Using VoiceThread for Communication in Mathematics Writing

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Abstract

This action research study was conducted on a fourth grade rural classroom in Orange County, N.Y. for the purpose of determining if the use of the VoiceThread program will affect student performance in mathematics writing. A baseline of student performance on this measure was administered in the fall of 2010 using the NYS Holistic rubric of a 3 point total value as provided from the NYS 2009 4th grade Math Test. Four questions on varying topics were pulled from the same test as the rubric mentioned here. In addition, a graphic organizer was utilized to support organization of student thoughts on the problem. A survey was administered to the students at the end of this study which demonstrated positive attitudes towards the use of graphic organizers and the VoiceThread Program to communicate in math. Other results of the data provide positive results with an increase in student performance. Implications from this study's results should lead educators to try VoiceThread as a way to increase communication in mathematics and also to increase 21st century skills in their own classrooms. Recommendations for further studies in this area include; making the sample size larger, paying more attention to the type of question the participants work on and having the parties conducting the study someone different than the teacher of the participants.

Using VoiceThread for Communication in Mathematics Writing

Introduction

The Technology Mission Statement of a School District in Orange County New York states that all graduates will be prepared to meet challenges of a changing and diverse world. Learning and applying the rapidly evolving web 2.0 technologies in the classroom is vital in meeting this objective. Applying such technologies for a mathematics classroom is also in line with other educational organization's standards. The National Council of Teachers of Mathematics standards clearly state that for grades three to five it is appropriate for students to engage in problem solving activities utilizing representation strategies towards that end (NCTM, 2006). An in-depth look at the available research today supports the idea that utilizing Web 2.0 technology such as VoiceThread to prepare students for their future and to help them achieve successfully in math problem solving follows.

Importance of the Role of Communication in Math

As stated above, the role of communication in math is so important that it is included in national standards. The National Council of Teachers of Mathematics publishes a document entitled "The Principles and Standards for School Mathematics," which lists communication and collaboration as an essential tool for mathematics students at all levels, particularly young learners (Ponce & Garrison, 2005). It stands to reason such an idea came forth due to research on this topic.

Some recent research accounts for the importance of communicating in math. The value of writing in mathematics is that it enables learners to make sense of their world. It allows learners to make their mathematical thinking visible (Whitin, 2000). Staats and Bateen (2009) explore secondary students' ability to write a meaningful statement about the

context of the topic and the related math within an essay. The results portray that this activity will sharpen their quantitative skills and their ability to express the relevance of mathematics in the world. When students are able to relate mathematics to the world they live in it is powerful. Ping Xin, Jitendra and Deatline-Buchman (2005) backed up this idea whey they looked at the effects of mathematical word problem instruction in their study. They found middle school students with learning problems that utilized schema-based instruction which is a learned conceptual understanding of problem structure and this facilitated higher-order thinking and problem solving skills.

The role of communication in math has been documented in various studies that provide strategies to use with students. One such study found a direct link between a student's ability to rephrase mathematical concepts in his or her own original words and the student's performance on a traditional, paper-and-pencil test covering the same concepts (Nickerson, 2002). To be able to explain one's thoughts in a different way shows knowledge and understanding.

Mathematics Language

Mathematics is a language that can be communicated by talking, drawing and writing text. One of the most concrete examples of mathematics as language is in the reading and solving of story problems or word problems (Whitin, 2000). Previous exploration on word problems found them to be useful if they involve student writing exercises. This would allow students to explore their own ideas and reveal their level of understanding (Countryman, 1992). This is a great benefit to teachers to be able to see where a misunderstanding lies in a student's mathematical thinking. It would stand to reason that hearing a student's ideas would also benefit a teacher in the same effort. Thinking out

loud is a concept that has recently been researched and clarified. Greenhow, Dexter and Riedel (2009) report that thinking out loud has its highest validity when capturing conscious thoughts, which are easily verbalized, as they occur.

Lack of reading comprehension is a known obstacle that blocks mathematical success. If a student does not understand what they are reading in a word problem for example then they cannot solve it. A teacher should read the problem to their students if necessary in a non-test environment. Vocabulary is often an obstacle to students understanding of what is being asked of them. Additionally, teachers can change the mathematics in the problem to match the child's level of understanding. Teachers can then explore what a child has already done, and remind the child to use other strategies if necessary (Jacobs & Ambrose, 2008). Prompting and guiding by a teacher are sometimes necessary to get students to say out loud what they are thinking.

