Increasing Student Achievement in Mathematics

with the Flexible Block Schedule

A Special Project

Presented to

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Increasing Student Achievement in Mathematics

With the Flexible Block Schedule

Approved for the Faculty

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ABSTRACT

The researcher conducted a study about the effects of the flexible block schedule and student achievement in mathematics at the middle school level. Two groups of participants were involved in the study which compared participants in Group A with the traditional class period versus participants in Group B with the flexible block class period. The researcher used results from a pre/post-test from the mathematic content of probability and statistics.

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CHAPTER 1

Introduction

Background for the Project

Washington's middle school students did not demonstrate significant achievement in mathematics based on the results of the 2005 edition of the Washington Assessment of Student Learning. Many opinions speculated that a cause of the poor student achievement was due to lack of time for mathematics instruction. Washington State Common School Manual 2005, Washington Administrative Code 180-16-200, required that the amount of instruction time for grades 1-12 needed to average at least 1,000 hours in a school year. The 1,000 hours of mandated instructional time was not designed for solely mathematics instruction, but also had to include time for instruction for other academic content areas such as English, science, and reading.

Middle schools tried to address the problem in a variety of ways. One type of change altered the structure of instructional time in the school day. An assortment of scheduling templates were researched and implemented. In the school district where the middle school for the study was located, a district task force investigated and designed a middle school schedule to fit the flexible block schedule module.

Statement of the Problem

The researcher wanted to conduct a study to determine if a flexible block schedule model allowed students to make necessary gains in mathematics achievement when given the opportunity to receive more time in instruction. A comparison was done to compare the effects of the increased time in mathematics instruction to student achievement in the content area.

Purpose of the Project

The purpose of the study demonstrated the effects of a flexible block schedule model on student achievement in mathematics compared to the students in a traditional class period schedule model. Did the change in the amount of time for instruction in mathematics improve or hinder the achievement level of the students? The researcher hoped the study would provide data to prove what the effects were on student achievement in mathematics when the school used the flexible block schedule model structure.

Delimitations

The researcher conducted the study at a middle school in a rural town with the approximate population of 32,000 residents based on the 2000 census. The rural middle school housed students in grades six through eight. Based on the information provided by Washington State's Office of Superintendent of Public Instruction as of September 2006, the school's student count was 807 students with 51.4% males and 48.6% females. Demographics of the middle school demonstrated 92.4% of the students classified as Hispanic, 5.0% as White, 2.4% as Black, American Indian/Alaskan Native as 0.1% and Asian as 0.1%. Of the student body, there were 93.4% students who qualified for free or reduced lunches and migrant students accounted for 36.0% of the student population. At the middle school, the data from Washington State Office of Superintendent of Public Instruction school report card showed 44.9% of the students were in transitional bilingual programs and students who received services in the special education program accounted for 13.6% (OSPI, 2006).

Participants in this study were selected by school assignment to the researcher into two groups. Both groups of participants consisted of students from each grade level served at the middle school. All the participants involved in the study were determined as limited English proficient due to the fact the participants' families arrived from México to the United States within the last three years. All the participants identified Spanish as the native language and the language spoken at the home. Since Spanish had been identified as the main first language learned by the participants in the study, mathematics instruction was delivered in Spanish using the Spanish instructional materials from *Connected Mathematics Project*.

The type of block schedule followed at the investigated school designated 120- minute academic core block for two core subject areas such as mathematics and science. To test whether or not the amount of mathematics instructional time affected student achievement, Group A students followed a traditional class period schedule where instruction in mathematics was provided daily for 55 minutes. Participants in Group B followed the flexible block schedule where mathematics instruction could be offered up to 120 minutes if needed.

Assumptions

The flexible block schedule model allowed sufficient time to instruct mathematics to students in grades six through eight. The researcher assumed the more instructional time the teacher had to deliver quality instruction, the more the students would understand mathematics. Students understood more when given the opportunity to be taught well and the ability to ask questions for clarification. When teachers and students had limited time for instruction and practice, the level of comprehension of the lesson was lower compared to the teachers and students who had the option to extend time with a lesson if needed.

Hypothesis

Middle school students who received mathematics instruction in a flexible block schedule model would demonstrate increased achievement in mathematics as measured by a pre and post assessment. The pre and post assessment was developed by the researcher in conjunction with the guidelines established on the district classroom-based assessment developed by the school district.

Null Hypothesis

Middle school students who received mathematics instruction in a flexible block schedule model would not demonstrate increased achievement in mathematics as measured by a pre and post assessment. The pre and post assessment was developed by the researcher in conjunction with the guidelines established on the district classroom-based assessment developed by the school district.

Significance of the Project

The purpose of the project was to determine if the change in scheduled instructional time affected student achievement in mathematics. Research indicated when students received an extended time in instruction, students tended to demonstrate higher academic achievement because often students lacked adequate time to present content, practice skills, and reinforces concepts (Wormeli, 2000). The intent of the study was to show student achievement improved in mathematics when class time was extended from 55 minutes daily to 120 flexible minutes daily.

Procedure

For the researcher to conduct the study, a procedure was established. The researcher used the assigned class groups as the participants. All study participants followed a flexible block schedule module. Both groups took a pretest to determine the level of understanding in a variety of mathematical content. Group A had mathematics instruction in the morning with only 55 minutes provided for mathematics instruction. The participants in Group B had flexible class time so instruction in mathematics could be provided up to 120 minutes if needed.

The mathematical concept unit the researcher used for the study was probability. Instructional materials used from the *Connected Mathematics Project* were the textbooks titled *How likely is it?* and *What do you expect?* for both groups. The pre and post-test was identical for comparison on each of the participant's academic growth made during the unit. The pre/post test used incorporated the learning targets established by the school district as well as the state's grade level expectations.

Most class routines for the groups functioned similarly. Both groups of participants entered the classroom and started to work on the entry task which consisted of fifth grade basic mathematics skills. Participants worked daily on problems, an average of three concepts, for 15 minutes. Afterwards, students transitioned to use of the *Connected Mathematics Project* instructional materials to learn the next concept. At that point, the amount of time for instruction varied between the two study groups.

Group A utilized the given time using a variety of teaching strategies. Participants engaged mostly in lecture format and independent exploration of mathematical investigations. The daily instructional and practice time for the group was approximately 35 minutes. An allotment of time had to be given to transition to science where two other students joined Group A from another mathematics class. The overall function of the class was often rushed to deliver instruction and to practice problems with the concept of the day. Participants in Group A often did not have adequate time to ask for assistance or clarification. Assistance or clarification was available at the other times of the school day if the participants felt the need and chose to attend.

