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NUTRITION AND STUDENT ACHIEVEMENT IN KINDERGARTEN STUDENTS:

AN EXPERIMENTAL STUDY

by  
Stephanie Lynn Terista

A Thesis

Submitted in partial fulfillment of the requirements of the  
Master of Science in Teaching  
of  
The Graduate School  
at  
Rowan University  
6/28/00

Approved by

Professor

Date Approved

June 28, 2000

## ABSTRACT

**Stephanie Lynn Terista, Nutrition and Student Achievement in Kindergarten Students: An Experimental Study, 2000, Dr. Randall Robinson, Master of Science in Teaching.**

The purpose of this study was to investigate the relationship between the effects of nutrition on student achievement. The subjects were a transitional kindergarten class, ages 5-6, who took part in a 3-week experimental study.

Each week the subjects were instructed to perform a cognitive task directly following a treatment. Week 1, the cognitive task was performed following a nutritional snack; week 2, the cognitive task was performed following a non-nutritional snack; and week 3, a cognitive task was performed without any snack at all.

The results indicated that the findings for each week were not statistically significant:  $F(1,13)=213.86, p < .000$ . The snacks or lack thereof, did not have any affect on the ability of the students to complete cognitive tasks. The highest mean of scores, although not enough to make the week statistically significant, occurred week 3 when the cognitive task was performed after no snack at all.

The findings are not congruent with research on the effects of nutrition and cognitive development. Research shows that proper nutrition yields the highest level of child development, both mentally and physically.

Limitations which may have threatened the internal validity of the experiment, and implications for future research are discussed.

## **MINI-ABSTRACT**

**Stephanie Lynn Terista, Nutrition and Student Achievement in Kindergarten Students: An Experimental Study, 2000, Dr. Randall Robinson, Master of Science in Teaching.**

This study was designed to investigate the impact of nutrition on cognitive development. With overwhelming research on the detrimental effects of poor nutrition and child development, this study took an in-depth look at nutrition and its role in the ability of kindergarten student to perform cognitive tasks.

## Acknowledgments

The author of this study would like to extend thanks to all of the people who played an invaluable role in the completion of this thesis:

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To Dr. Randall Robinson, graduate advisor, whose guidance and support were always available, no matter how trivial or earth-shattering the growing pains were. He will always be remembered as a true professional and whose simple but truthful words “you will do this” kept the motivation going.

To my husband, Tim, for patiently waiting on the sidelines while I clicked away at the computer, claiming “thesis” for what seemed like an eternity—thank you.

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## Chapter 1

### SCOPE OF THE STUDY

#### Introduction

One of the primary concerns for parents and educators is the decline of student achievement in overall academic performance. An area of increasing concern is poor nutrition and its link to this decline. Poor nutrition among children in America is on the rise. The rise is due, in part, to poor eating habits, which include malnutrition, overeating, and skipping meals. The US Department of Health and Human Services (DHHS) found that from 1984 to 1991 there was a 42% increase in the number of children between 3 and 17 years of age who were overweight (Murphy, 1994).

The rise in poor nutrition among American children is also due to increased poverty. A survey by the U.S. Conference of Mayors found that requests for emergency food assistance from families with children increased by 14% from 1991 to 1992 (Waxman, 1992). The Community Childhood Hunger Identification Project (CCHIP) estimates that 12% of US families with children under 12 experience hunger, based on parents' responses to survey questions. This survey found correlation's between rates of poverty and rates of reported hunger. The CCHIP survey also found that children in families who reported hunger were more likely to suffer form infections, have trouble concentrating, and miss school more than non-hungry children (PTA Today, 1993).

Strong evidence exists that nutrition-related disorders are greater among low-income households than among the rest of the population. Growth retardation, which may

reflect dietary inadequacy, occurs in preschool children from low- income families at up to three times the rate as in their non-poor peers. Iron deficiency anemia is twice as common in poor children between the ages 1 and 2 than it is in the general population (Pollitt, 1993).

With the increase in the number of working parents and the ubiquity of fast-food establishments, children are eating more meals away from home than ever before. One study found that children in urban areas obtain more than half their calories outside the home. Fast foods, although convenient, tend to be high in fat and increase children's risk of becoming obese and developing various chronic diseases in adulthood (Toccolli 1993).

Children receive messages about food and nutrition from television and food packaging. The Center for Science in the Public Interest, a nonprofit nutrition advocacy organization, determined that nine of ten food commercials on Saturday morning television advertise foods high in sugar, salt, or fat. Children also learn about nutrition from what they observe around them at school and home. One study found that preschoolers were better able to describe the food their parents ate than parents were able to describe what their preschoolers ate (Hellmich, 1992).

### Statement of the Problem

The impact of nutrition on physical and cognitive development are reciprocal to one another-that is, one cannot exist without the other. This can be an alarming fact when research shows us that poor nutrition is on the rise in the U.S. Educators need to be more aware of the facts behind proper nutrition so that they can detect possible sources of poor

achievement and more importantly, increase awareness in the minds of children and parents.

The study attempted to investigate the following problems:

- 1) Does proper nutrition have an effect on the ability of young children to perform a task?
- 2) Will the ability to perform that task increase or decrease following a nutritional snack?
- 3) Will the ability to perform that task increase or decrease following a non-nutritional snack?
- 4) Will the ability to perform that task increase or decrease if there is no snack at all?

#### Hypothesis

Based on review of related literature, the following hypothesis were derived:

- 1) The level of student achievement on cognitive tasks will be significantly higher when the task is performed directly following a nutritional snack.
- 2) The level of student achievement on cognitive tasks will be significantly lower when the task is performed directly following a non-nutritional snack.
- 3) The level of student achievement on cognitive tasks will be the lowest when the task is performed directly following no snack at all.

#### Limitations of the Study

The following were limitations of the study that may have affected the results:

- 1) In terms of the data, tests may reflect things such as false positives and false negatives. False positives occur when the student performs on a level higher than what he or she really knows; likewise, false negatives could occur giving the impression the student does not know what he or she is truly capable.
- 2) Time to conduct the experiment and research the data were limited, therefore, too much interpretative value should be cautioned against.
- 3) The researcher was limited in terms of advanced biological and psychological

training that could be involved with this type of study. Therefore, results should be interpreted and integrated with additional research and data if they are to be applied.

4) The researcher conducted studies on the background of the children, but it was difficult to assess how well they were nourished outside of the school environment. Therefore, a baseline prognosis of their nutritional status may have been a marginal one.

5) The transitional kindergarten had only 15 students. Therefore, it is not advisable to generalize the results to a larger population based on such a small sampling.

6) The cognitive task in the experiment consists of arranging 5 basic shapes in an order designated by the researcher. Although the order changed everyday-making the task different each time-some learning is expected to take place by the third week.

7) Outcomes of tests will vary time to time as a result of the aspects of an individual. For example, an individual's health, motivation, anxiety, guessing luck, attitude and attention change from time to time influence performance. Similarly aspects of testing such as interruptions during test taking, changes in room comfort, time of day the test is taken.

8) The school takes part in a state funded school breakfast program. The subjects of the study receive a nutritional breakfast and lunch each day in school. Therefore, the results of this study may be a function of the nutritional program they receive as part of the school feeding program and not of the treatment itself.

### Definition of Terms

The following terms were defined for this research study:

Transitional kindergarten: A lower grade level for children who do not meet the instructional or emotional level of a traditional kindergarten student or grade level.

Nutritional foods: USDA approved nutritional snack, preferably high in iron. Liquids were in the form of either water or fruit juices (with no added sugar).

Non-nutritional foods: Foods containing sugar, salt or fat (i.e. cookies or potato chips).

## Chapter 2

### REVIEW OF THE LITERATURE

#### Introduction

What and how children learn to eat can profoundly affect their ability to learn. Children require a high protein breakfast for alertness, and a balanced diet, including complex carbohydrates throughout the day. Chronic stress causes the brain and body to deplete available nutrients (Given 1998). In addition, new research about child development and cognitive development indicate that undernourished children are typically fatigued and uninterested in their social environments (Tufts University 1994). Therefore, nutrition is a very important issue in the home environment and in the schools.

The following synopsis provides significant background regarding the issue of nutrition and student achievement, as well as research that supports the hypothesis of this study.

#### The History of Nutritional Research and Programs

In 1975, Congress established the School Breakfast Program, which gives federal funds to help schools provide morning meals to children (Tingling-Clemons 1991). The food research and action program has worked to increase the number of schools participating in the program. Since then, studies have been conducted in an effort to analyze the relationship between school feeding programs (SFP) and cognitive development (Levinger 1989).

In April 1993, President Clinton sent to congress the Goals 2000: Educate America Act, which embraces the objectives of goal one of the ten national educational goals. Goal one states that “By the year 2000, all children in America will start school ready to learn.” One of the objectives formulated to meet this goal asserts that “Children will receive the nutrition and health care needed to arrive at school with healthy minds and healthy bodies.” With the implementation of this national goal, research and studies relevant to nutrition and student achievement abound (Goldberg 1998).