Reading comprehension skills play a crucial role is the success that young math students have when approaching story problems. Deficits in this area can impact students' problem-solving skills, and collaboration is one way to help students lacking in reading comprehension skills. By collaborating with one another on story problems, students have the opportunity to learn from and teach each other using verbalization, illustrations and numeric symbols. This collaboration can not only enhance the problem-solving strategies of young learners, but help to foster greater mathematical literacy and reading comprehension.

Graphic Organizers

Utilizing graphic organizers as a strategy to help solve word problems encourages communication and clear modeling of one's thinking mathematically. The graphic organizer intended for use is in this study is from Alan Zollman and it is a revised template from the Frayer Model. This particular graphic organizer has four compartments that include: what the student already knows, what they need to find out, a place to do computations and finally a section to explain how the solution was obtained. Initial thinking about a word problem is not as linear as the graphic organizer itself meaning that the students should and will fill in the pieces to the organizer as they think of them. (Zollman, 2009) Graphic organizers therefore help students remain organized even if their thinking is non-linear. It is also helpful to the teacher assessing conceptual mastery.

Graphic organizers help visual learners plot out steps, and promotes critical thinking. They are instructional tools students can use to organize and structure information. Concepts and the relationships between concepts are highlighted in this format (Zollman, 2009). Englard creates the argument to use graphic organizers in math too. She states in the absence of a visual model that focuses on the relationships between the quantities, the words in the problem may confuse the solution strategy (Englard, 2010). Tools and strategies that alleviate confusion will help all types of learners.

It is also noteworthy to mention that the type of learner that a student is can be a factor in student success. A category of high interest referred to the ability to be able to explain yourself to others. It is a process that not only assesses one's understanding but may also play a part in creating understanding. Students labeled as "explainers" were more likely

to spend time in class discussing mathematics with their peers (Goos, 1995). Not all students are equal in their verbal abilities and this should be a consideration.

The Role of Technology in Mathematics

The role of technology in a mathematics class has also been documented in various educational journals. Maloy, Edwards and Anderson (2010) found that the online and in-person activities used in two of the schools in their studies showed evidence of supporting the development of a problem solving mindset among 4th grade students. The program called 4MALITY provided a bi-level approach for supporting students in math word problems. If the students wanted hints they could easily click on the virtual tutors. Otherwise they solved the problems independently. Some of the in-person activities included the creation of word problems that incorporated familiar topics such as pets, food, music and shopping. This relates back to earlier studies mentioned that discuss the importance of students relating mathematics to their world.

Bates and Weist (2004) investigate math word problems further based upon individualization of word problems and the type of questions put forth to students. Their discussion includes a way to include the Internet as a way to individualize materials simultaneously to a larger group. Their idea is to:

> Develop a web site that allows students to complete an interest inventory online and then submit the inventory to the server. The server would then apply that information to an existing word problem template document, updating the characters and other referents to individualize the problems for each student.

Professional Development- Teaching Mathematics with Technology

Professional development in the teaching of mathematics with technology has also been documented in studies. Bennison and Goos (2010) acknowledge the need for teachers to engage in continuing professional development. They state that although they have not investigated the nature and direction of the links between professional development, changes in a teacher's classroom practices, and changes in attitudes and beliefs, it is clear that participation in professional development plays a crucial role in whether and how technology is used in mathematics classrooms. Without proper professional development teachers may wind up misguided even in the best of their efforts. Riccomini's (2005) recent study on systematic errors in subtraction found that many teachers attribute errors to inattention rather than misconceptions. The teachers were found not to apply the deficit area to their instruction but rather they returned back to basic subtraction facts as a focus. He suggests professional development on applying the correct instruction.

Goos, Galbreith, Renshaw and Geiger (2001) echo the sentiment about professional development for teachers implementing technology in a math classroom. They argue that the most significant challenge to teachers lies in orchestrating collaborative inquiry so that control of the technology and the mathematical argumentation it supports is shared with students.

Another research focus on math and technology in the classroom is how it promotes collaboration. Eskrootchi, R., and Oskrochi's (2010) study suggests that students learn best by actively constructing knowledge from a combination of experience, interpretation and structured interactions with peers when using simulation in a Problem Based Learning setting. They also suggest that simulations do not work on their own, but that there needs to

be some structuring of the students' interactions with the simulation to increase effectiveness.