The instructional strategies for Group B were similar. The researcher used mostly lecture format as well as independent exploration of mathematical investigations for the second group. The exploration time for Group B was not limited to the 35 minutes like Group A. There were days when the group only needed 35 minutes and there were days when instructional and practice time extended up to 100 minutes. Instead of rushing into a transition to science, the group of students received other methods of instruction for mathematical understanding. Time for science instruction was made up at a later time in order to continue with the development of the students' mathematical understanding. Group B also had other times of the school when assistance or clarification was available if the participants felt the need and chose to attend.

Definition of Terms

classroom-based assessment. An assessment created by the instructor under the guidance of the school district, instructional materials and the state objectives. The classroom-based assessment assessed the concepts taught during the unit of study.

Connected Mathematics Project. Instructional materials utilized in the study to instruct mathematics as published by Prentice Hall.

flexible block schedule. The school of study established two main blocks of time in the school day for academic content instruction – morning block and afternoon block where the blocks were referred to as academic core blocks. Teachers utilized the time for quality instruction in two content areas.

interdisciplinary team. Team of teachers, usually between two to maximum of five, collaborated on strategies and content information in regards to students shared between the team.

L_1. The acronym meant first language. The language for the language study participants was Spanish. Mathematics classes labeled L_1 indicated mathematics instruction was delivered in the first language of the students which was Spanish.

Acronyms

CBA. Classroom Based Assessment.

CMP. Connected Mathematics Project.

GLEs. Grade Level Expectations.

IDT. Interdisciplinary Team.

L_1. First language (Spanish).

NCLB. No Child Left Behind.

NMSA. National Middle School Association

OSPI. Office of Superintendent of Public Instruction.

WAC. Washington Administrative Code.

WASL. Washington Assessment of Student Learning.

CHAPTER 2

Review of Selected Literature

Introduction

Students entered middle school with the understanding things would be different from elementary school. One noticeable difference was the amount of teachers and classrooms students interacted with on a daily basis. In elementary school, students stayed generally with one teacher in one classroom for the school year. At the middle school level, the students possibly received instruction from multiple teachers in a variety of classroom environments.

The potential of multiple teachers and classroom environments was due to the many variations of scheduling utilized in middle schools. Each type of schedule determined the amount of time as well as the number of teachers and classrooms a middle school student might interact with within the school day. Gallagher (1999) stated, "Time is always in short supply during the school day" (p. 1). Hackmann and Valentine (2000) indicated for middle schools "the school day must be structured in the best manner possible to operate efficiently and effectively to meet their goals" (p. 1). Middle schools established the schedule module needed to fit the needs of the school and the students.

Many middle schools utilized the traditional class period schedule model. However, more and more, a movement started to modify the established schedule model to a block schedule format (Thomas, 2001). Schools found studies claimed positive effects of block scheduling as a means to enhance student performance (Mattox, Hancock, & Queen, 2005). Changes made at various middle schools strived to accommodate the assortment of needs for higher student achievement in all content areas.

The study investigated specifically how the flexible block schedule affected student achievement in mathematics at the middle school level. Research was done to help understand the history of class scheduling, types of middle school scheduling, and instructional practices in regard to class scheduling.

History of Class Scheduling

When students entered middle school, the students transitioned from a self-contained classroom situation (elementary school) to a multiple classroom experience (middle school). Typically elementary school students were taught mathematics, reading, science, and writing by one teacher in one classroom environment (self-contained). In comparison, middle school students were instructed by teachers identified as specialists in specific academic content areas. Due to a need for more specialized teaching, students in middle school experienced several teachers in numerous learning environments. For example, the typical middle school student received instruction in mathematics in one classroom from one teacher for a designated amount of time and then changed to another classroom environment to receive instruction in science from another teacher. Each content area students had in general resulted a different instructor and classroom.

The numerous transitions that middle school students and teaching staff faced daily impacted both groups negatively. One negative effect of multiple changes was the level of student achievement in academic content areas, especially in mathematics. The time crunch and constant movement affected student achievement since schools tended to “operate more like factories on overdrive” (Gallagher, 1999, p. 1).

Due to the enactment of No Child Left Behind (NCLB) in 2002, states administered assessments, such as the Washington Assessment of Student Learning (WASL) for Washington State, to measure if students met academic proficiency in mathematics as well as reading. Results from assessments indicated not all students demonstrated strong performance or adequate levels of proficiency in academia based on the NCLB standards. School administrators had an obligation to restructure to improve student performance (Arnold, 2002). Two main goals were associated with restructuring efforts. “One goal of restructuring is to improve students’ academic performance. Another goal of restructuring is to make better use of instructional time” (Arnold, 2002, p. 42).

Schools had an assortment of needs and resources that differed from one school site to the next. The length of the school day and opportunities (such as class selections and student activities) offered to students and staffs varied.

Scheduling was no exception. According to Hackmann and Valentine (2000), scheduling was a mechanism to facilitate the school's goals and purposes. Development of the ideal middle school schedule was "an unavoidable task that must be accomplished so students and teachers could attain maximum instructional benefits from the allotted time" (Wunderlich, Robertson, & Valentine, 2000, p. 3).

Schools had many models of class scheduling to research, adopt, and utilize. Each model variation shared similarities and differences from slight to grandiose with other schedule models. The researcher reviewed a variety of structures allotting instructional time for the different content areas from a minimum of 45 minutes up to a maximum of 120 minutes per school day (Mattox et. al., 2005).

As scheduling was a focus to restructure middle schools, two general types of schedules emerged; traditional and block schedules (Mattox et. al., 2005). Research stated that block scheduling was an innovative and increasingly popular method of restructuring time during the school day (Gallagher, 1999). In addition, the block schedule for middle schools allowed flexibility "to ease the transition of students from the self-contained elementary environment to the highly departmentalized high school environment" (Daniel, 2006, p. 1). As a result, many schools "jumped on the block-scheduling bandwagon" (Thomas, 2001, p. 74).

While schools considered which schedule model would best fulfill the needs of the students, the research done by Wunderlich, Robertson, and Valentine (2000) indicated six factors to account for to support and promote the schedule for the middle school. Factors schools had to keep in mind were the following – "interdisciplinary team organization, appropriate curriculum, quality instruction in the discipline through the expanded and flexible uses of time, development and supportive relationships between students and teachers, quality teacher collaboration, and teacher empowerment" (Wunderlich et. al., 2000, p. 4).