One study, conducted by Levinger (1989), states that the main areas of concern regarding education and nutrition are: 1) the relationship between diet and cognitive development; 2) limitations of intelligence quotient tests and the need for more adequate instruments; 3) school feeding programs and the socioeconomic background of the students; and 4) long-term behavioral effects.

Another study conducted by Negussie (1989) finds that education, health, and nutrition are so closely related that changes in one cause changes in the others. Improvement of maternal preschooler health and nutrition is a precondition for improved educational achievement. Several federal and non-federal government initiatives intended to address children’s nutritional status are highlighted in Karen Toccolli’s article, *Eat to Learn, Learn to Eat* (1993). The researcher recommends collaboration and cooperation between public and private agencies, parents and schools, and health professionals in order to help increase funding and effectiveness child nutrition programs. Toccolli supports the research and action taken in nutritional programs but insists that child nutrition programs can benefit from the reduction of red tape and administrative requirements for federal programs.

Historically, socioeconomic status has not been emphasized in studies regarding nutrition. Children of all socioeconomic levels are at risk for poor nutrition (Toccolli 1993). With an upward trend toward inclusion and mainstream classrooms, studies on nutrition and its relationship to socioeconomic status is on the rise. Rizzo (1997) connects personal, family and job responsibilities for youth in economically depressed areas of the states so individuals can learn to manage and balance these aspects of their lives in order to prepare for academic and future professional achievement. An overview of research reveal that children in the United States suffer a mild to moderate degree of malnourishment associated with poverty (Tufts University 1994). By using the Rizzo's (1997) competency unit educators, can address the following topics: 1) defining wellness 2) planning food choices to meet the individual needs of the child 3) assessing mental and emotional health; and 4) assessing state of physical fitness and needed improvements. Each competency unit consists of learner outcomes, key ideas, definitions, teaching strategies and methods, and learning activities.

#### School Feeding and Educational Performance

Research has shown that poor health affects children's learning. These affects include cognitive and socioemotional deficits low scores on developmental and achievement tests, and inattentiveness. Programs that provide children with access to good nutrition and health care and education about health and nutrition can lessen or eliminate the detrimental effects and foster the readiness of all students (Levinger 1989).

Research also shows that nutritional supplementation has long-term consequences for cognitive development and that the relationship of nutrition and cognitive performance does not fit a main-effects model (Wachs 1993). Based on this theory,

school-feeding programs have an important role in increasing the educational performance of students. Goldberg (1998) provides nutritional guidelines for the development of school breakfast programs in an effort to promote academic achievement that will be accepted by a wide range of users. The programs should start early; research shows that as early as the preschool years, poor nutrition causes stunting, lethargy, and other symptoms (Scrimshaw 1993). Scrimshaw also notes that correcting early malnutrition provides large benefits to children when they become adolescents and young adults.

In a study conducted by Pollitt (1993), adolescents who had received a protein supplement when they were infants scored higher on tests of knowledge, numeracy, reading, and vocabulary, and showed faster reaction times in information processing tasks than adolescents, who, as infants did not receive the supplement.

Tingling (1991) states in her study that all schools should have breakfast programs. In her school breakfast campaign, Tingling offers suggestions on how to organize school breakfast programs at the local level: 1) present suggestions on organizing or expanding breakfast programs and contain fact sheets about such programs; 2) contains surveys and data sheets for collecting information for factors related to the implementation of school breakfast programs in local communities; 3) discuss the relationship between nutrition and learning, and the child's right to receive school meals; 4) Lists facts that answer commonly asked questions about school breakfast programs; 5) list organizations that have endorsed campaigns to end childhood hunger and to expand the national school breakfast program; 6) offer suggestions on marketing a breakfast



program; and 7) present results of two surveys concerning the effects of eating breakfast and students' feeling and behavior at school.

Overall, studies show that nutritional programs do play key roles in safeguarding the health and cognitive development of children who are at risk for malnourishment (Tufts University 1994). The School Breakfast Program, the School Lunch Program, the Summer Food Service Program, and the Food Stamp Program are all programs that have improved nutrition and warded off hazardous developmental affects to which underprivileged children have been exposed. Additional benefits of theses programs, states Tufts University, is savings in medical costs and in special education programs.

#### Health and Nutrition in Early Childhood Development

Research has indicated that there is a connection between food additives and learning disabilities, and that children who eat an adequate breakfast show better late morning learning than those who do not (Rizzo 1997). For these reasons children in preschool and kindergarten settings should be provided with nutritious breakfast and snacks and should be offered nutritious foods such as fruits and vegetables instead of foods high in sugar, salt, and fat. One way to involve children in cooking experiences is to engage children in cooking experiences.

Poor nutrition also tops the charts when it comes to child development. Ford (1991) states that problems which can affect children's later development and school readiness include a lack of prenatal care, low birth weight, maternal substance abuse, malnutrition, vaccine-preventable diseases, sensory impairments, high blood levels, and anemia. Efforts to promote children's health and nutrition and to prevent children's illness include federal and state programs, and initiatives to serve preschool children in

health care settings, in preschool programs, and in community settings. The efforts help children's development as they address prenatal care, health and nutrition, parent education, teacher education, and health and nutrition instruction for children.

### Multicultural Research

Noting that children of all socioeconomic levels are at risk for poor nutrition and that national and developing countries face issues of poor nutrition, multicultural research is an important factor in nutrition research. Researchers have also studied the long-term effects of nutritional programs both locally and nationally (Wachs 1993).

At 3 years of age, children who received food supplementation were an average of 2.6 centimeters and 642 grams larger than control groups. (Super 1990). Home visiting and supplementation combined reduced the number of children with severe growth retardation. The trends for extensive research on nutrition extend globally. Gupta (1991) has concluded that malnutrition in early childhood, as studied in many developing countries, influences subsequent behavior and intellectual performance. The impairments are associated with further reduction in fine motor skills and academic performance. Another study in a village of Egypt assessed whether specific nutritional variables added a unique variance to the prediction of toddler development. Using 153 toddler, results suggest that 18 to 23 months of age, specific nutritional predictors can be identified and that there is specificity of nutritional action (Wachs 1993).

In an effort to improve child development in community settings, Los Ninos agency in San Ysidro, California serves Mexican and Mexican-American children living in colonias along the California-Mexico border. The agencies efforts, reports Ford (1991), include teaching parents and educator's about basic food requirements, helping

mothers plan menu's and purchase food, and encouraging families to plant gardens to improve their diet with home grown fruits and vegetable. Another data program in Richmond, Kentucky is a comprehensive data system developed to track families with preschool and kindergarten children living in isolated communities. Pathways to Understanding in Bernalillo, New Mexico seek to increase the effectiveness of health care professionals working with American Indian families by improving their knowledge of culturally appropriate methods of providing care to American Indian children. Health care programs have had positive impacts on children's health and nutrition and have aided in getting children to school ready-to-learn (CDF 1991).

#### Benefits of Nutritional Research in Education

A study conducted by Murphy (1994) evaluated student's knowledge, attitudes, and practices regarding dietary guidelines, school lunches and nutrition instruction. Results indicated that students needed education about the Food Pyramid Guide and more importantly, that students were eager to take part in furthering their education about nutrition and their personal development.

Long term follow-ups on nutritional research have provided additional insight into the ill effects of poor nutrition as well as the physiological benefits of proper nutrition. Grantham (1994) conducted a study that examined the relationship between childhood malnutrition and later intellectual development in 18 severely malnourished children. The children participated in a 3-year home visitation intervention program and follow-ups were done 7,8,9 and 14 years after the study. The children had a markedly higher vocabulary and achievement score than a control group of severely malnourished children who did not receive the intervention.

## Summary

Research has shown that poor health affects children's learning. The effects include cognitive and socioemotional deficits low scores on developmental and achievements tests, and inattentiveness. Programs that provide children with access to good nutrition and health care and education about health and nutrition, such as those reported on in this literature review, can lessen or eliminate the detrimental effects and foster the school readiness.

The researcher's purpose in this study was to describe the results of an experiment conducted with subjects in transitional kindergarten. The focus of the study was to determine if nutrition had an effect on cognitive tasks, and if nutrition affected the level of student achievement. The researcher hypothesized that cognitive tasks would be highest after the subjects received a nutritional snack. The researcher also believed that the level of achievement would scale down after receiving a non-nutritional snack, and show the least achievement after receiving no snack at all.

## Chapter 3

### METHOD

#### Introduction

In this study, the researcher attempted to investigate the relationship between student achievement and nutrition. The experiment had a duration of three weeks and consisted of three phases: The first week, the subjects performed a cognitive task directly following a nutritional snack. The second week the subjects performed a cognitive task directly following non-nutritional snacks. The subjects were not provided with any snack the third week, but were directed to complete the same task implemented the first and second week. The researcher hypothesized that achievement on cognitive tasks would be highest following week 1 (nutritional snack), lower following week 2 (non-nutritional snacks) and least week 3 (absence of snacks).