VoiceThread

A VoiceThread is a multimedia program where one is able to hear and see the information. VoiceThread is a web 2.0 tool that accepts various digital formats such as .wav, .jpg .ppt and more. This online tool allows a community of interested learners to share thoughts and opinions by talking or writing through these mediums. Enabling audio and visuals to share information when learning is helpful not only for students but it also helps in professional development for teachers. Jacobs, Ambrose, Clement and Brown (2006) suggest that:

> When teachers produce and share video clips, they have opportunities to (a) see other teachers at work, (b) pose and discuss hypotheses about children's mathematical thinking (c) identify instructional strategies that build on how children think about mathematics and (d) both support and act as critical friends to other teachers.

Audio can provide a record of discussing math and the pictures provides a representation of numbers and concepts in a visual form. The multimedia approach opens up the possibility of reaching more diverse student populations and learning preferences through the combined use of audio and visual communications. The audio dialogue increases the number of perspectives offered and can contribute to the students overall knowledge base. (Holland, 2010)

Online classes in higher education are starting to use web 2.0 tools such as VoiceThread to supplement communication activities that start in BlackBoard, Moodle or Sakai. Michelle Pacansky Brock, winner of the 2010 Sloan C Best Practices Award,

surveyed her online Art History class on their feelings about using Voicethread. The responses of 80% of her 101 students showed they enjoyed using VoiceThread as a supplemental communication tool in the online class delivered through Blackboard since it increased a sense of community. 88% believed that a VoiceThread helped them to understand a visual concept better (Brock, 2010). The other results from her survey highlight student approval of improved online learning experiences.

VoiceThread has a few advantages in asynchronous learning according to John Orlando (2010). Student driven discussions and a growing lecture for future classes to build upon for the instructor. Social presence improves and there is also better understanding of nuance or tone of voice as compared to text. Plus, there is a new way to create a student project.

Using a VoiceThread will also make conversations permanent and allow students to review their thinking and their peer's thinking on a particular math concept as many times as they want or need to. The constraints of time and place are not an issue with VoiceThread. Anyone—including homebound students—can add comments to a developing VoiceThread conversation at any time as long as they have a connection to the Internet (Ferriter, 2009).

Methodology

Design

The data collected for this action research study took place in the spring of 2011 through mixed methodology approach. The sample consisted of 21 fourth grade students of mixed ability in a rural Orange County, NY classroom. Nine boys and 12 girls were included in this group. Qualitative results were gathered from the anonymous survey created

and distributed using Google forms. Quantitative data was gathered from grades the students received on the NYS Fourth Grade Math Rubric.

Word Problems from the 2009 NYS 4th Grade Math test were chosen as the questions the students would be working on for this study. These specific questions were selected after analyzing the results of this exam from Data Mentor. Data Mentor is a web-based assessment tool utilized by K-12 educational institutions within New York State to identify strengths and weaknesses in their instructional programs. The results showed that the district was out-performed by the region on these questions. Table 1 shows the exact performance indicators; standards met and gap measures for each particular question.

Procedure

The pictograph problem was administered first. Students had to work out the problem on a graphic organizer which was then uploaded to VoiceThread. The students then had to comment on their own work and also on their fellow students' work. The instructor made comments on all students' work whether to reinforce a correct answer or to direct another student to view the correct answer on another student's slide of their graphic organizer. The other question topics covered money, number patterns and the associative property of multiplication and were administered in a similar fashion.

After the completion of the fourth question the students were directed to take the survey about their feelings on using VoiceThread to solve mathematical word problems. The survey was created with the Forms tool from Google Docs and the six questions included both open ended and closed type questions.

Previously a baseline grade for word problems without the use of graphic organizers and the use of Voicethread was recorded. An analysis comparing the grades on the graphic organizers, VoiceThread responses and the pre-study question follows in the results section of this paper.

Findings

This action research study, conducted in a fourth grade classroom in Orange County New York, sought to find out if utilizing the VoiceThread Program for communicating solutions of fourth grade math word problems would in fact improve student performance. Out of 26 students, 21 students participated in the study by completing four short answer math problems on various topics. A graphic organizer assisted the students in organizing their thoughts as they recorded their responses on voice thread.