Types of Middle School Scheduling

The researcher discovered there were a variety of formats for scheduling classes of middle school students, not one specific schedule template. The array of scheduling models resulted from the diversity of needs and requirements schools had to achieve optimal student achievement. Each school varied in needs for the students and staff from other schools. Schools had to evaluate the needs of the students and school to determine the best fit. With many different scheduling options considered for middle school use, the researcher construed two general classifications of middle school scheduling based on characteristics – traditional schedule and block schedule (Mattox et. al., 2005).

Traditional schedule, often departmentalized, was the most practiced schedule structure (Hackmann & Valentine, 2000). Students learned content from multiple teachers and usually in multiple classroom environments since middle school teachers were recognized more as content specialists. The traditional departmentalized schedule structured classes into locked periods of time of anywhere between 45 minutes to 60 minutes per content (Arnold, 2002). The adoption of the traditional departmentalized schedule at different middle schools meant students could attend school from any range between five to ten periods per day. Teachers seldom taught more than one content area (Hackmann & Valentine, 2000).

The other general scheduling classification was block schedule. Block scheduling was commonly recommended and used in middle schools (Wunderlich et. al., 2000). Daniel (2006) indicated in his research that block scheduling utilized time innovatively to match the instructional time and form to the learning needs of students. According to research by Wunderlich, Robertson, and Valentine (2000), the most common forms of block scheduling were the alternate day plan and the flexible block.

Alternating-day block schedule, or sometimes referred to as “A/B schedule,” allowed students and teachers to receive extended time of 90 minutes or more per class with not as many classes attended per day (Daniel, 2006). The notion of a class period held for 90 minutes or more definitely surpassed the amount of time given in the traditional departmentalized schedule model. The alternate day schedule structure gained popularity in high schools as students did not change classes often nor did teachers deal with multiple groupings of students within one school day (Hackmann & Valentine, 2000). As Daniel (2006) stated in his research, the alternate day schedule arranged classes to meet every other day during the week. For example, a student attended math and science classes on Mondays, Wednesdays, and Fridays. On Tuesdays and Thursdays, the student attended language arts and history.

Due to the fact the normal school week consisted of five days, concerns arose about equitable time for each content area. Some school sites adjusted by designating one day, typically Monday, in the week where students attended all content classes. The other four days followed the A/B schedule module (Hackmann & Valentine, 2000). Other middle schools chose to schedule academic content classes on a daily basis and alternated days for elective classes such as music and art (Daniel, 2006).

Flexible block schedule designated time for teachers to possibly instruct two content areas within a block of time (Hackmann & Valentine, 2000). The goal of the schedule model was to establish a school within a school that cultivated bonding between students and teachers (Wunderlich et. al., 2000). Students had less transition to other classes when teachers taught two academic content areas (e.g. math and science) in one block of class time which helped students adjust from the elementary school setting to the more departmentalized situation (Daniel, 2006). Teachers were placed generally in teams of two (the ideal) based on the content areas. An example of a team of two was a teacher of math and science teamed with a teacher of language arts and history. The two teachers shared groups of students. In addition, the two teachers were involved in a collaborative team classified as an interdisciplinary team (IDT). At times, teams expanded to four teachers on a team, the recommended maximum number of members of an IDT. The IDT made decisions on the amount of time to devote for subject instruction as well as delivery of the content (Hackmann & Valentine, 2000). In addition, the IDT had time to collaborate, discuss, and address student concerns (Wormeli, 2000). The flexible interdisciplinary block schedule became a trademark of middle schools (Wunderlich et. al., 2000).

<u>Instructional Practices</u>

With block schedules, teachers needed to rethink how they worked and adapt or alter teaching strategies to the flexible block schedule (Gallagher, 1999). Some strategies remained effective with the new schedule structure while other strategies had to be modified. Most changes made to pedagogy were due to the extension of time for instruction.

One teaching strategy of many that underwent immediate revision was the traditional lecture seminar where students listened as the teacher lectured about the content. The classroom lacked interaction with the content since only the teacher was heard. Gallagher (1999) reported one teacher felt straight lecture in a block schedule was “the kiss of death” (p. 2). Teachers had to draw on opportunities for students to engage in projects which required in-depth investigation and critical thinking skills (Wunderlich et. al., 2000).

Students' engagement in class for a longer period of time concerned teachers with the block schedule. The most successful pedagogical strategies had to be student-centered approaches such as cooperative learning groups (Wunderlich et. al., 2000). Some instructional practices mentioned in research were the Socratic seminar, use of the Internet, and use of computers (Gallagher, 1999).

Socratic seminars had participants "seek deeper understanding of complex ideas through rigorously thoughtful dialogue" (Risi, Schiro, & Serret-Lopez, 2005, p. 155). Meaningful and educational dialogue would not necessarily occur within a short period of time as teachers admitted time did limit what types of activities and strategies were used in classroom instruction (Gallagher, 1999). Use of Socratic seminars encouraged active learning because students had the opportunity to explore and evaluate more freely since time was not a major factor (Risi et. al., 2005).

With the advancement of technology, the incorporation of the Internet and computers into classroom lessons was another practice cited. Teachers often opted not to include the Internet and computers as part of content delivery and exploration because of time (Gallagher, 1999). Computer labs were a nuisance for teachers to get students to the lab, set up, complete assigned tasks, and get back to the classroom. Gallagher (1999) noted the extended amount of time significantly increased the chances that teachers would utilize the Internet and computers for student tasks.

Teacher Perspectives

Teachers had mixed feelings on schedule changes. Some teachers either had adjustment difficulties or refused to accept the modification while some teachers embraced the new challenge.

As schools jumped on the block schedule bandwagon, others fell off due to feeling disheartened and discouraged (Thomas, 2001). The researcher found articles which recounted negative views from teachers about block scheduling and the effects on math instruction. Some resistance stemmed from the fear that the math curriculum would not fit well into longer time blocks (Kramer, 1999). In other research, Thomas (2001) stated, “Block schedules may give students more freedom within a day to discuss ideas and concepts but less time over the course of the year to develop and internalize concepts as part of a larger whole” (p. 75). As teaching processes changed, professional development was critical because teachers felt challenged to develop creative ways to present lessons during an extended time frame (Kramer, 1999). Teachers felt frustrated since planning for the longer periods took significantly more of their personal time (Kramer, 1999).

