

Can the use of edible hands-on math materials increase student achievement when used during introductory lessons?

Contact Information:
Mariah Gaskins
3rd grade teacher
Arlington Heights Elementary
gaskinsm2@educationcentral.org

1. Focus Statement

It has been proven* that the use of hands-on materials during teaching can increase achievement. Based upon these findings, another question is formulated: can the type of hands-on material actually increase achievement? More specifically, can the use of edible hands-on math materials increase student achievement? I'll operationally define achievement as an increase in unit test scores.

2. Literature Review

All teachers are pressed to increase assessment scores and 'there is a clear need for improved math and science education' (Duffrin, Cuson, and Phillips). Using hands-on materials will help increase student achievement and help 'students to more readily understand concepts and boost self-confidence' (DeGeorge). Often they even help teachers feel more confident (Duffrin, Cuson, and Phillips).

When using edibles as the hands-on materials, students already have a connection with new concepts since food is something that students are exposed to daily. Students can also see that math has a purpose, and math 'all around them, in the kitchen, at a fast-food establishment, in the grocery store, and in the garden' (Cloke, Ewing, and Stevens). Nutrition is also addressed for one particular group using edible hands-on materials (Duffrin, Cuson, and Phillips).

Knowing hands-on materials are so important in teaching, combining these materials with food can only be very powerful when striving to achieve student interest and achievement!

3. Research Variables

The variable within my focus is the type of math hands-on material used. The materials will be edible or non-edible. I will operationally define hands-on materials as the use of teaching aids beyond a published math book or workbook in which each individual student may explore to aid in the comprehension and practice of concepts being taught.

Student information

The study was conducted in my own classroom of 22 students. My classroom is organized into 4 groups of either 5 or 6 students. The groups sit at tables with chairs versus traditional desks and are organized as best as possible into equal number of girls, boys, ability levels, ESOL students, and ESE students (with some attention detailed to a few behavior issues). 22 students were tested in the first two units and only 21 in last two units.

ESE

1 Male- Caucasian
1 Male- African American
1 Male- Asian

ESOL

1 Girl- Hispanic
2 Boys- Hispanic
1 Boy- Asian
1 Boy- Caucasian

Regular Education

1 Boy- Hispanic
1 Boy- Caucasian
6 Girls- Caucasian
5 Girls- African
American
1 Girl- Asian

*one African American girl transferred to another school before the last two units were completed.

4. Research Questions

1. Does the use of hands-on edible math materials during the introduction of mathematical concepts increase student achievement on unit assessments?

2. How do students view the use of hands-on edible math materials in regard to helping understanding?

5. Research Approach/Description of Innovation

Four units of mathematical concepts: measurement, geometry, probability, and fractions were chosen to implement my plan. Four units were taught to have as much data as possible to compare in the time allotted. Simply teaching two units may not provide as much accurate information as teaching four units. Two units being taught with the use of hands-on edible math materials and two units with non-edible hands-on math materials, will lessen the possible misconception that one unit was simply harder than the other and thus skew any results.

In teaching this innovation, I taught two units together that are somewhat viewed similar in degree of difficulty. Again, this would lessen the likelihood of skewed results based upon one unit simply being more difficult than the comparison unit.

Each unit will be taught with some kind of hands-on material; the variable is the type of material used. Materials were not be used in every lesson; just during the introduction and beginning practice for each new concept. Each student had equal access to the materials provided.

After each unit was completed, students were given a simple sheet with a smiley face and sad face in which to record the students' thoughts concerning the unit of study. This type of feedback was chosen for the students to be able to freely respond about either the method of teaching, the actual teaching itself or any other reactions.

6. Negotiations and Permissions Secured

My study did not directly require any administrative involvement other than general knowledge and some resource funds. A parent letter was sent home outlining the general study and what is involved.