The questions that the students worked on were based on data collected from Data Mentor on the 2009 NYS Fourth Grade Math Exam. A variety of topics were chosen based on the criteria of having a substantial performance gap between the district and the region played a role. Table 1 demonstrates the specific performance gap of each question.

Grades

The three point rubric used on the New York State Fourth Grade Math exam was used in grading the students work completed during this study. A score of three from this rubric warranted a response which is complete and correct. A score of two meant the student response was partially correct while a score of one meant the answer was incorrect and incomplete. Finally, a score of zero on this rubric meant the student response was incorrect, incomplete or it could have possibly been correct but the student obtained a solution using a

wrong method. The actual rubric and graphic organizer are included in the appendix for further examination.

Table 1
Gap Scores between District and Region on Questions from NYS 2009 Fourth Grade Math Exam

Question Content	Performance Indicator	NYS Standard	Gap Scores between District and Region
Pictograph	4.S.3 Represent data using tables, bar graphs, and pictographs	Statistics and Probability	-8
Number Patterns	4.A.4 Describe, extend, and make generalizations about numeric (+, -, x, ÷) and geometric pattern	Algebra	-6
Money	4.M.8 Make change, using combined coins and dollar amounts	Measurement	-6
Associative Property of Multiplication	4.N.6 Understand, use, and explain the associative property of multiplication	Number Sense and Operation	-7

The grades the participants obtained based on this rubric were recorded for all questions involved in the study and in fact were the grades the student obtained for their class work grade. First, the average grades from all questions including the baseline word problem given to students in the fall of 2010 were calculated. Figure 1 shows an increase in average score over the course of all four questions in the study. Although there is a drop on the pictograph question in average score that was the first question that was implemented in this study. It is also important to note that it has the largest performance gap of a negative eight as compared to the other questions. This means that this type of question is challenging to this population in general.

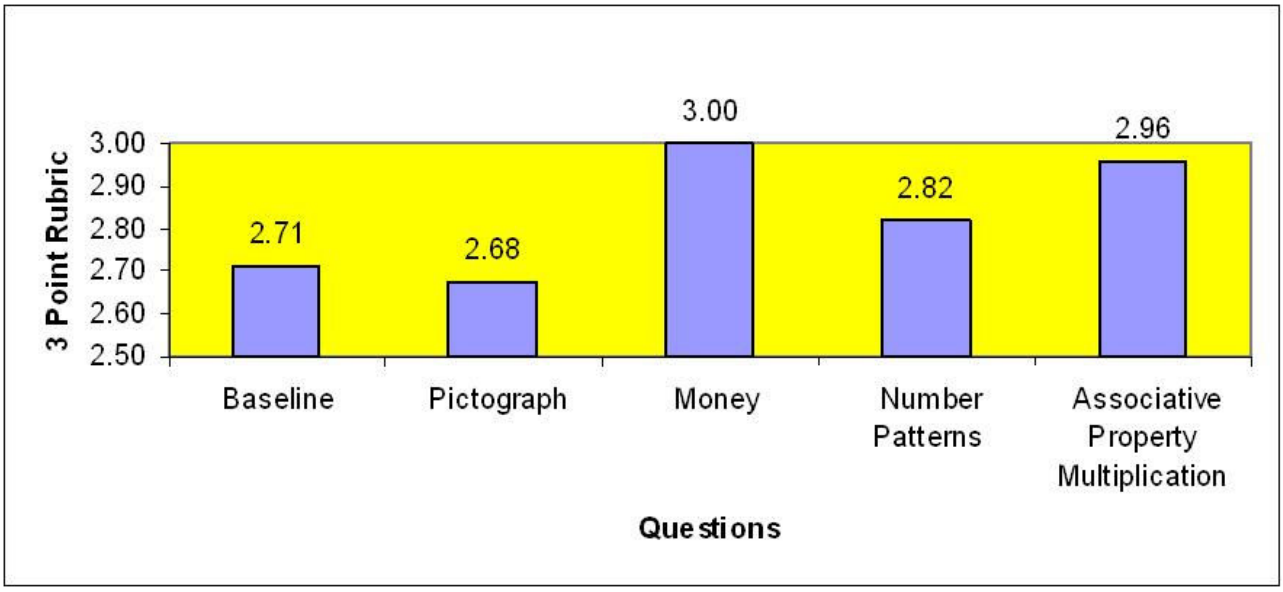

Figure1. Average Rubric Score- NYS Fourth Grade Math Exam 2009

The mode for the grade on each question is demonstrated in Table 2.and it provides the count at which the mode was obtained. The mode was a grade of 3 in all four questions but it is important to note that the count increases from the baseline count of 12 every time on each question. The number pattern question has the lowest increase at a count of 16 students receiving a grade 3. This correlates with the data mentioned previously collected from Data Mentor in that the data showed the performance gap between the district and the region was the greatest on this question. This means that this particular topic is generally more difficult for this population.