#### Population and Sample

Abbott districts are in greater danger of low academic performance compared to other school districts because of the high incidence of poor families. Since it has been proven that there is a direct link between lower socioeconomic groups and poor nutrition, the researcher felt Millville School District was a good candidate for this type of study. The results of poor nutrition are said to be poor concentration and overall, lower levels of achievement. One of the U.S. DHHS's health promotion objectives is to increase the number of schools that provide nutrition education from preschool through twelfth grade.

The subjects of this study were 15 children who were enrolled in Transitional kindergarten. The children were placed in this program because they did not meet certain social, emotional, physical, or academic standards of traditional Kindergarten.

The class consisted of 11 male students and 4 female. The age range extended from 5-6 years of age. The class was very diverse in terms of their culture and socioeconomic scale. Because of the diverse culture, it was common for children to experience language barriers and social phobias. General learning disabilities were the major factor in determining their placement in Transitional kindergarten. Although the children have a beginning concept of word, the children were still learning the alphabet.

All of the subject's will participate in a three-week study with three different treatments and observations to follow.

#### Design of Study

The design of this study was a posttest-only control group design. A pretest was not necessary since it was formerly observed that each child knew each of the 5 basic shapes. The same group of 15 (N=15) will received 3 different treatments in 3 successive weeks. The snack changed each week, but the task remained the same (see table 1).

*Table 1: Experimental Design*

Assignment	Subjects (N)	Treatment	Posttest
Random	15	Nutritional Snack	Self-Administered Cognitive achievement test
Random	15	Non-nutritional snack	Self-Administered Cognitive achievement test repeated (different sequential order)
Random	15	No snack	Self-Administered Cognitive achievement test repeated (different sequential order)

## Procedure

Each of the subjects learned their geometric shapes in September. The 5 geometric shapes used in this study were the triangle, rectangle, circle, oval, and square. They were also provided with a review the week before the experiment. It was assumed for the experiment that all subjects could identify the 5 basic shapes. The challenge in this experiment was to use their cognitive skills to put the shapes in correct order.

Each week, directly following the treatment (week 1 nutritional snack, week 2 non-nutritional snack, week 3 no snack), the subjects received a set of each of the 5 geometric shapes. The subjects were instructed to arrange the shapes in a certain sequential order (see appendix). After the subjects completed the task, they were instructed to leave their work at their seats and move to another area of the room. Completion of the activities took approximately 20 minutes. Scores were tabulated for each day (20 points for each correct answer/100point scale). At the end of the three weeks, scores were tabulated on a daily and weekly basis.

## Description of Instrument

A self-developed instrument was developed by modifying the Brigance Kindergarten screening test. In this multi-task test, students are expected to know the five basic shapes (triangle, rectangle, square, circle, and oval) and to name them upon sight (see Appendix A).

The self- developed test utilized the five basic shapes, each of which were arranged in different order on every testing day for three weeks. A set of scores was tabulated for each testing week.

Score interpretations were made following the three week experiment period to decide if the independent variable (snack vs. no snack) had any affect on the dependent variable (achievement level on cognitive assessment).



## Chapter 4

### ANALYSIS OF THE FINDINGS

#### Introduction

In this study, the researcher attempted to investigate the relationship between student achievement and nutrition. The experiment had a duration of three weeks and consisted of three phases: The first week, the subjects performed a cognitive task directly following a nutritional snack. The second week the subjects performed a cognitive task directly following non-nutritional snacks. The subjects were not provided with any snack the third week, but were directed to complete the same task implemented the first and second week. The researcher hypothesized that achievement on cognitive tasks will be highest following week 1 (nutritional snack), lower following week 2 (non-nutritional snacks) and least week 3 (absence of snacks).

#### Tabulation of Scores

The level of cognitive achievement was measured each day, following the treatment, by a 5 item self-administered post-test. The researcher analyzed the scores for each day by tabulating how many participants received each score. The graphing of the frequency of the scores enabled the researcher to determine which treatment had the most significant effect. The frequency pie graphs revealed that the most significant level of achievement occurred week 3, directly following no snack (see Appendix B for post-test scores of the treatment group).

Analysis of variance was used to test for differences between subjects on the performance measure. Analysis of post-test data revealed the type of snack (nutritional, non-nutritional, none), had no statistical significance in correlation to the ability of the subjects to perform cognitive tasks  $F(1, 13) = 213.86, p < .000$ . Even though the frequency pie graphs revealed a slight elevation in achievement level following week 3, (no snack), statistically, the correlation between the treatments and cognitive achievement was not significant. Table 2 includes a summary of the Test of Between-Subjects Effects.

*Table 2: Tests of Between- Subjects Effects*

Source	Type III Sum of Squares	Df	Mean Square	F	Significance
Intercept	247726.08	1	247726.08	213.860	.000
Error	15058.620	13	1158.355		

The results do not support the researcher's hypothesis because there was no statistical significance between the treatment (nutritional snack, non-nutritional snack, no snack) and level of cognitive achievement. Therefore, the results are not in agreement with extensive research regarding nutrition and levels of cognitive achievement. Further investigation is recommended due to original limitations listed in the study such as threats to internal validity. For example, table 3 reveals that the highest mean of scores occurred the third week of the experiment. Although this is in direct contradiction to the researcher's hypothesis, this does address a limitation listed earlier in the study. The

researcher theorized that learning might take place throughout the three-week experiment. If the results of learning were to surface in the experiment, the strongest evidence of learning would surface the third and last week of the study. Other possible discrepancies may lie in the fact that the children are part of the breakfast program and well-nourished to the point that snacks during the day do not make a significant difference in their achievement (in fact, they may be a distraction, especially to the nature of the transitional kindergarten).

*Table 3: Descriptive Statistics*

	Subjects (N)	Minimum Score	Maximum Score	Mean	Standard Deviation
Week 1	14	15.00	100.00	73.80	26.53
Week 2	14	15.00	100.00	72.45	24.79
Week 3	14	35.00	100.00	84.15	20.99

## Chapter 5

### SUMMARY AND CONCLUSIONS

#### Introduction

In this study, the researcher attempted to investigate the relationship between student achievement and nutrition. With overwhelming research on the detrimental effects of poor nutrition on child development, this study took an in-depth look at nutrition and its role in the ability of young children to perform cognitive tasks.

The experiment had a duration of three weeks and consisted of three phases: The first week, the subjects performed a cognitive task directly following a nutritional snack. The second week the subjects performed a cognitive task directly following non-nutritional snacks. The subjects were not provided with any snack the third week, but were directed to complete the same task implemented the first and second week. The researcher hypothesized that achievement on cognitive tasks will be highest following week 1 (nutritional snack), lower following week 2 (non-nutritional snacks) and least week 3 (absence of snacks). The overall intention of this study is to support research and programs involving nutrition in the schools and to prove that better school food equals better school learning. The impact of nutrition on physical and cognitive development is crucial to one another. Educators need to be more aware of the facts behind proper nutrition so that they can detect possible sources of poor achievement and more importantly, increase awareness in the minds of children and parents.

### Summary of the problem

This study attempted to investigate the following problems behind poor nutrition and its relationship to student achievement. Does proper nutrition in the form of a snack have an effect on the ability of Kindergarten students to perform a cognitive task? Will the ability to perform the cognitive task increase or decrease following a nutritional snack? Will the ability to perform the cognitive task increase or decrease following a non- nutritional snack? Will the ability to perform the cognitive task increase or decrease if there is no snack at all? Although the experiment was conducted on a kindergarten class, the hopes were to generalize the results to the larger population.

### Summary of Hypothesis

Based on research of nutrition and cognitive development, the researcher hypothesis was derived on the premises that higher levels of nutrition yield higher levels of cognitive achievement. The results of this study do not support the original hypothesis: The level of student achievement on cognitive tasks will be significantly higher when the task is performed directly following a nutritional snack. The level of student achievement on cognitive tasks will be significantly lower when the task is performed directly following a non-nutritional snack. The level of student achievement on cognitive tasks will be the lowest when the task is performed directly following no snack at all.

Score interpretations were made following the three week experiment period to decide if the independent variables (nutritional snack, non-nutritional, no snack) had any affect on the dependent variable (achievement level on cognitive assessment).

### Summary of Procedure

The challenge for the treatment group in this experiment was to use their cognitive skills to put the shapes in correct order. The 5 geometric shapes used in this study were the triangle, rectangle, circle, oval, and square. Each week, directly following the treatment (week 1 nutritional snack, week 2 non-nutritional snack, week 3 no snack), the subjects received a set of each of the 5 geometric shapes. The subject's were instructed to arrange the shapes in a certain sequential order (see appendix). After the subjects completed the task, they were instructed to leave their work at their seats and move to another area of the room. Completion of the activities took approximately 20 minutes. Scores were tabulated for each day (20 points for each correct answer/100point scale). At the end of the three weeks, scores were tabulated on a daily and weekly basis in the form of frequency pie graph figures.