7. Timeline

Jan. 18 through Jan. 28- Completion of unit one (Measurement- with edible materials)

- Standards: MA.B. 3.2.1, MA.B.4.2.2 (Sunshine State Standards)
3.1-3.5 (Performance Standards)
- Used with *From Paces to Feet* (Math Investigations)

Jan. 31 through Feb. 11- Completion of unit two (Probability- without the use of edible materials)

- Standards: MA.E. 2.2.1, MA.E. 2.2.2 (Sunshine State Standards)

Feb. 14 through Feb. 25- Completion of unit three (Geometry <including volume> with the use of edible materials)

- Standards: MA.C. 1.2.1 (Sunshine State Standards)
9.1, 9.2 (Performance Standards)
- Used with *Exploring Boxed and Solids* (Math Investigations)-

March 7 through 11- FCAT testing

March 21 through March 25- Spring Break

March 28 through April 8- Completion of unit four (Fractions- without the use of edible materials)

Standards: MA.A.1.2.1, MA.A. 1.2.2, MA.A. 1.2.3, MA.A.1.2.4
8.1, 8.2 (Performance Standards)

April 11 through May 30- Completion of data collection and report

8. Data Collection Plan

4 total units of comparable mathematical topics were taught. One unit was taught with the use of edible hands-on materials and the next unit was taught using materials that were not edible. The last two units were taught in the same manner. Each unit was followed with an assessment that was compared to its opposite unit approach. Various other activities were assessed throughout each unit but not compared for organization reasons and time availability on my behalf.

A student attitude sheet was given to collect reactions from the students and their view on each unit.

9. Data Analysis and Interpretation

After organizing the results of my research, the test medians, modes, and means were all greater when using edible materials. The data was only slightly higher between unit 1 and unit 2 compared to the last units. I can interpret the data to support that edible materials do increase student achievement, although more research could be conducted to continue to compare data.

Other significant data was that the ranges of test scores were greater when using materials that were not edible. I would have to conduct more research to try and explain this data. (see spreadsheet and graphs)

After reading the student's reactions to the lessons, many were interested by the food and stated that they understood better because of the use edibles. Others mentioned liking the group work involved during the explorations while others even specifically mentioned topics they enjoyed and understood. No student actually stated that they preferred edible materials to non-edible materials but the reactions to the edibles were more pronounced. It is obvious that motivation is highest when using edible materials. (see examples provided)

10. Action Plan

Action Research has become a constant in my thought process throughout my daily teachings. Most teachers conduct informal Action Research without even knowing. I know that food is a great motivator and even seems to increase achievement and therefore I know I will use it more consistently. One student even mentioned that we should have food in other subjects- one of my next projects waiting to happen!

An additional project topic also emerged as I walked around to monitor my students during the NRT, which was given March. I noticed the test pictures were in color and it caught the attention of my students as well. The previous FCAT assessment was simply in black and white and the students noticed! Could the use of colored assessments increase student achievement? (Especially on high stakes assessments!) Another Action Research in the waiting!

11. Reaction to Action Research

Using the edible materials captured the attention of my students and sparked their interest. The average test scores were even slightly greater. However, other questions still remain. I originally had planned to look at daily class assessments and compare the scores but the maintenance within the time constraints was too much for me. With additional organizational help I would like to know if the daily class assessment scores were also greater.

As previously mentioned, I would like to know the same question originally researched within other subjects such as science. In an extension of this project I would like to develop a better questionnaire to study the student's opinion on the distraction variable when using edible materials. Originally, I had intentions to study the 'on task' behavior differences when using edible materials versus other hands-on materials but it needs to be redeveloped for manageability.

12. Networking Reaction

Being a part of the MURMSI project was beneficial for many reasons. Besides causing addiction to the idea of Action Research, I learned how to 'blog' and what it is all about, conversed with professionals and other colleagues concerning my project, as well as attended informative meetings in which questions were answered and ideas shared. I couldn't imagine trying to enter into such an undertaking without a 'cohort' in which to lean on. I would be skeptical of becoming involved with any other further Action Research project without the same supportive approach.