With pessimism, there was optimism with the block scheduling idea. Gallagher (1999) included a positive perspective from a teacher, Kevin Crotchett, who considered “the expansive block of instructional time exhilarating” (p. 1).

Another teacher, Meri Kock, felt the block schedule allowed time for students to explore and to deepen concept understanding “while everything is still fresh in their minds” (Gallagher, 1999, p. 2). Additionally, block schedules helped teachers rework the curriculum to eliminate redundancy (Kramer, 1999).

Summary

The act of scheduling instructional time of middle school classes changed throughout the years. Teachers employed a plethora of instructional strategies to maximize student engagement in the learning of various academic contents for the allotment of time given for each class. Based on the school adopted schedule format, the allotment of time for teachers had affected lesson delivery positively and negatively. As many schedule models were utilized, the purpose of the study was to investigate the model of flexible block scheduling and the effects the model had on student achievement in mathematics.

CHAPTER 3

Methodology and Treatment of Data

Introduction

Middle school students did not demonstrate significant achievement in mathematics based on WASL 2005 results. Due to the lack of achievement, school districts and administrators investigated how to restructure middle schools to help raise student achievement in mathematics. Hackmann and Valentine (2000) indicated for middle schools that the school day must be structured in the best manner possible to operate efficiently and effectively to meet their goals. According to Gallagher (1999), "Time is always in short supply during the school day, the bigger problem seems to lie in its distribution" (p. 1). The purpose of the study was to investigate the model of flexible block scheduling and the effects the model had on student achievement in mathematics.

Methodology

The researcher utilized an experimental design method to gather data. The study investigated the effects of a flexible block schedule model on student achievement in middle school mathematics compared to the students in a traditional class period schedule model. Pre/post test data from a classroom-based assessment (CBA) was the measurement utilized to collect data to analyze the effects of the flexible block schedule model had on student achievement in middle school mathematics.

Participants

School assignment designated the two groups of participants involved in the study. Both study groups consisted of students from each grade level served at middle school and classified as limited English proficient. All participants involved in the study indicated Spanish as the native language and language spoken at home. Since the commonality of Spanish was identified by all the participants, both study groups received L_1 support, and academic content instruction in mathematics was delivered in Spanish.

Instrument

The instrument used to determine if the flexible block scheduling model impacted mathematics achievement was a CBA on a specific concept unit, probability. Elements of the unit CBA consisted of word problems and statements. The CBA utilized incorporated the learning targets established by the school district and the state's GLEs. A copy of the CBA used was included in Appendix A. Appendix B was the CBA translated from Spanish into English.

Design

The researcher used the pretest-post-test control group design for the study. The pretest-post-test control group design involved the administration of the pre-determined assessment to the two groups of participants prior to the formal instruction of unit concept as a pretest (Gay, Mills, & Airasian, 2006). One group (Group A) was considered the control as the group received the traditional 55 minute class period for mathematics only. The other group involved in the study, Group B, received the flexible block of 120 minutes for mathematics and science. At end of unit, the researcher utilized the same assessment used for the pretest to conduct the post-test. Information received from the results was compared to determine if the amount of instructional time middle school students received in mathematics impacted student achievement.

Procedure

For the researcher to conduct the study, a procedure was established. The researcher used the assigned class groups as the participants. All study participants followed a flexible block schedule module. Both groups took a pre-test to determine the level of understanding in a variety of mathematical content. Group A had mathematics instruction in the morning with only 55 minutes provided for mathematics instruction. The participants in Group B had flexible class time so instruction in mathematics could be provided up to 120 minutes if needed.

The mathematical concept unit the researcher used for the study was probability. Instructional materials used from CMP textbooks titled *How likely is it?* and *What do you expect?* for both groups. The pre and post-test was identical for comparison on each of the participant's academic growth made during the unit. The pre/post test used incorporated the learning targets established by the school district as well as the state's GLEs.

Most class routines for the groups functioned similarly. Both groups of participants entered the classroom and started to work on the entry task which consisted of fifth grade basic mathematics skills. Participants worked daily on problems, an average of three concepts, for 15 minutes. Afterwards, students transitioned to use of the CMP instructional materials to learn the next concept. At that point, the amount of time for instruction varied between the two study groups.

Group A utilized the given time using a variety of teaching strategies. Participants engaged mostly in lecture format and independent exploration of mathematical investigations. The daily instructional and practice time for the group was approximately 35 minutes. An allotment of time had to be given to transition to science where two other students joined Group A from another mathematics class. The overall function of the class was often rushed to deliver instruction and to practice problems with the concept of the day. Participants in Group A often did not have adequate time to ask for assistance or clarification. Assistance or clarification was available at the other times of the school day if the participants felt the need and chose to attend.

The instructional strategies for Group B were similar. The researcher used mostly lecture format as well as independent exploration of mathematical investigations for the second group. The exploration time for Group B was not limited to the 35 minutes like Group A. There were days when the group only needed 35 minutes and there were days when instructional and practice time extended up to 100 minutes. Instead of rushing into a transition to science, the group of students received other methods of instruction for mathematical understanding. Time for science instruction was made up at a later time in order to continue with the development of the students' mathematical understanding. Group B also had other times at the school when assistance or clarification was available if the participants felt the need and chose to attend.

At the end of unit study, the researcher administered the post-test, which was identical to the pretest given at the beginning of unit study. Results from the study groups were used to determine the effect of time and student achievement in middle school mathematics.

Treatment of Data

The researcher believed the amount of instructional time middle school students received in mathematics would affect students' mathematical achievement. Results from the study demonstrated the degree of impact time had on student achievement.

Summary

The researcher gathered the data from the CBAs administered from the two groups of participants. Data provided from the scores of the assessments were compared using the group averages from the pretest and post-test. In addition, the degree of growth was compared between the two groups.

CHAPTER 4

Analysis of the Data

Introduction

Based on WASL 2005 results, middle school students did not achieve required expectations in mathematics. Schools investigated what changes could be employed to solve the issue. One change researched and addressed was the structure of the middle school schedule. The researcher conducted a study to evaluate if changes in the amount of time for instruction in middle school mathematics improved or hindered student achievement.