### Summary of Findings

Even though the frequency pie graphs revealed a slight elevation in achievement level following week 3, (no snack), statistically, the correlation between the three levels of treatment (nutritional snack, non-nutritional snack, no snack) and the level of student achievement was not found significant:  $F(1, 13) = 213.86, p < .000$ . Therefore, the results are not in agreement with research regarding the effects of nutrition on cognitive development. The highest mean of scores occurred week 3, when the cognitive task was performed without any snack. Although the elevated mean in week 3 was not high enough to make the relationship between the three weeks statistically significant, the slight elevation was noted and is discussed for future implications.

## Conclusion

The findings were not significant, and therefore, not in agreement with research on the effects of nutrition and cognitive development. The researcher believes that limitations may have played a role in threatening the internal validity of the experiment. For example, the children were part of a school breakfast program, and overall well nourished throughout their school day. This factor, along with other limitations in the study, may be the reason that the snack did not have a profound effect on their ability to achieve. In fact, with slightly elevated levels of achievement noted the third week of the experiment (the week without the snack), the researcher concluded that the snack might have actually been a distraction.

## Implications and Recommendations

The overall intention of this study was to support research and programs involving nutrition in the schools and to prove that better school food equals better school learning. Regardless of the statistical findings in this experiment, the physiological impact of nutrition on physical and cognitive development is an issue that cannot be ignored. If the relationship did not reveal significance from a statistical standpoint, we must consider the significance from a practical one. Educators need to be more aware of the facts behind proper nutrition so that they can detect possible sources of poor achievement and more importantly, increase awareness in the minds of children and parents.

Future studies may find statistical significance with same type of study based on different experimental designs. For example, valid examination of the effects of nutrition on cognitive achievement may consist of two groups; the first group who receives a

breakfast program each morning and a second control group who does not. Gay and Airasian (1996) state that the power of a significance test depends on three interrelated factors: 1) sample size 2) the significance level selected and the directionality of the significance test, and 3) the effect size, which indicates degree of the departure from the null hypothesis. Significance in the statistical sense is largely a function of sample size, significance level, and a valid research design.

Although the researcher did not support the hypothesis in this study, due to possible issues of validity and general limitations, future research on the topic of nutrition and cognitive achievement is highly recommended. Surrounding research around the classroom is extremely valuable to parents and teachers because it can provide the background and knowledge necessary to guide them in the process of improved student learning.



APPENDIX A

BRIGANCE KINDERGARTEN TEST AND THE FIVE BASIC SHAPES

# FIRST-GRADE Pupil Data Sheet for the BRIGANCE® K & 1 SCREEN



**A. Student's** Name \_\_\_\_\_ Date of Screening \_\_\_\_\_ Year \_\_\_\_\_ Month \_\_\_\_\_ Day \_\_\_\_\_ School/Program \_\_\_\_\_  
 Parent/Guardian \_\_\_\_\_ Birthdate \_\_\_\_\_ Teacher \_\_\_\_\_  
 Address \_\_\_\_\_ Age \_\_\_\_\_ Assessor \_\_\_\_\_

**B. BASIC SCREENING ASSESSMENTS**

Page	Assessment Number	Skill (Circle the skill for each correct response and make notes as appropriate.)	Number of Correct Responses	Point Value	Student's Score
2	1	<b>Personal Data Response:</b> Verbally gives: 1. first name    2. full name    3. age    4. address (street or mail)    5. birthdate (month and day)	x	1 point each	/5
3	2	<b>Color Recognition:</b> Identifies and names the colors: 1. red    2. blue    3. green    4. yellow    5. orange    6. purple    7. brown    8. black    9. pink    10. gray	x	.5 point each	/5
5	3	<b>Picture Vocabulary:</b> Recognizes and names picture of: 1. dog    2. cat    3. key    4. girl    5. boy    6. airplane    7. apple    8. leaf    9. cup    10. car	x	.5 point each	/5
7	4B	<b>Visual Discrimination:</b> Visually discriminates which one of four symbols is different: 1. o    2. c    3. c    4. b    5. n    6. on    7. be    8. can    9. they    10. was	x	1 point each	/10
8	5	<b>Visual-Motor Skills:</b> Copies:    1. O    2. -    3. +    4. □    5. Δ	x	1 point ea.	/5
11	7	<b>Draw a Person (Body Image):</b> Draws picture of person that includes the body parts: 1. head    2. legs    3. eyes    4. nose    5. mouth    6. arms    7. trunk    8. hands    9. ears    10. neck	x	1 point each	/10
12	8	<b>Role Counting:</b> Counts by rote to: (Circle all numerals prior to the first error.) 1 2 3 4    5 6 7 8    9 10 11 12    13 14 15 16    17 18 19 20	x	1 pt./4 in seq.	/5
14	10	<b>Recites Alphabet:</b> Recites alphabet to: (Circle all letters prior to the first error.) a b c d e    f g h i j    k l m n o    p q r s t    u v w x y z	x	1 pt./5 in seq.	/5
17	12	<b>Numeral Comprehension:</b> Matches quantity with numerals:    2    1    4    3    5    7    9    6    8    10	x	1 point ea.	/10
18	13	<b>Recognition of Lowercase Letters:</b> Recognizes and names lowercase letters. o    a    d    g    q    b    p    c    e    l    t    i    f    j    n    m    r    h    u    v    w    y    x    z    k    s	x	.5 point each	/13
20	14	<b>Auditory Discrimination:</b> (Circle the number or letter if both responses are correct.) 1. m— mel-met; sum-sun    2. b— tab-tab; bit-mit    3. h— hide-wide; hat-mat    4. j— jet-wet; just-just 5. g— gate-late; sag-sat    6. r— rid-bid; raid-raid    7. s— set-wet; bus-bud    8. d— hid-hid; dab-dab 9. n— next-next; nut-mutt    10. f— fix-mix; fan-fan	x	1 point each letter	/10
21	15	<b>Prints Personal Data:</b> Prints:    1. first name    2. last name    Reversals:    Yes _____ No _____	x	5 pts. ea.	/10
23	17	<b>Numerals In Sequence:</b> Writes numerals to:    1    2    3    4    5    6    7    Reversals:    Yes _____ No _____	x	1 pt. ea.	/7

**D. OBSERVATIONS:**

1. Handedness: Right \_\_\_\_\_ Left \_\_\_\_\_ Uncertain \_\_\_\_\_
2. Pencil grasp: Correct \_\_\_\_\_ Incorrect \_\_\_\_\_
3. Maintained paper in the proper position when writing:  
Yes \_\_\_\_\_ No \_\_\_\_\_
4. Record other observations below or on the back.

**E. SUMMARY:** (Compared to other students included in this screening)

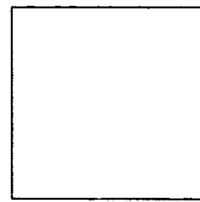
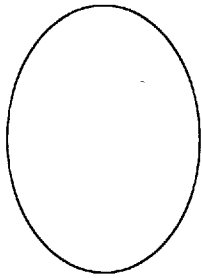
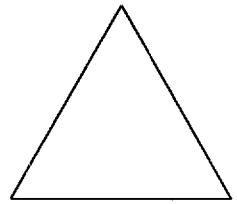
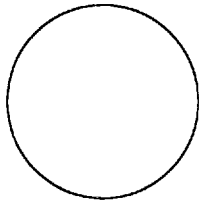
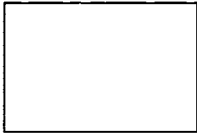
1. this student scored: .....	Lower _____	Average _____	Higher _____
2. this student's age is: .....	Younger _____	Average _____	Older _____
3. the teacher rates this student: .....	Lower _____	Average _____	Higher _____
4. the assessor rates this student: .....	Lower _____	Average _____	Higher _____

**F. RECOMMENDATIONS:**

Place in:    Low First Grade \_\_\_\_\_    Average First Grade \_\_\_\_\_    High First Grade \_\_\_\_\_  
 Other (Indicate) \_\_\_\_\_  
 Refer for: (Indicate if needed) \_\_\_\_\_