13. References

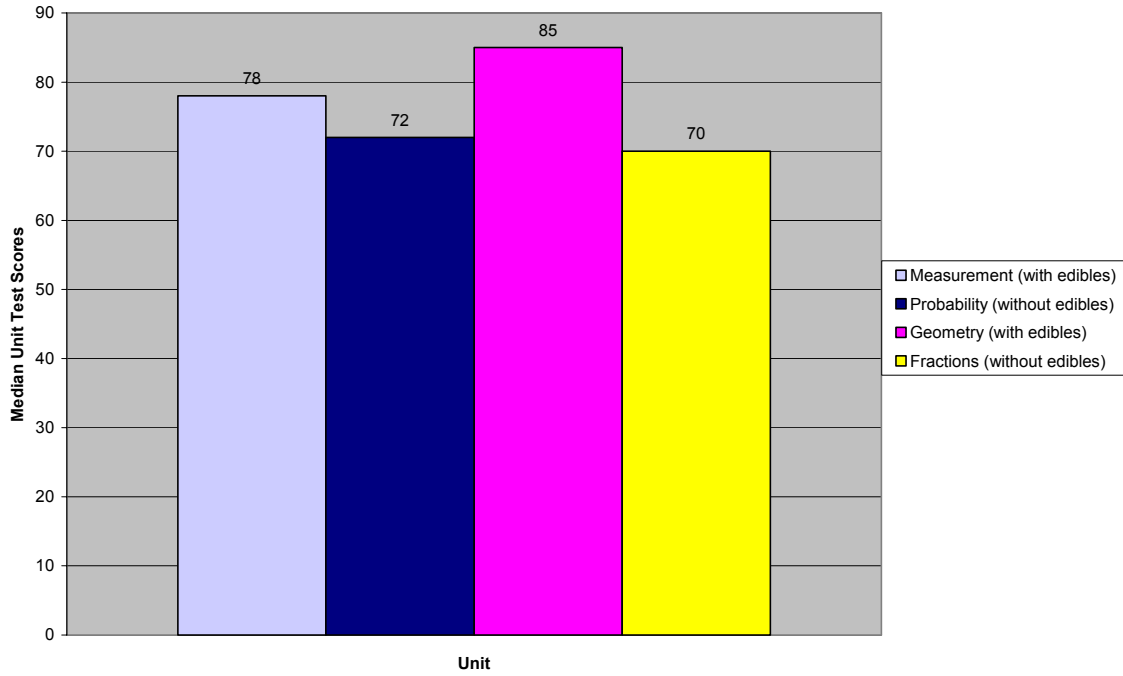
- Cloke, G., Ewing, N., and Stevens, D. (2001) Food for Thought. *Teaching Children Mathematics*, 8(2),148-150.
- DeGeorge, B. and Santoro, A., (2004). Manipulatives: A Hands-on Approach to Math. *Principal*, 84(2), 28.
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14. Special Thanks

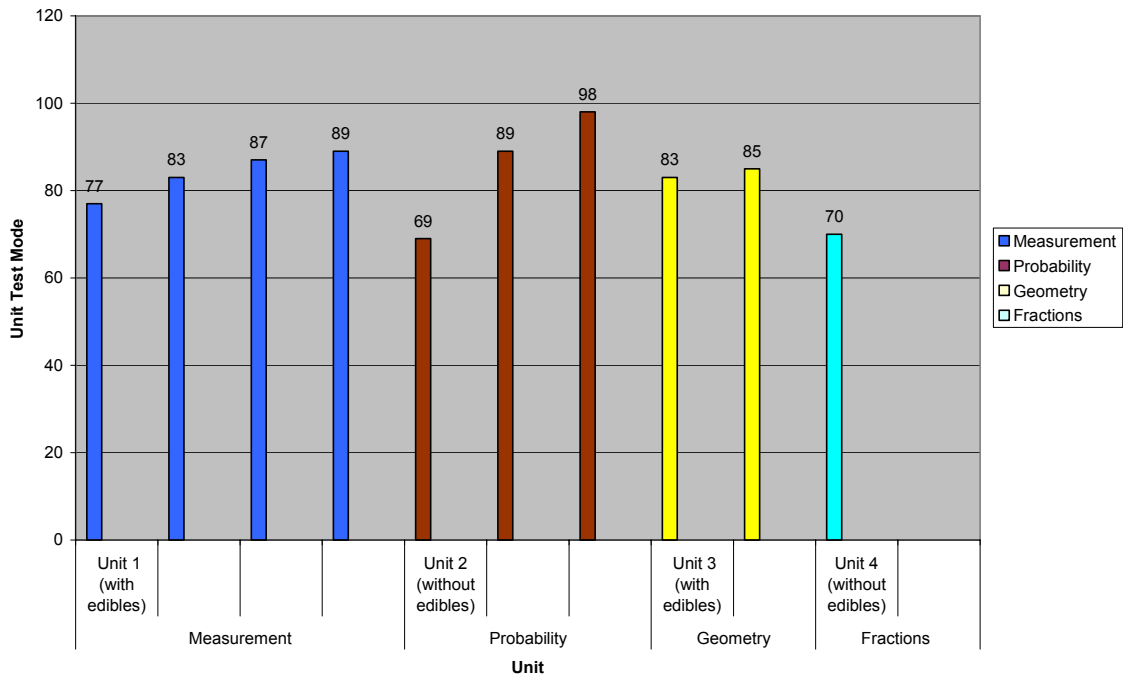
- To all of the MURMSI professionals who aided in this process
- To Karen Thiess and her expertise in technology
- To Barbie Chenault and her listening ear, willingness to attack some of the same idea in her own classroom, and help with unit construction