Table 2
Mode of Grade Scores for Questions in Study

Question	Mode
Baseline Question	Score of 3 is the mode with a count of 12
Pictograph Question	Score of 3 is the mode with a count of 17
Money Question	Score of 3 is the mode with a count of 19
Number Pattern Question	Score of 3 is the mode with a count of 16
Associative Property Of Multiplication Question	Score of 3 is the mode with a count of 20

Survey

The survey responses showed that of all the 21 participants most of them enjoyed using the VoiceThread program overall with twenty responses as yes and only one no. When prompted to explain why they enjoyed it thirteen responded that it was fun, four found it interesting and two found it challenging in a good way. Two students had no response on this particular question. No student involved in the study responded that they did not like the VoiceThread program.

In response to the question: "How did listening to other student's responses help you?" thirteen responded that it helped them understand and confirmed that they were correct. Eight students did not originally understand the question but listening to another's response clarified what was being asked of them. One student responded that they did not listen to another response at all.

A majority of the students at a count of 20 concluded that they would use the VoiceThread program again for a math word problem. One respondent said they would not use it again. In regards to the last question in the survey on the use of the graphic organizer,

17 students said they thought it helped them to organize their thoughts while four students said it confused them.

The findings from the survey overall demonstrate positive results from this action research study. Listening to other's audio response and communicating their own thoughts on math word problems was an experience that the students wanted to do again if given the chance. The participants also liked utilizing the graphic organizer to plot out their mathematical thinking overall.

Summary and Conclusions

Summary and Implications

This action research study sought to find out if using the VoiceThread program to communicate answers on math word problems would in fact benefit students and increase their performance in this area. The findings on these fourth grade students in a rural school district in Orange County New York show an increase in average grades amongst participants and the survey results show a positive attitude towards using the program and in using the graphic organizer too.

As a result of these positive findings there are important implications for educators to note. The increase in grades for students' communication in mathematics is motivating and should warrant enough curiosity to try VoiceThread out in other classrooms and in other subjects as well. The positive responses on the survey about using VoiceThread imply that if one were to use this program in their own classroom their students would also enjoy using it. More importantly though, are the vital skills gained by utilizing web 2.0 technologies such as VoiceThread for students and teachers alike that provide new ways for communication in math.

Limitations and Recommendations

Upon reflection at the conclusion of this study, the first limitation is the small sample size which limits the results. Secondly, the study only brings forth the point of view of the students and not that of the teacher. It is highly recommended therefore that future research on this topic be further explored through longitudinal studies and that a larger sample size is obtained for both the quantitative and qualitative data collection. A different perspective that collects qualitative data on an educator's point of view on VoiceThread is also recommended.

The topics of the questions the participants worked on vary and one could actually find individual students that may have decreased their grade to a 2.5 on the number pattern question. Further analysis may conclude that fourth grade students score lower on this topic on the whole. However, it is beyond the time limits of this research to fully explore this factor and therefore it is recommended to have further research conducted that looks into the skill required to answer a particular type of question.

Another limiting factor is that the conductor of the study is also the classroom teacher of the participants of the study. The decision to participate could have been influenced by this factor either way. Students may have felt obligated to participate for example. On the other hand students that opted out could have done so because of their overall feelings about math. A final recommendation is to conduct a pre-survey that determines student's feelings on technology, the use of VoiceThread and why they are in fact participating.

In conclusion, this study determined that fourth grade students utilizing VoiceThread to communicate their responses to mathematical word problems is motivating and increases

the student's skills in this area. Utilizing VoiceThread to increase the mathematical language of one student, in a community of learners that VoiceThread easily provides, will allow for more efficient communication in mathematics.

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Appendix:

This Holistic Rubric was created by:
New York State Education Department
Math Grade 3 - 8 2010 3 Point Rubric

SCORE
CRITERIA
3 points
A three-point response is complete and correct.