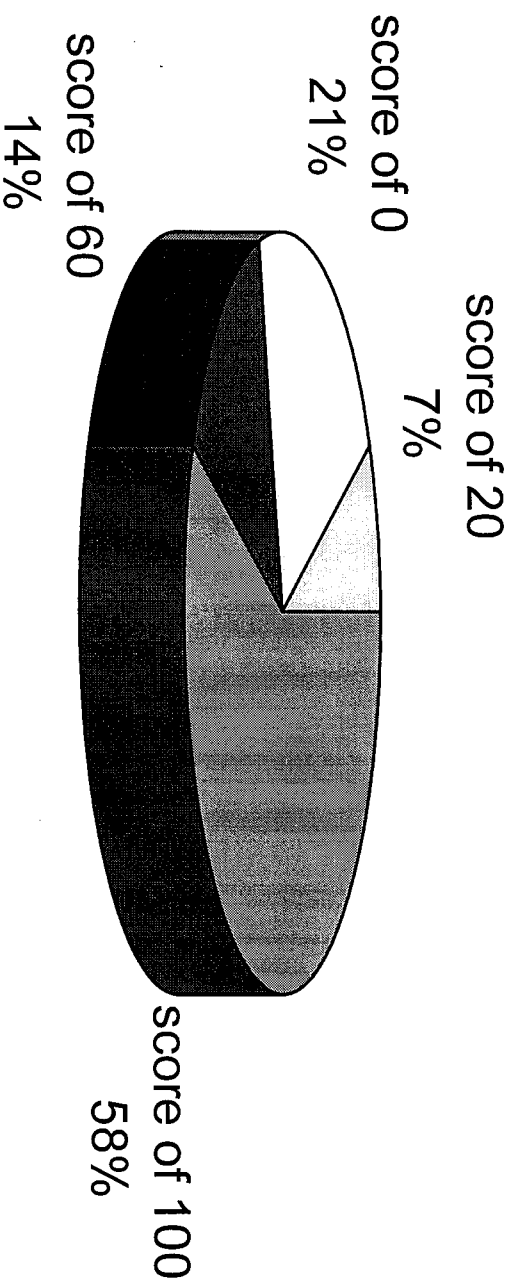
C. SCORING	Total Score
/100	/100

**The five basic shapes: rectangle, circle, triangle, oval and square.**

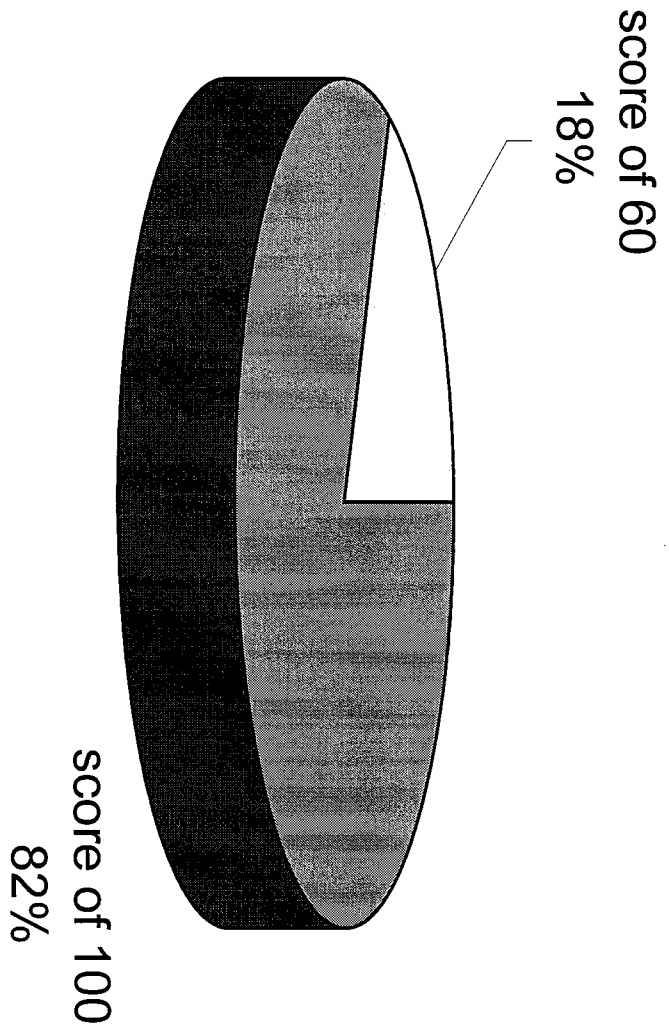


APPENDIX B  
FREQUENCY PIE GRAPHS

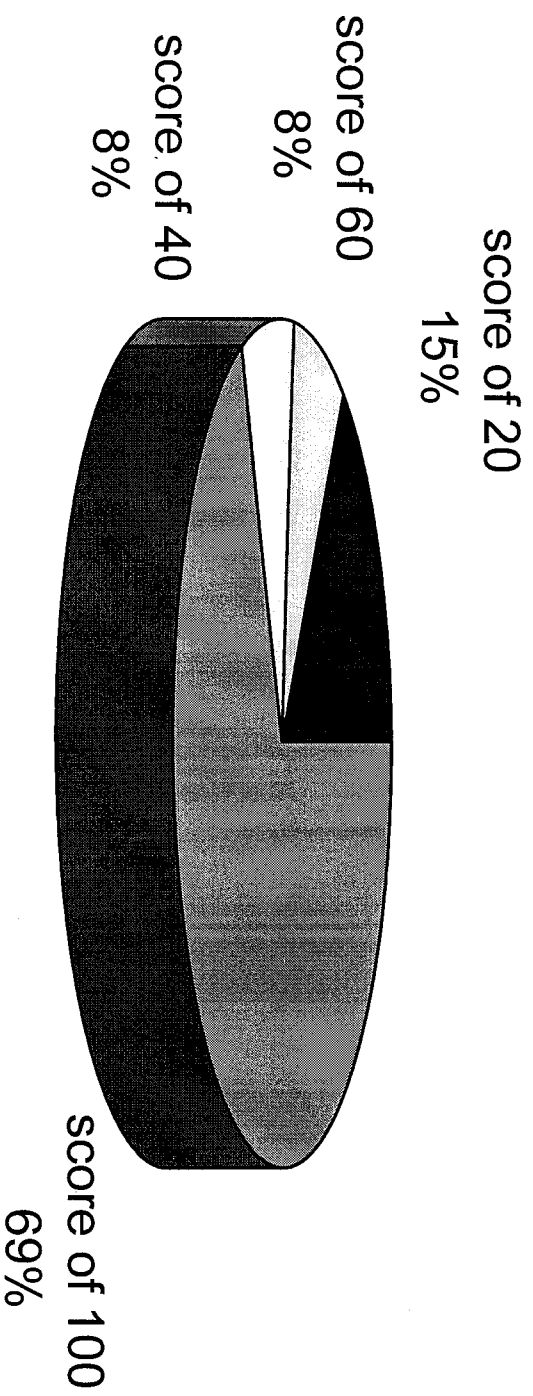
# frequency: week 1, day 1



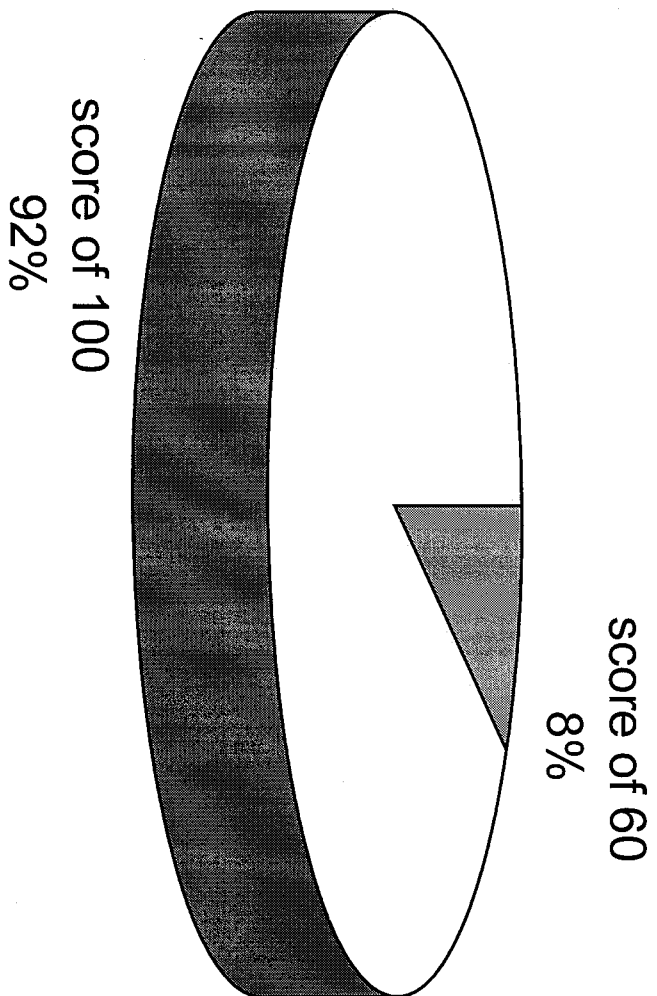