Description of the Environment

The researcher conducted the study at a middle school in a rural town with the approximate population of 32,000 residents based on the 2000 census. The rural middle school housed students in grades six through eight. Based on the information provided by Washington State's OSPI as of September 2006, the school's student count was 807 students with 51.4% males and 48.6% females. Demographics of the middle school demonstrated 92.4% of the students classified as Hispanic, 5.0% as White, 2.4% as Black, American Indian/Alaskan Native as 0.1% and Asian as 0.1%. Of the student body, there were 93.4% students who qualified for free or reduced lunches and migrant students accounted for 36.0% of the student population. At the middle school, the data from Washington State OSPI school report card showed 44.9% of the students were in transitional bilingual programs and students who received services in the special education program accounted for 13.6% (OSPI, 2006).

The study compared the amount of time students received in mathematics instruction with student achievement. Two groups of participants were selected for the study by school assignment.

Hypothesis

Middle school students who received mathematics instruction in a flexible block schedule model would demonstrate increased achievement in mathematics as measured by a pre and post assessment. The pre and post assessment was developed by the researcher in conjunction with the guidelines established on the district classroom-based assessment developed by the school district.

Null Hypothesis

Middle school students who received mathematics instruction in a flexible block schedule model would not demonstrate increased achievement in mathematics as measured by a pre and post assessment. The pre and post assessment was developed by the researcher in conjunction with the guidelines established on the district classroom-based assessment developed by the school district.

Results of the Study

The study showed a more dramatic improvement in students' mathematic achievement in Group B versus Group A. Results for each participant in each study group were organized into two tables. Table 1 featured the results and difference between pretest and post-test scores of Group A. Table 2 presented the results and difference between pretest and post-test scores of Group B.

In analyzing the study results, Figure 1 demonstrated gains made based on the overall class average of the two study groups between the pretest and post-test. The difference in the class average from pretest and post-test in Group A was an increase of 43%. Participants in Group B improved the class average by 65% between the pretest and post-test results.

The researcher continued evaluation of data results with the examination of the distribution of letter grades. A comparison was made in Figure 2 of the grade distribution on the post-test. Group A revealed only 13% earned an A on the post-test, while in the same group almost half of the participants (47%) received a failing grade. In Group B, only 14% of the students in the study group failed the post-test. In addition, Figure 2 showed had 36% of the participants in Group B obtained an A on the post-test.

In further investigation of the grade distribution of pretest and post-test between the two study groups, Figure 3 and Figure 4 displayed the comparison between the pretest and post-test of Group A and Group B, respectively. The difference in the failing grade (F) was extremely obvious between the two groups of participants. Group A decreased the amount of failing students by 53% which could be considered admirable. However, when results of Group A were compared to the other study group, Group B outperformed the other group of participants with a drastic reduction of 81% of students failing the post-test.

***Figure 1.* Comparison of Class Averages between Study Groups.**

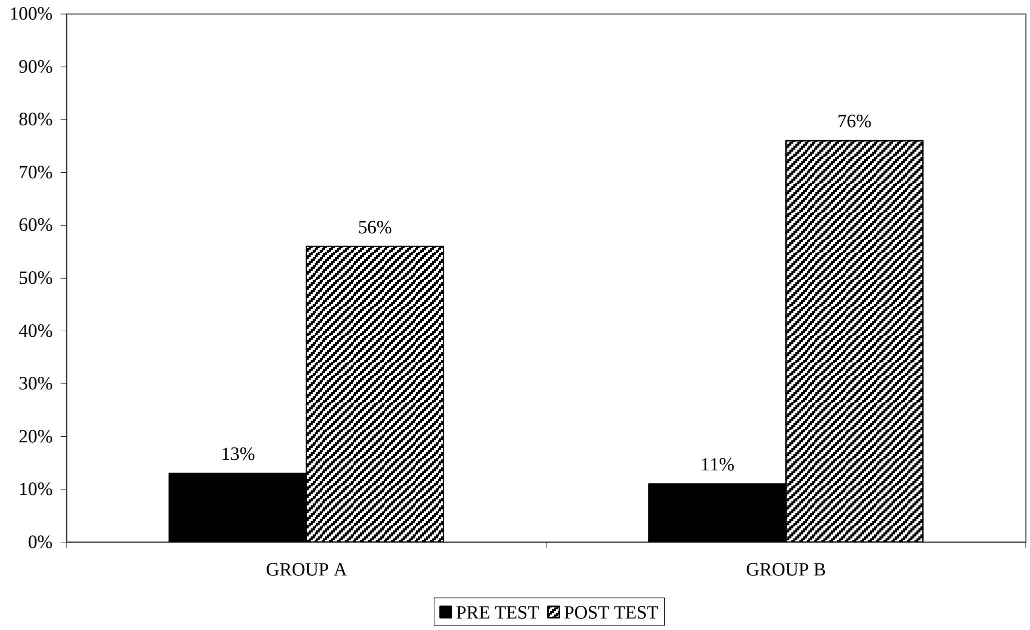


***Figure 2* . Post Test Grade Distribution.**

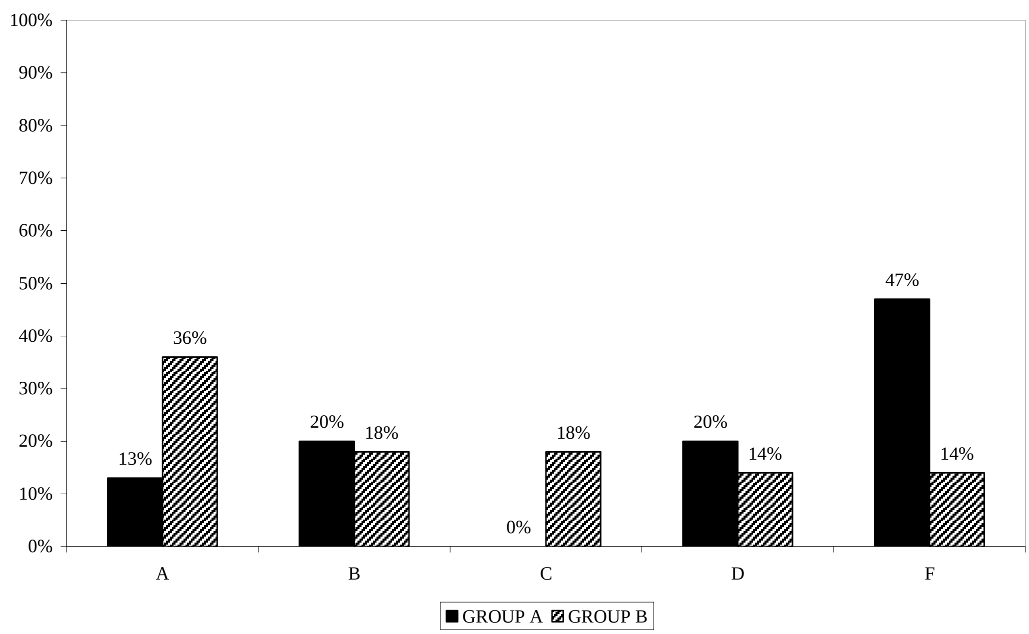


Figure 3. **Group A: Traditional Class Period Pre-Post Test Grade Distribution.**