This response demonstrates a thorough understanding of the mathematical concepts and/or procedures embodied in the task indicates that the student has completed the task correctly, using mathematically sound procedures contains clear, complete explanations and/or adequate work when required.

2 points
A two-point response is partially correct.

This response demonstrates partial understanding of the mathematical concepts and/or procedures embodied in the task addresses most aspects of the task, using mathematically sound procedures may contain an incorrect solution but provides complete procedures, reasoning, and/or explanations may reflect some misunderstanding of the underlying mathematical concepts and/or procedures.

1 point
A one-point response is incomplete and exhibits many flaws but is not completely incorrect.

This response demonstrates only a limited understanding of the mathematical concepts and/or procedures embodied in the task may address some elements of the task correctly but reaches an inadequate solution and/or provides reasoning that is faulty or incomplete exhibits multiple flaws related to a misunderstanding of important aspects of the task, misuse of mathematical procedures, or faulty mathematical reasoning reflects a lack of essential understanding of the underlying mathematical concepts may contain a correct numerical answer but required work is not provided.

0 points

A zero-point response is incorrect, irrelevant, incoherent, or contains a correct response. arrived at using an obviously incorrect procedure. Although some parts may contain correct mathematical procedures, holistically they are not sufficient to demonstrate even a limited understanding of the mathematical concepts embodied in the task.

This Survey will be conducted online through Google Docs. This format here is for convenience to view questions.

Answer questions 1 through 6 by checking all that apply to your feelings on using VoiceThread. Use other if your explanation is different.

1. Did you enjoy using a VoiceThread for math class?
☐ Yes (answer #2 next) or ☐ No (answer #3 next)

2. If yes, why did you enjoy creating a VoiceThread for math class? Check all that apply.
☐ It was fun using the VoiceThread technology.
☐ It was interesting to hear other students' solutions.
☐ It was challenging to use VoiceThread but I like a challenge
☐ Other - Please explain _____
_____

3. If no, why didn't you enjoy creating a VoiceThread for math class? Check all that apply.
☐ It was confusing to use VoiceThread
☐ I do not care about other student's ideas on solving math equations.
☐ Other - Please explain _____
_____

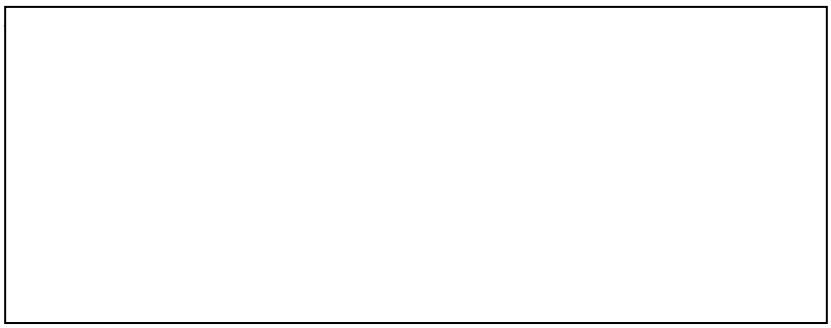
4. How did other student explanations help you understand the math problem better? Check only one answer
☐ I understood what they meant and it confirmed that I was right
☐ I did not originally understand the solution and their answer helped me
☐ Other - Please explain _____
_____

5. Will you use VoiceThread in the future for a math project?

☐ Yes, I will use VoiceThread again for a math project.
☐ No, I do no think that I will use VoiceThread again for a math project.

6. Did you think that using the graphic organizer method on paper first was helpful to you in trying to explain how to solve a math problem? Check only one answer.

☐ It was confusing to use the graphic organizer
☐ The graphic organizer helped to organize my thoughts
☐ Other- Please explain _____
_____



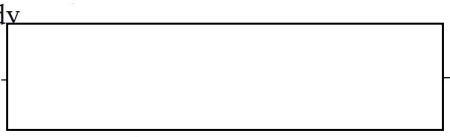
As I near completion of my Master's program in Instructional Technology at the New York Institute of Technology, there still remains the matter of a thesis. The name of the research will be Communication in Math. To provide the necessary information to write my thesis concerning communication in math a technology called VoiceThread will be utilized with the fourth grade students in room 304. The importance of this study is to determine if the use of this technology does or does not increase the level of their communication in math. The holistic rubric attached is the same as the one implemented on the NYS Fourth Grade Math Exam. Also attached is the survey on the use of VoiceThread that will be given to the students.