# frequency: week 1, day 2



frequency: week 1, day 3

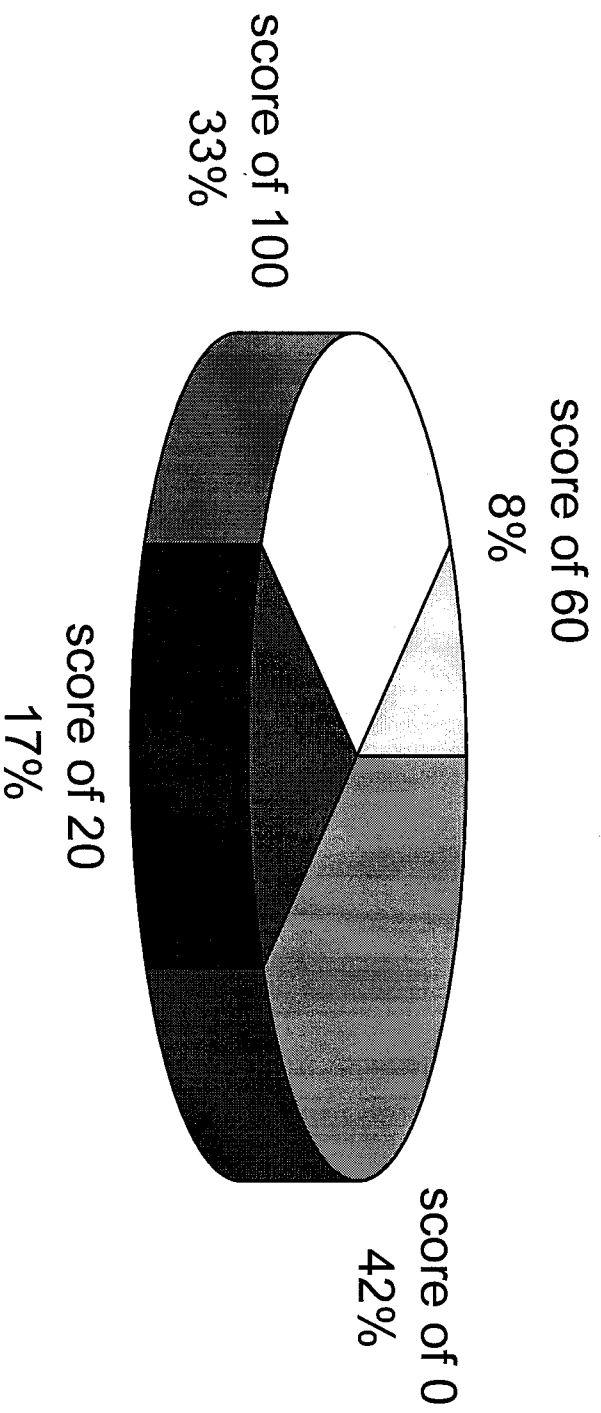


**frequency: week 1, day 4**

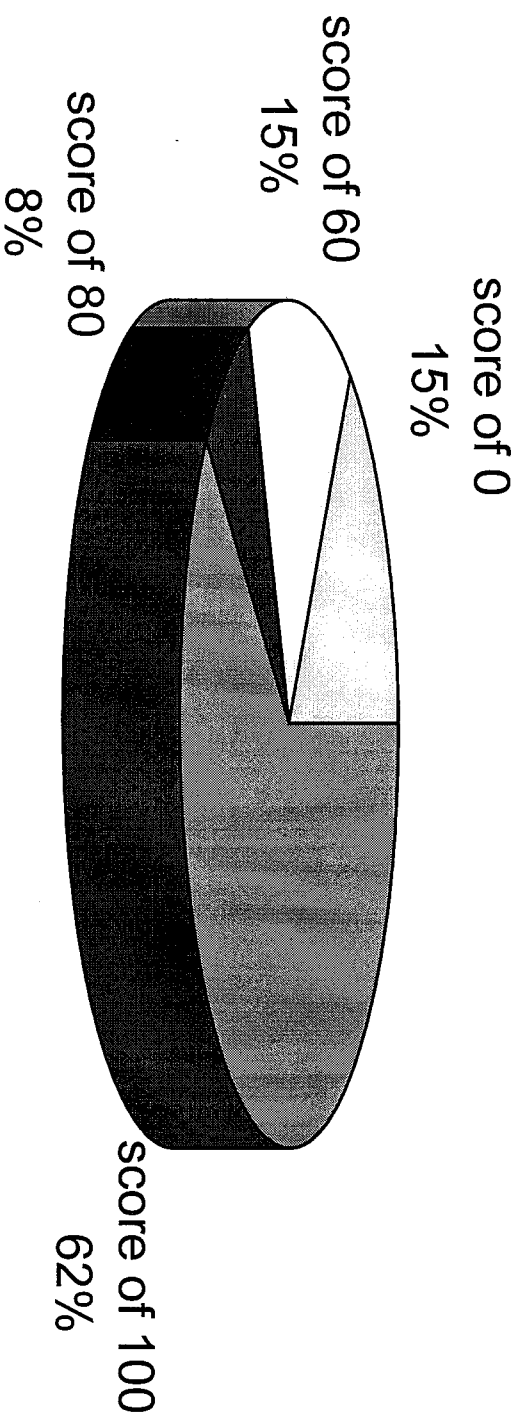




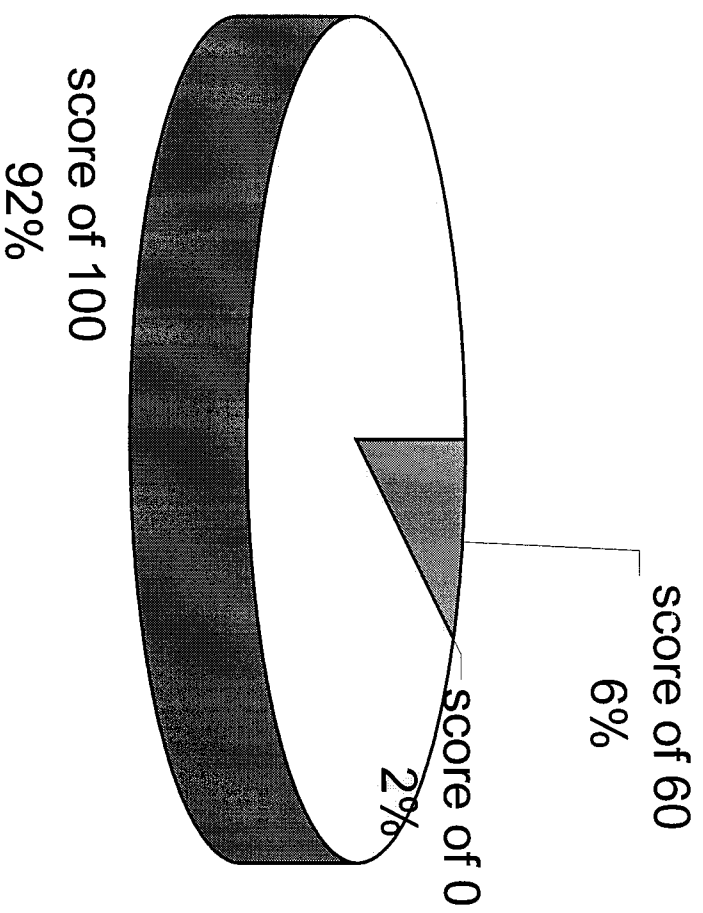
# frequency: week 1, day 5



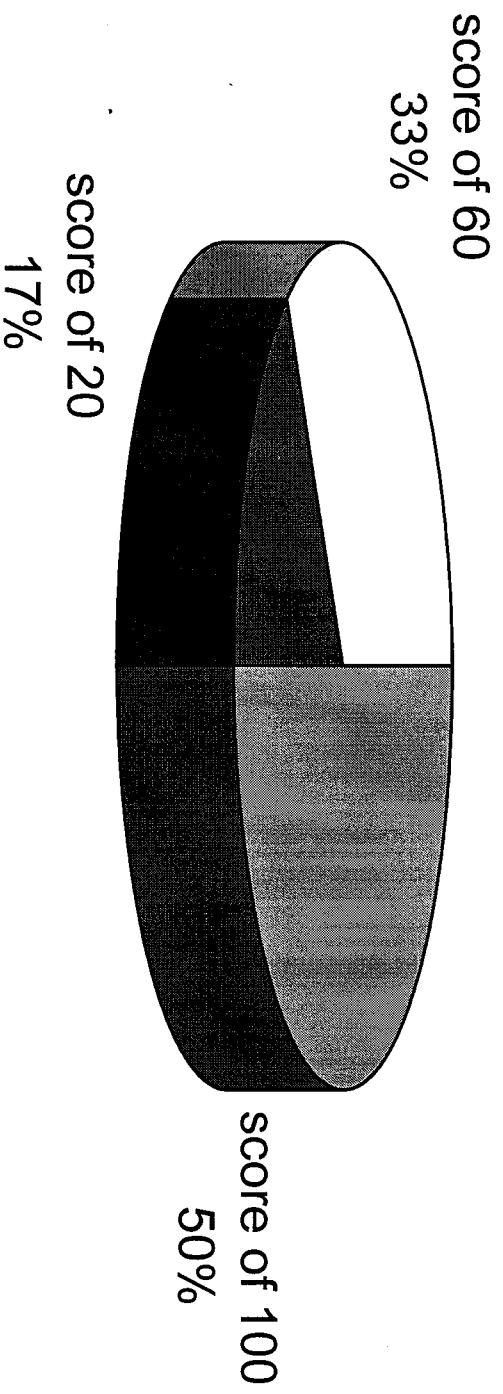