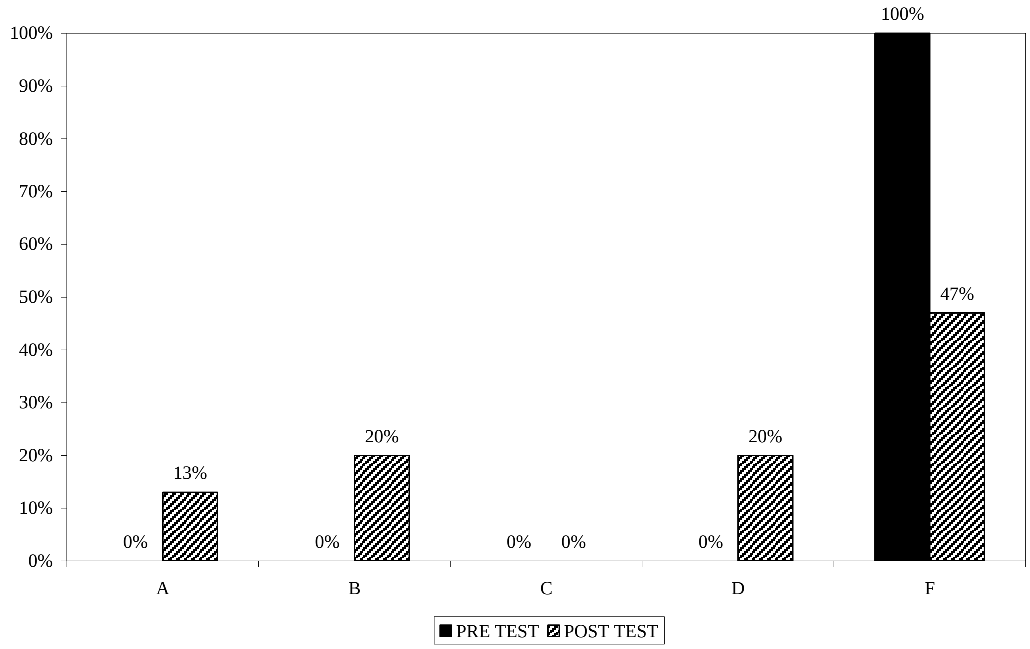
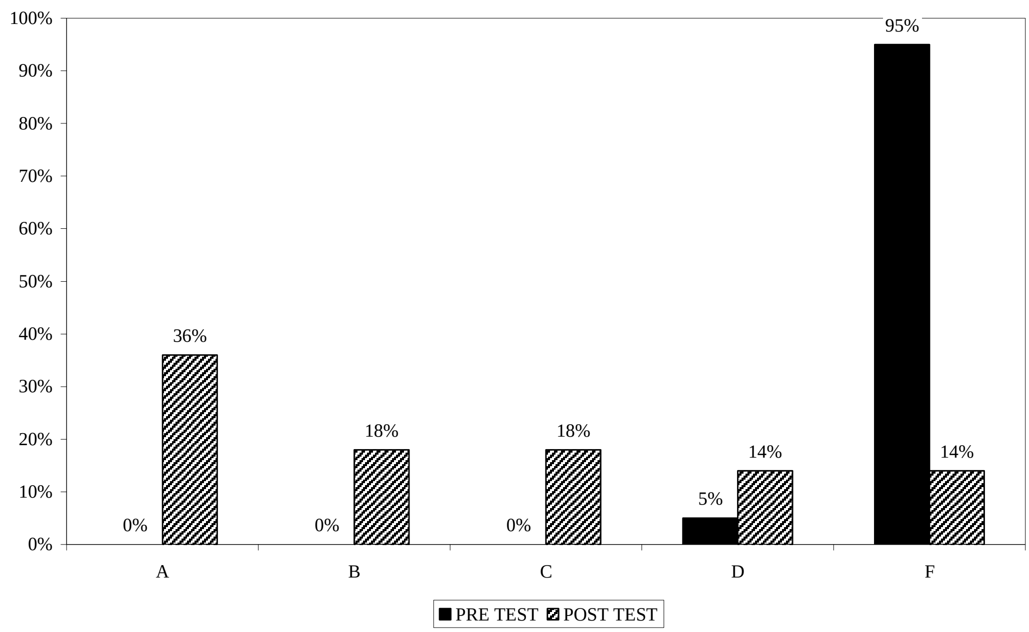


Figure 4. **Group B: Flexible Block Period Pre-Post Test Grade Distribution.**



Findings

Most students demonstrated improvement from the pretest scores to post-test scores. Table 1 showed the results of the pre/post-test for each participant in Group A, who followed a traditional class period model. The results of the pre/post-test from Group B who followed the flexible block were displayed in Table 2.

The degree of improvement between the two study groups indicated the impact time had on student achievement. In Group A, participants increased the class average from pretest to post-test by 43% and had achieved an overall final class average of 56% for the probability math unit. The participants of Group B increased the class average between pretest and post-test by 65% with an overall final class average for the mathematic unit of 76%.

With the data collected and reviewed, the hypothesis was accepted. The participants in Group B demonstrated a significant improvement in test scores compared to the participants in Group A.

Summary

Student achievement increased substantially in Group B versus Group A. Group B improved the class average by 65% while Group A only increased 43% during the probability unit. The study proved the hypothesis of the researcher as correct and disproved the null hypothesis.

CHAPTER 5

Summary, Conclusions and Recommendations

Introduction

Results from the 2005 WASL indicated middle school students did not demonstrate significant achievement in mathematics. A variety of reasons were offered in explanation of why students performed poorly on the mathematics section of the WASL. Based on WAC 180-16-200, students in grades 1-12 needed to average at least 1,000 hours of instruction in a school year divided between a multitude of academic content areas such as English, science, reading, and mathematics (Washington State, 2005).