The participants will remain completely anonymous and all results will exclude names, thus making the research confidential. A consent form will be sent home to parents and also an assent form provided to students. No students will be coerced in the implementation of this study. Also, the safety of the students working online in the VoiceThread program will be monitored and set up to provide privacy of student identities. I assure you that this study will not interfere with regular student schedule, their learning of curriculum or even my responsibilities of teaching. Please review consent form to parents and assent form to students at your nearest convenience.

Thank you for your consideration,

Patricia McKane

☒ I approve this study

Principal's Signature 

Dear Parents and Guardians,

As I near completion of my Master's program in Instructional Technology at the New York Institute of Technology, there still remains the matter of a thesis. The name of the research will be Using VoiceThread for Communication in Mathematics Writing. To provide the necessary information to write my thesis concerning communication in math a technology called VoiceThread will be utilized with the fourth grade students in room 304. The importance of this study is to determine if the use of this technology does or does not increase the level of their communication in math. The holistic rubric to be used is the same as the one implemented on the NYS Fourth Grade Math Exam. Also, a survey on the use of VoiceThread will be given to the students.

The participants will remain completely anonymous and all results will exclude names, thus making the research confidential. The safety of the students working online in the VoiceThread program will be monitored and set up to provide privacy of student identities. I assure you that this study will not interfere with regular student schedule and it is inline with the learning of NYS curriculum. Please sign this consent form below and return by the deadline. Also have your student sign the assent form if you are providing consent. If you have questions, concerns or would like to discuss the matter further, please feel free to contact me via email. I appreciate your cooperation in this matter.

Sincerely,

Patricia McKane, Fourth Grade Teacher

I give_____permission for my child to be a participant in this study.

Parent/Guardian Signature _____Date_____

If you want to be in this research study you will be asked to write your name on this form. You **do not** have to be in this study. If you do not want to be in this study, then that is OK, too.

Introduction
You are being asked to be in a research study in which you will utilize VoiceThread to communicate your answers to four math problems.

Purpose
The purpose of this study is to learn more about if using VoiceThread technology will benefit students' communication in math.

Description of Procedures
If you decide to be in the study, you will be asked to use an online program VoiceThread to answer word problems in mathematics. The use of a graphic organizer will be used to support your thinking. You will also be asked to answer a survey on the use of VoiceThread.

Benefits
This study is not expected to help you, but what is learned from the study may help other people.

Confidentiality
Anything we learn about the people in the study will be kept as secret as possible. Your full names are not used in the work online nor will it be used in the research paper. Data collected is under a password protected file on the school's computer.

Voluntary Participation
You do not have to be in this research study. No one will be mad at you if you don't do this or if you decide to quit. If you do not like being in the study, you can quit at any time. You still have to complete your regular schoolwork however. Before signing this form make sure that all your questions about this research study have been answered.

Signature

I understand what Ms. McKane has told me and I want to be in this study.

Child's Printed Name: _____

Signature: _____ **Date:** ____/____/____

Parent/Guardian Name: _____

Signature: _____ **Date:** ____/____/____

PI Name: _____

Signature: _____ **Date:** ____/____/____

Questions from the 09-10 NYS Fourth Grade Math Exam

Question: 39 ***Part A***

Megan writes a number pattern. The rule is to subtract 3 from a number to get the next number. Complete Megan's pattern below by writing the missing numbers on the lines.

50, _____,44, _____,38, 35

Part B

Joseph writes the number pattern below.

100, 101, 96, 97, 92, 93, 88, 89, **?**

What is the **next** number in his pattern?

Answer _____

On the lines below, explain how you found the next number in Joseph's number pattern.

_____

_____

_____

Answer
Complete and Correct Response.

Part A

- (50 ,) 47 (, 44 ,) 41 (, 38 , 35)

AND

Part B

- 84

AND

- The pattern is first add 1 to get the next number, and then subtract 5 to get the number after that.

  OR other valid response

Question: 45

Ashley writes the equation below.

(60 x 3) x 4 = 60 x (**?** x 4)

What number should be written on the line to make the equation true?

Answer _____

On the lines below, explain why your number makes the equation true.