## frequency: week 2, day 1



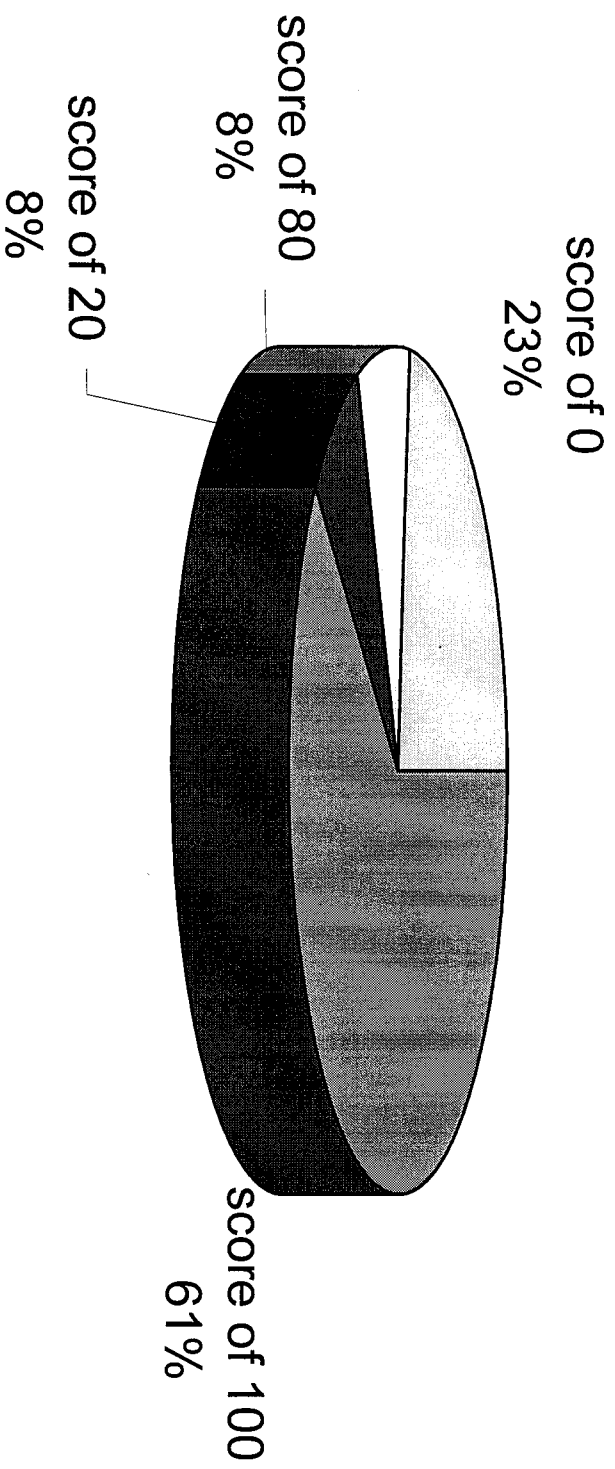
## frequency: week 2, day 2



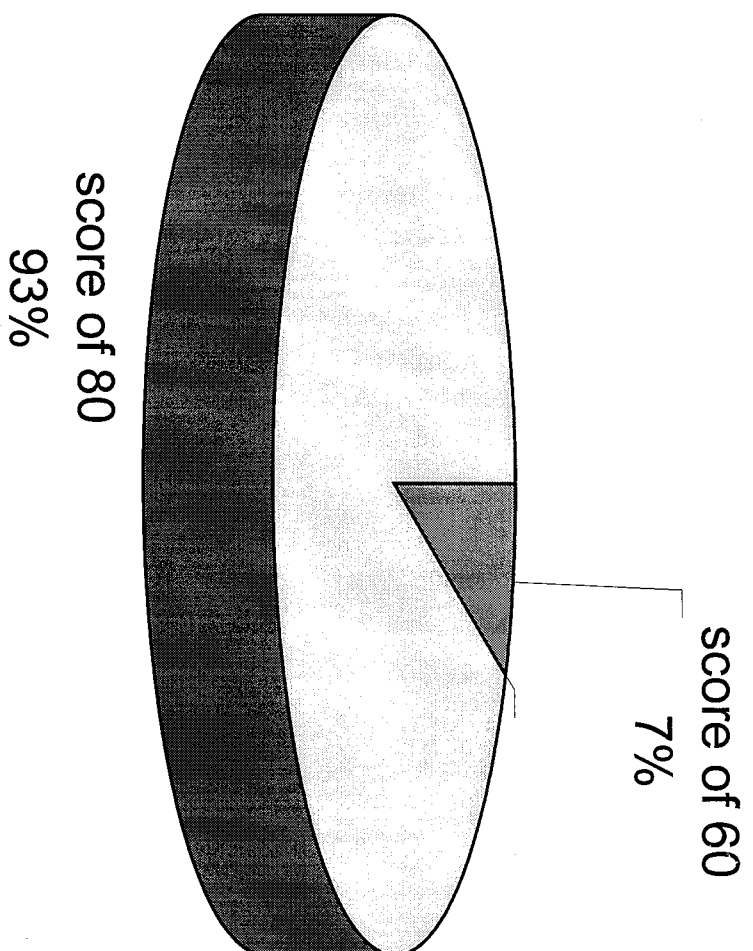
# frequency: week 2, day 3



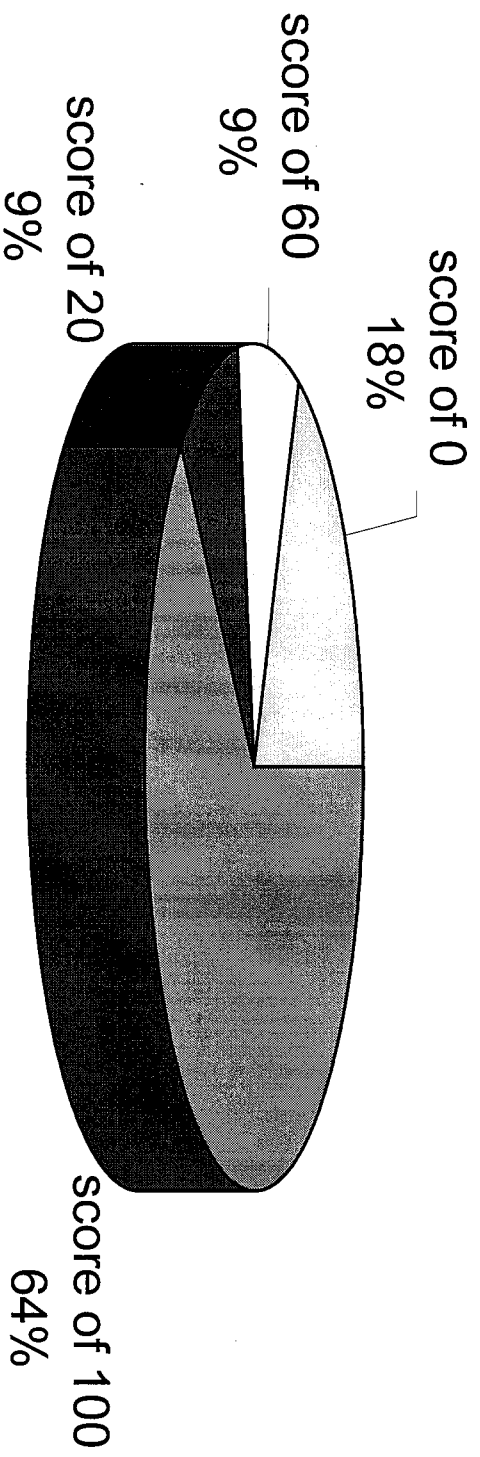
## frequency: week 2, day 4



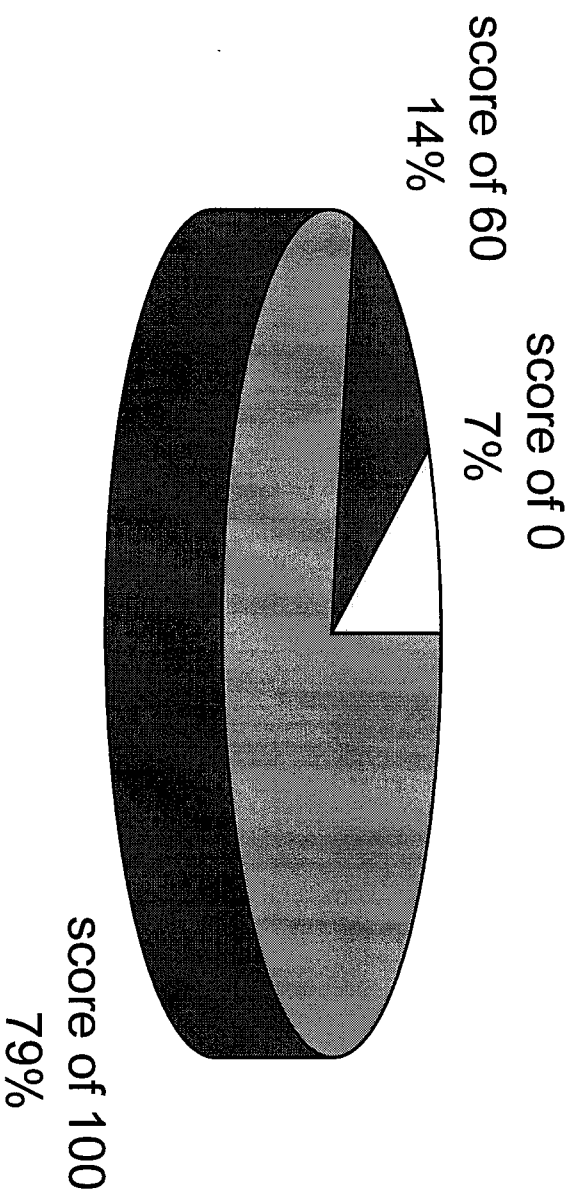
