindergarten or first grade. The students in the second group had just finished second or third grade. The students in the oldest group had just finished fourth, fifth, or sixth

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grade. Teachers of the core classes were licensed, experienced, currently-practicing elementary school teachers who had all had taught at least four years. There were two teachers for literacy, one for mathematics, and one for arts enrichment. The mathematics teacher had an elementary mathematics endorsement, a master's degree in Curriculum Design and Instruction, and eight years of teaching experience. Professors of Education from the university that received the grant with specialties in mathematics, literacy, and arts education helped the teacher who taught in their area of expertise plan and prepare for instruction during the program as well as with assessment of each of the students at the beginning and end of the program. There were also six mentors who helped with the program, assisting the teachers and helping with behavior management. Two of the six mentors had recently completed the Elementary Education program the the participating university, and they were going to be teaching full-time in the fall. Two of the mentors were current students in the Elementary Education program, and the final two were students majoring in counseling and social work. Two mentors were assigned to work with the youngest group, and the other two groups of students each had one mentor. One mentor was assigned to assist the program coordinator, and the other helped with physical education and by giving needed support to other groups.

Purpose of the Study

The purpose of this study was to assess the effects of this summer school program on the learning and retention of mathematics knowledge of the participants. Although each student in the summer program participated in mathematics, literacy, and arts enrichment classes, the focus of this study was to specifically look at the mathematics learning.

Related Literature

Summer Learning Loss

McCombs, Augustine, Schwartz, Bodilly, McInnis, Lichter, and Cross (2011) reported studies that showed that after summer vacation, on average, students performed roughly one month behind where they had performed in the spring. The loss was especially severe in mathematics. Other research on the loss of academic learning during the summer has shown that without ongoing opportunities to learn and practice essential skills, students fall behind on measures of academic achievement during the summer months, losing as much as two months of grade-level equivalency in mathematical computation (Alexander, 2007; Cooper, 2003; McLaughlin & Smink, 2009). Even more concerning, other research has suggested that this summer learning loss is cumulative. When students have repeated episodes of learning loss, it results in them falling further and further behind (McCombs et al. 2011).

Purpose of Summer School Programs

Summer school programs now are often created to help lessen that potential learning loss. However, that hasn't always been the case. Originally, many summer school programs were created with the purposes of remediation or prevention of behavior problems (Cooper, Charlton, Valentine, & Muhlenbruck, 2000). In recent decades, there has been a change in thinking about the role of summer school programs. Instead of the punitive and remedial models of the past, summer school programs are now thought of as an opportunity for a blend of core academic learning with other experiences in the arts, sports, skill-building, and building meaningful relationships (Cooper et al., 2000; McLaughlin & Smink, 2009).

Effectiveness of Summer School

Evidence suggests that summer school programs can lessen the drop in achievement over the summer break (Borman & Dowling, 2006; Cann et al, 2014; Lauer, Akiba, Wilkerson, Apthorp, Snow, & Martin-Glenn, 2006). In a meta-analysis of 33 out-of-school-time programs conducted by Lauer et al. (2006), they found small but statistically significant positive effects of out-of-school-time programs on mathematics student achievement. They found that whether the out-of-school-time program took place after school or during the summer did not make a difference in effectiveness (Lauer et al., 2006). When summarizing findings from a meta-analysis conducted by Cooper, Nye, Charlton, Lindsay, and Greathouse (1996), they recommended that the research on alleviating summer learning loss suggested that a primary focus on mathematics instruction seemed to be the most needed (Cooper et al., 2000). Cooper et al. (2000) also concluded that summer school was an effective system for achieving educational goals, and while the benefits of such programs vary due to the differences in the children and the content and delivery of the program, overall, the positive results were unmistakable.

Summer Programs and Low SES Children

Considerations of the needs of children from low SES families or other underserved populations have been a major influence on the creation of summer programs, and several pieces of research have shown that there are distinct differences in the rates at which low-income and higher-income students learn in the summer (Cooper et al., 2000; Lauer et al., 2006; McCombs et al., 2011). Some studies have shown that while students from high-income and low-income families learn at the same rate during school, learning for the low-income students falls far behind during the summer months. This is one of the reasons that some have suggested that summer programs for low SES children are especially important (McCombs et al., 2011).