_____

_____

Answer
Complete and Correct Response.

- 3

AND

- It does not matter how we group numbers that are multiplied.

  OR other valid response

Question: 38 Sharrline made the pictograph below to show the number of students from different grades who walk to school every day.

STUDENTS WALKING TO SCHOOL

KEY
 = 4 students

Grade	Number of Students
1	
2	
3	
4	

Complete the **table** below to show the number of students in each grade who walk to school every day.

Be sure to

- title the table
- label the first column
- enter all the data

	Number of Students
1	6

How many **fewer** Grade 3 students walk to school than Grade 4 students?

Answer _____ students

Answer
Complete and Correct Response.

- **STUDENTS WALKING TO SCHOOL**

Grade	Number of Students
1	6
2	16
3	12
4	22

OR other valid response

AND

- 10 (students)

Question: 42

Dennis buys an apple to eat after school. He pays for the apple with the money shown below.

Quarter Quarter Quarter

The price of the apple is $0.57. How much money should Dennis get back in change?

Show your work.

Answer $ _____

Answer
Complete and Correct Response.

- 0.75 – 0.57 = 0.18

  OR other valid process

AND

- ($) 0.18

Graphic Organizer #31

Enter text into the fields below.

What I know	What I need to find out
Work	Solution explained

Links to VoiceThread information:

- Overall features of VoiceThread
  http://voicethread.com/about/features/

- My presentation about this project
  http://voicethread.com/share/1564318/

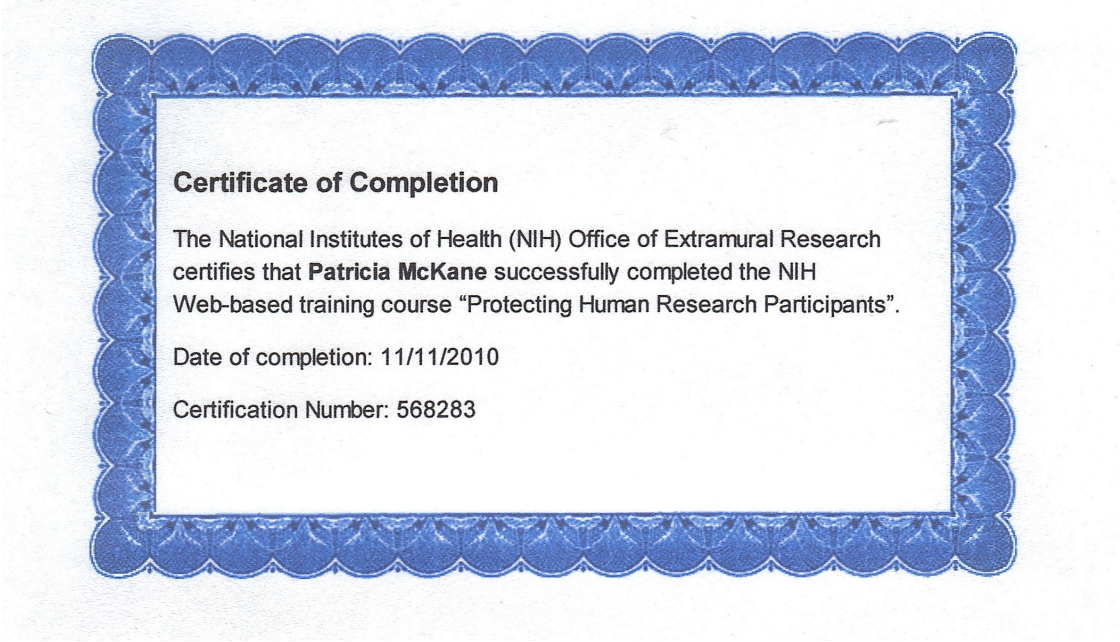
- Pictograph Problem
  http://voicethread.com/share/1641727/

- #42 Money Problem
  http://voicethread.com/share/1688231/

- #39 Number Patterns
  http://voicethread.com/share/1724902/

- #45 Associative Property of Multiplication
  http://voicethread.com/share/1711816/

Copy of NIH Certificate



Certificate of Completion

The National Institutes of Health (NIH) Office of Extramural Research certifies that **Patricia McKane** successfully completed the NIH Web-based training course "Protecting Human Research Participants".

Date of completion: 11/11/2010

Certification Number: 568283