# frequency: week 2, day 5



# frequency: week 3, day 1

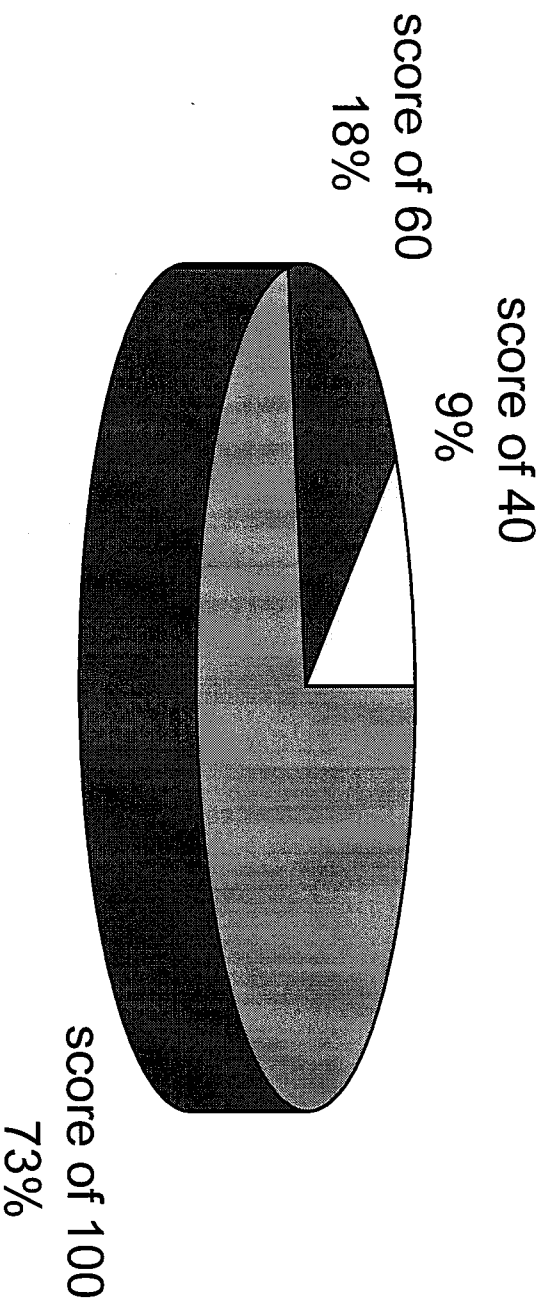


## frequency: week 3, day 2

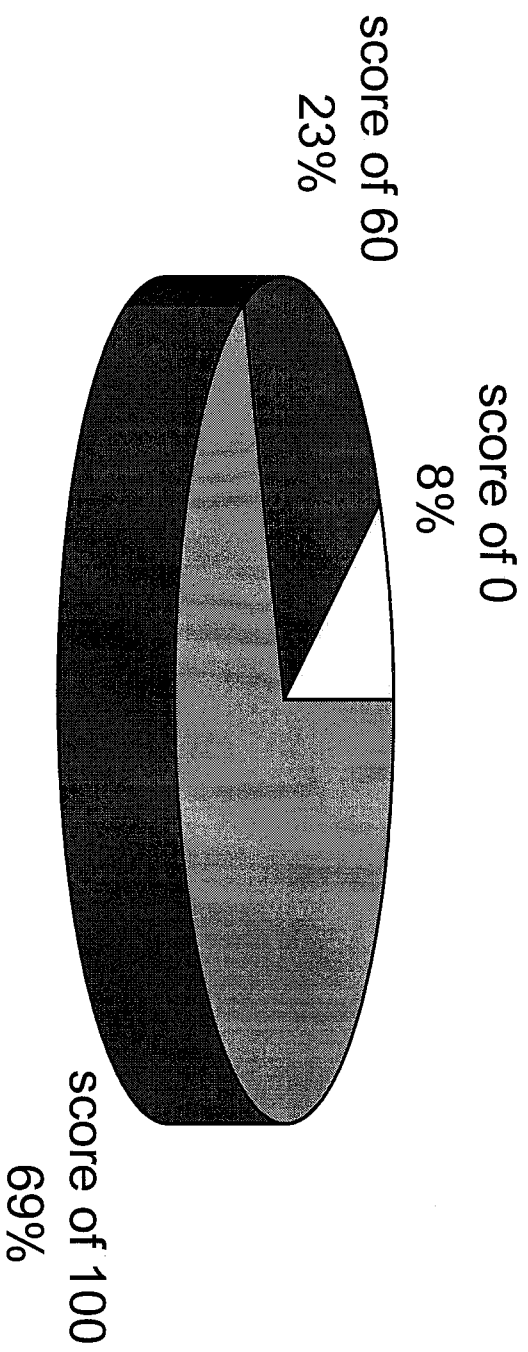




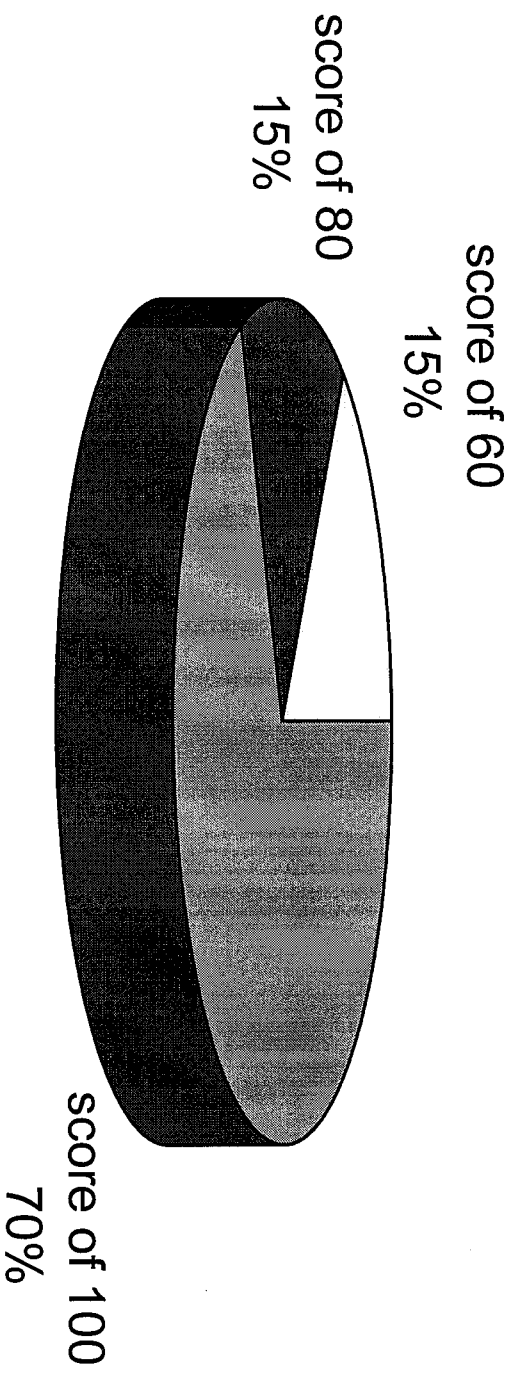
# frequency week 3, day 3



## frequency: week 3, day 4



# frequency: week 3, day 5



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