Methodology

Participants

The participants in this study were the K-6 students who participated in the summer program. The majority of these students live in an area of the city that is considered to be of low socio-economic status, includes many apartment buildings, and is almost entirely composed of non-white citizens. There were a total of 61 students enrolled in the program. Of those 61 students, 54 attended two or more times. Thirty-five attended more than 20 days. Of the 54 who attended at least twice, 51 were Latinos/as, and the other three were Caucasian. Twelve of the students were not proficient in English. Two students had been diagnosed with autism, and one of those students had also been diagnosed with ADHD. Parents of the participating students filled out a questionnaire with demographic information at the beginning of the program, and 23 reported that their children received free and/or reduced rate lunch; five reported that they did not; and 26 did not report. Most of these parents had more than one child in the program. Thirty-seven students were given both pre and posttests that were used in the analyses, 31 of those students attended more than 20 days.

Instruments and Data Collection

Information about each child's understanding of mathematics concepts was collected through mathematics tests that were given to the students the first or second day of the program

and again during the last week of the program. The students were given a test that corresponded to the grade they had just completed. A different test was created for each grade K-6 by the researchers. The researchers created tests for grades 2-6 by using a bank of questions from the appropriate grade-level test from *Go Math* (Houghton Mifflin Harcourt, 2011), which was the mathematics curriculum that was used by the participating school district. The mathematics emphasis of this summer program was number and operation. Therefore, representative items for these tests were also chosen that matched the grade-level state core standards in those areas. These tests each consisted of 10 items. The test items for Kindergarten and 1st grade were created by the researchers, also to correspond with the state core standards related to number and operation in those grades. The Kindergarten and 1st grade tests were administered individually by the university professor and a trained student mentor. The Kindergarten test consisted of nine separately scored points; the first grade had seven; and the tests for 2nd – 6th grade each consisted of 10 items.

Qualitative data was also collected to assess the students' retention and learning in mathematics through observations, anecdotes, informal interviews with students and parents, and documented patterns of learning.

Analysis

The quantitative analysis of the mathematics learning and retention of these students was mostly descriptive. Pre and post means on the mathematics tests were compared for each grade as a total score. Because of the small number of students in each grade, it was deemed that making comparisons using *t*-tests was not meaningful. The qualitative data was analyzed by looking for themes and patterns.

Results and Discussion

Both quantitative and qualitative analyses of the data used to inform the effectiveness of this program in helping these children retain or increase their mathematics learning indicated that the effect had been positive.

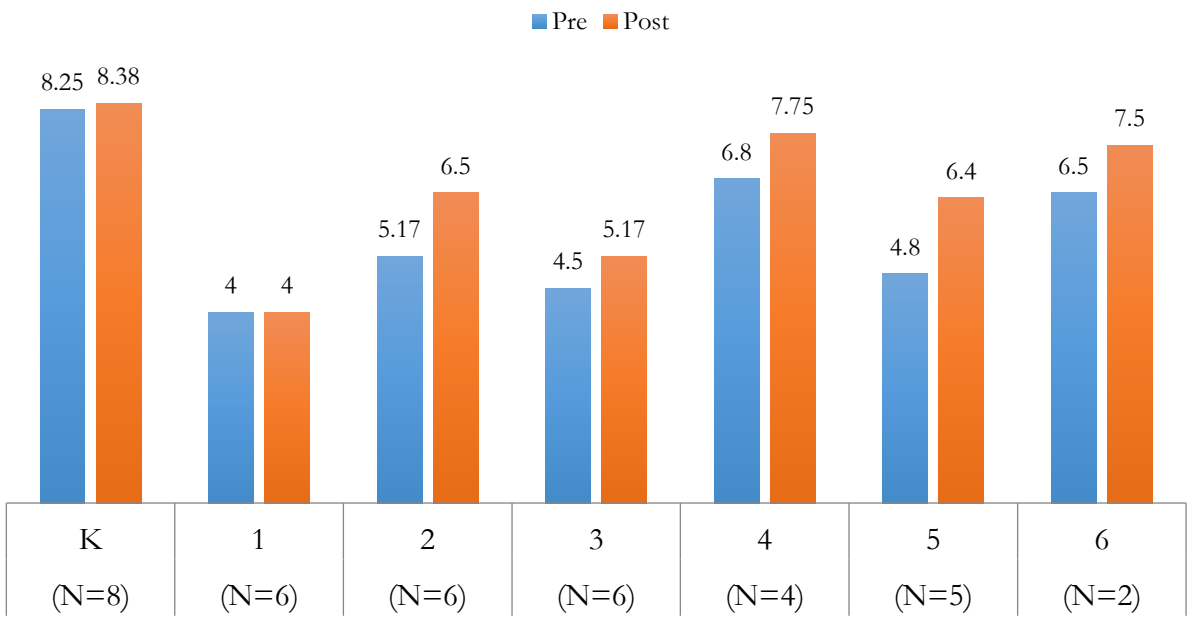
Quantitative Analysis

Of the 37 students who took both the pretest and posttest, 31 of them attended more than 20 days. Of those 31, the scores for 20 of them increased, six of them were the same, and five decreased. Overall, the average score for each grade increased or stayed the same. Figure 1 shows the comparison between the pretest and posttest