Middle schools examined and addressed the problem in a variety of ways. One type of change altered the structure of instructional time in the school day. According to Gallagher (1999), “Time is always in short supply during the school day, the bigger problem seems to lie in its distribution” (p.1). A study was conducted to examine if changes in the amount of time for instruction affected student achievement in middle school mathematics.

Summary

The researcher investigated whether the flexible block schedule model demonstrated increased achievement in mathematics. School assignment designated the two groups of study participants. The average of students’ scores from the pre and post assessment was calculated for each group of participants.

Comparisons were made between the data produced from the two study groups. The researcher used the comparison data to determine whether the original hypothesis was proven or disproven.

Conclusions

Students' scores in Group B increased dramatically compared to the scores of participants in Group A. The study demonstrated the increased amount of time given to content instruction, especially in mathematics, had positive effects on student achievement.

Recommendations

This study demonstrated that time largely affected the degree of achievement that students made in middle school mathematics. Participants in the two groups of the study were selected by school assignment. The participants in both groups varied in academic ability and age. A recommendation by the researcher for further replication of the study would be to narrow the age span and grade level of the students. The researcher also would recommend the study be replicated in other academic content areas to determine if outcomes would be similar.

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APPENDICES

APPENDIX A

Examen final de *¿Qué probabilidad hay?* y *¿Qué esperas?*

Nombre: ________________________________ Fecha: __________________

En este examen, tiene que representar las probabilidades en las tres formas.

1. Jorge tiene una bolsa que tiene dos canicas verdes, cuatro canicas amarillas, tres canicas azules, y una canica roja.

   a. Halla la probabilidad teórica de escoger cada color.

      P(verde) =

      P(amarillo) =

      P(azul) =

      P(rojo) =

   b. ¿Qué probabilidad hay de que NO saque una canica amarilla?

      P(no es canica amarilla) =

   c. ¿Qué le sucederá a la probabilidad de sacar una canica azul si se agregan dos canicas más de cada color?

      P(azul) =

2. Diego y Gerardo tienen un restaurante donde los clientes pueden escoger su almuerzo. Los clientes escogerán una cosa de cada categoría – sándwiches, verduras, y bebidas.

El restaurante de Diego y Gerardo		
SÁNDWICHES	**VERDURAS**	**BEBIDAS**
• Pavo • Jamón • Queso	• Zanahorias • Espinaca	• Soda • Jugo

a. Nombra todos los resultados posibles con este menú.

b. ¿Qué probabilidad hay de que su almuerzo tenga pavo?

c. ¿Qué probabilidad hay de que su almuerzo tenga espinacas?

d. ¿Qué probabilidad hay de que su almuerzo tenga queso y jugo?

Del punto 3 al 8, decide si los posibles sucesos resultantes son igualmente probable o no y explica por qué.

3. Si Elian lanza un centavo, el centavo cae cara o cruz.

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4. Si nace un bebé, el bebé sería diestro o zurdo.

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5. Si Nicolás le pide permiso a su mamá para ir al cine, contestaría ella sí o no.

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6. Si Diana adivinará en una pregunta de respuesta verdadero o falso, la respuesta sería correcta o incorrecta.

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7. Si nace un bebé, el bebé sería niño o niña.

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8. Si Liliana lanza un dado, sale un número par o número impar.

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Del punto 9 al 12, decide si el problema se trata de una probabilidad teórica o experimental y explica por qué.

9. Iván está jugando a los dardos sobre un blanco dividido en partes concéntricas de color azul, rojo, y amarillo. El dardo cae 7 veces en la parte roja y un total de 13 veces en las otras partes. Iván dice que el próximo dardo que lance tiene una probabilidad del 35% de caer en la parte roja.

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10. Carolina lleva en su mochila una caja de 10 lápices de color. Cuando la maestra de escritura pide a los estudiantes que diseñen una carátula para sus proyectos, Carolina saca uno de los lápices sin mirar. Ella adivina que tiene una probabilidad del 10% de sacar el de su color favorito, el azul.

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11. Santiago está en la casa de sorpresas de un parque de diversiones. Tiene que escoger entre tres salidas. En una de ellas, te lanzan un chorro de agua. En otra, te rocían con crema. Y en la tercera, te hacen pasar por una zona de barro. Santiago desconoce la sorpresa que corresponde a cada salida. Decide que si escoge una al azar, tiene una probabilidad de 1/3 de ser lanzado un chorro de agua.

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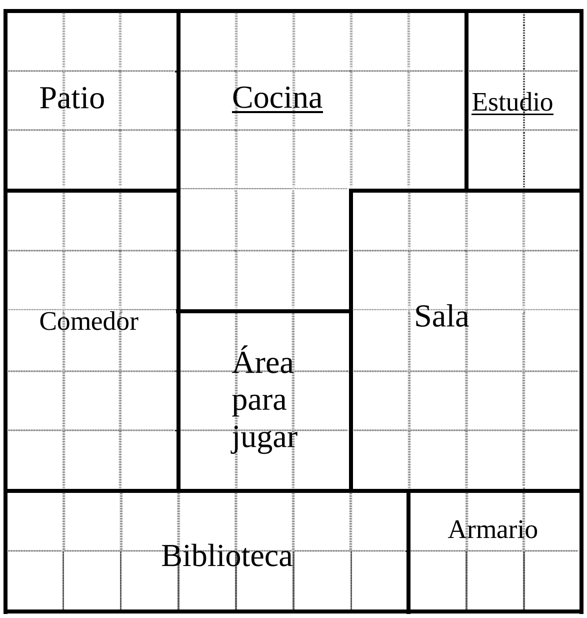
12. Durante 10 minutos cada día y antes de que empiecen las clases, algunos estudiantes de la clase de Mr. García anotan los tipos de vehículos que pasan cerca de la escuela. Quieren saber si es más probable que pase un coche o un camión. Después de una semana de observaciones, los estudiantes utilizan los datos y predicen que es más probable que pase un auto que un camión.

Use el diagrama para contestar las preguntas del 13 al 18 sobre la ubicación de la gente. Recuerda a representar las probabilidades en las tres formas.



Plan de Casa

13. ¿Qué probabilidad hay de encontrar a Rodolfo en el área de jugar?

14. ¿Qué probabilidad hay de encontrar a Lupe en la cocina?

15. ¿Qué probabilidad hay de encontrar a Pedro en el dormitorio?

16. ¿Qué probabilidad hay de encontrar a Susana en el estudio o la biblioteca?

17. ¿Qué probabilidad hay de encontrar a Vivian en el comedor o en el patio?