Graphs and Data

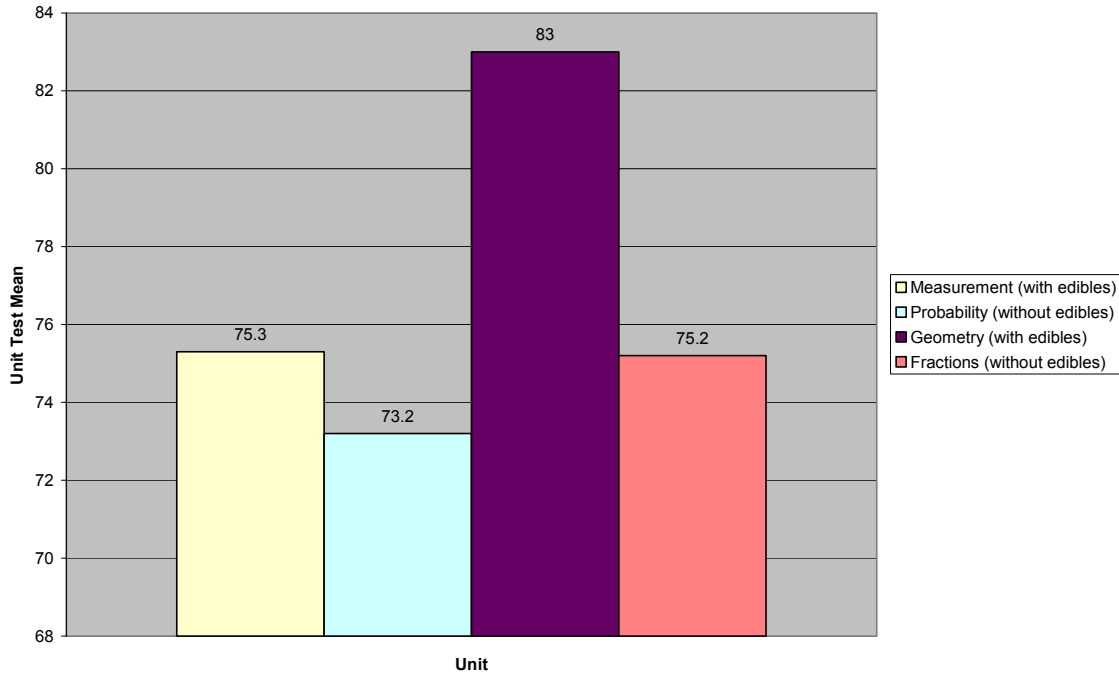
Edible Materials Median



Edible Material Unit Mode



Edible Material Unit Test Mean



Edible Materials Action Research Results

Measurement		Probability		Geometry		Fractions	
Unit 1 (with edibles)		Unit 2 (without edibles)		Unit 3 (with edibles)		Unit 4 (without edibles)	
Unit Test Median	78	Unit Test Median	72	Unit Test Median	85	Unit Test Median	70
Unit Test Mode	77, 83, 87, 89	Unit Test Mode	69, 89, 98	Unit Test Mode	83, 85	Unit Test Mode	70
Unit Test Mean	75.3	Unit Test Mean	73.2	Unit Test Mean	83	Unit Test Mean	75.2
Unit Test Range	42	Unit Test Range	56	Unit Test Range	34	Unit Test Range	70
# of students tested	22	# of students tested	22	# of students tested	21	# of students tested	21

Edible Materials Action Research Results

Unit	Test	Mode
Unit 1 (with edibles) Measurement	77	83
	87	89
	69	89
	98	83
Unit 2 (without edibles) Probability	85	70
Unit 3 (with edibles) Geometry		
Unit 4 (without edibles) Fractions		