Qualitative Analysis

Qualitative experience and analysis of this program also showed that it had positive effects on the students' understanding of and engagement with mathematics. For example, throughout the program, the mathematics teacher spoke with students, and they expressed their feelings of the mathematics class and the program. Several of the students made comments to the mathematics teacher such as, "I used to hate math, but now it is one of my favorite subjects." One student usually rode with another family to and from the program. However, one day, the family that was giving the ride was not going to be attending, and the student's mother told the mathematics teacher, "My boy did not want to miss math class that day. So, he got up and walked about two miles that morning, all so he could get to your class. I don't know what you are doing, but he used to dislike math, and now he loves it."

Figure 1: Pretest and Posttest Comparison by Grade



Limitations of Study

This study, of course, is limited by the number of participants per grade. It is further limited by the fact that not all students consistently attended the classes, and the researchers were unable to obtain both pre and post assessments from all the students. In fact, three children from one family consistently attended the program and seemed to be doing well, but their family went on vacation and did not attend the last week of class when post assessments were administered. Still, the study provided much qualitative evidence that the experience was valuable and positive for those who did participate in the program.

Implications

The effectiveness of this summer program has great educational importance. The analyses showed that it was effective in diminishing the loss of mathematics achievement of these underserved students during the summer. It also showed that this type of program can be valuable in helping students improve their attitudes toward mathematics, which affects their achievement. Therefore, it can be implied from the results of this and other studies that summer school programs can be an effective and worthwhile investment of resources and time in helping alleviate potential summer learning loss of children.

References

Alexander, K. L. (2007). Lasting consequences of the summer learning gap, *American Sociological Review*, *72*, 167-180.

Borman, G. D., & Dowling, N. M. (2006). The longitudinal achievement effects of multi-year summer school: Evidence from the Teach Baltimore randomized field trial. *Educational Evaluation and Policy Analysis*, *28*, 25-48.

Cann, D., Karakaplan, M., Lubke, M. & Rowland, C. (2014, February) *Assessing the effectiveness of New Mexico's K-3 plus summer learning initiative*. Evanston, IL: Society for Research on Educational Effectiveness.

Cooper, H., (2003). Summer learning loss: The problem and some solutions. LD Online: The Educators' Guide to Learning Disabilities and ADHD. Retrieved from http://www.ldonline.org/article/8057/.

Cooper, H., Charlton, K., Valentine, J. C., & Muhlenbruck, L. (2000). Making the most of summer school: A meta-analytic and narrative review. *Monographs of the Society for Research in Child Development* (Serial No. 260), *65*(1), 1-118.

Cooper, H., Nye, B., Charlton, K., Lindsay, J., & Greathouse, S. (1996). The effects of summer vacation on achievement test scores: A narrative and meta-analytic review. *Review of Educational Research*, *66*, 227-268.

Houghton Mifflin Harcourt Publishers. (2011). *Go math!* Boston: Author.

Lauer, P. A., Akiba, M. Wilkerson, S. B., Apthorp, H.S., Snow, D., & Martin-Glenn, M.L. (2006). Out-of-school-time programs: A meta-analysis of effects for at-risk students, *Review of Educational Research*, *76*(2), 275-313.

LeBoff, B. A. (1995). *The effectiveness of a six-week summer school program on the achievement of urban, inner-city third-grade children* (Doctoral dissertation, Texas Southern University, 1995). Dissertation Abstracts International, *56*, 10A.

McCombs, J. S., Augustine, C. H., Schwartz, H. L., Bodilly, S. J. McInnis, B., Lichter, D. S., & Cross, A. B., (2011) *Making summer count: How summer programs can boost children's learning*. (Report commissioned by The Wallace Foundation). Santa Monica, CA: the RAND Corporation.

McLaughlin, M. P. P. & Smink, J. (2009). Summer learning: moving from the periphery to the core. Denver, Colorado: *Education Commission of the States. Progress of Education Reform*, *10*, 3.

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