18. ¿Qué probabilidad hay de <u>NO</u> encontrar a Humberto en la sala?

APPENDIX B

Summative Exam of *How likely is it?* and *What do you expect?*

Name: ___________________________________ Date: ___________________

On this exam, probabilities must be represented in three ways.

1. Jorge has a bag with two green marbles, four yellow marbles, three blue marbles, and one red marble

   a. Find the theoretical probability of choosing each color.

      P(green) =

      P(yellow) =

      P(blue) =

      P(red) =

   b. What is the probability of <u>NOT</u> choosing a yellow marble?

      P(not yellow marble) =

   c. If he added two marbles of each color, what is the probability of choosing a blue marble?

      P(blue) =

2. Diego and Gerardo have a restaurant where customers make their own lunch meal combinations. Customers choose one item from each of the categories – sandwiches, vegetables, and drinks.

Restaurant of Diego and Gerardo		
SANDWICHES	**VEGETABLES**	**DRINKS**
• Turkey • Ham • Cheese	• Carrot • Spinach	• Soda • Juice

a. List all possible outcomes with this menu.

b. What is the probability of having turkey in a lunch meal combination?

c. What is the probability of having spinach in a lunch meal combination?

d. What is the probability of having cheese and juice in a lunch meal combination?

For problems 3 - 8, read and decide if all possible outcomes are equally likely or not and explain why.

3. If Elian tosses a penny, the penny will land head or tail.

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4. If a baby is born, the baby would be right-handed or left-handed.

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5. If Nicolas asks his mom for permission to go to the movies, she would answer yes or no.

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6. If Diana guesses the answer to a true & false question, her answer would be correct or incorrect.

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7. If a baby is born, the baby would be a boy or a girl.

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8. If Liliana toss a dice, she would get an odd or even number.

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For problems 9-12, decide if the problem is theoretical or experimental probability and explain your answer.

9. Iván is playing darts on a dart board divided into concentric parts with the colors blue, red, and yellow. The dart landed 7 times on red and a total of 13 times on the other parts. Iván says the next dart tossed has a probability of 35% of landing on red.

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10. Carolina had a box of 10 colored pencils in her backpack. When her writing teacher asked the students to design a book cover for their projects, Carolina grabbed one of the colored pencils without looking. She predicts that she has a probability of 10% of getting her favorite color, blue.

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11. Santiago is at the fun house at an amusement park. He has to choose between three exits. In one of the exits, they spray you with water. In another, they spray whipped cream. And in the third, you walk through mud. Santiago does not know which surprise corresponds with which exit. He decides that if he chooses at random, he has a probability of 1/3 of being sprayed with water.

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12. For 10 minutes each day before the start of school, some students in Mr. García's class recorded the types of vehicles that pass near the school. They want to know if it is more probable that a car or truck would pass. After a week of observations, the students used the information and predict that it is more likely for a car to pass by than a truck.

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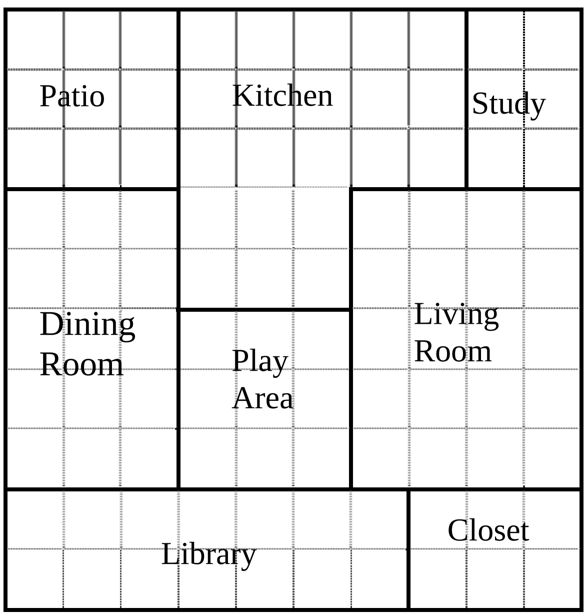
Use the diagram to answer questions 13-18 about the location of people. Remember to represent probabilities in three ways.



House Plan

13. What is the probability to find Rodolfo in the play area?

14. What is the probability to find Lupe in the kitchen?

15. What is the probability to find Pedro in the bedroom?

16. What is the probability to find Susana in the study or the library?

17. What is the probability to find Vivian in the dining room or the patio?

18. What is the probability of <u>NOT</u> finding Humberto in the living room?

LIST OF TABLES

Table 1. Study Results of Group A – Traditional Period

	Pre Test	Post Test	Difference
Student A1	18%	88%	(+) 70%
Student A2	16%	83%	(+) 67%
Student A3	33%	92%	(+) 59%
Student A4	21%	80%	(+) 59%
Student A5	0%	56%	(+) 56%
Student A6	39%	94%	(+) 55%
Student A7	9%	64%	(+) 55%
Student A8	11%	64%	(+) 53%
Student A9	21%	68%	(+) 47%
Student A10	0%	47%	(+) 47%
Student A11	7%	35%	(+) 28%
Student A12	0%	27%	(+) 27%
Student A13	0%	22%	(+) 22%
Student A14	7%	11%	(+) 4%
Student A15	8%	5%	(-) 3%
Class Average	13%	56%	(+) 43%

LIST OF TABLES

Table 2, Study Results of Group B – Flexible Block

	Pre Test	Post Test	Difference
Student B1	4%	100%	(+) 96%
Student B2	0%	92%	(+) 92%
Student B3	8%	94%	(+) 86%
Student B4	6%	92%	(+) 86%
Student B5	16%	96%	(+) 80%
Student B6	9%	89%	(+) 80%
Student B7	2%	82%	(+) 80%
Student B8	8%	87%	(+) 79%
Student B9	0%	79%	(+) 79%
Student B10	20%	96%	(+) 76%
Student B11	6%	78%	(+) 72%
Student B12	7%	78%	(+) 71%
Student B13	12%	82%	(+) 70%
Student B14	27%	96%	(+) 69%
Student B15	10%	76%	(+) 66%
Student B16	9%	67%	(+) 58%
Student B17	9%	66%	(+) 57%
Student B18	16%	61%	(+) 45%
Student B19	61%	96%	(+) 35%
Student B20	0%	31%	(+) 31%
Student B21	0%	27%	(+) 27%
Student B22	11%	14%	(+) 3%
Class Average	11%	76%	(+) 65%