

Robotics as a manipulative in mathematics instruction

Leonard Sheehy

Assessment and Evaluation

Introduction

The prominence of science, technology, engineering and mathematics to the economic future of society and for the progression of mankind is broadly recognized. The need for new teaching methods and types of assessments has been cited by United States Secretary of Education Arne Duncan. In a press release he called the 2011 Trends in International Mathematics and Science Study mathematics test results “unacceptable,” saying that they “underscore the urgency of accelerating achievement in secondary school and the need to close large and persistent achievement gaps” (U.S. Department of Education, 2012). He also cited the fact that scores in mathematics in the eighth grade U.S. students did not progress subsequent to the 2007 results (U.S. Department of Education, 2012). Problems with the reliance on standardized testing have uncovered many issues with the manner in which students are evaluated and started a call for alternative methods of assessment (Ballou, & Springer 2015).

This project proposes to measure the effectiveness of robotics as a motivating mathematics manipulative for teaching addition and subtraction of fractions to seventh grade students. Research conducted by Chin, Hong, & Chen, in 2014 found that motivating factors of attention, relevance, confidence, and satisfaction increased when using an educational robot-based learning system (Chin, Hong, & Chen, 2014). The study proposed here will engage students in a hands on mathematics application in an attempt to determine if robotics can be an effective and encouraging manipulative in mathematics education. The beneficial characteristics could then be used in other forms of learning to increase success rates in science, technology, engineering and mathematics. The Chin, Hong, & Chen study also states that consistent data endorsing the success of educational robots remains inadequate, thereby, further justifying the work conducted in this study (Chin, Hong, & Chen, 2014).

Seventh grade mathematical skills with fractions were chosen because knowledge of these skills is vital for achievement in algebra. Torbeyns, Schneider, Xin, & Siegler, state that fractional magnitude understanding leads to general mathematic achievement (Torbeyns, Schneider, Xin, & Siegler, 2015). This study will apply findings that students should interpret fractions as positions on number lines to have students calculate the distance a robots moves. It will also ask them to what extent the robot engaged them during the activity.

Relevant literature

The use of project based, hands-on learning in education has been popular since the efforts of Seymour Papert increased its popularity. He worked with Piaget in the 1960s where he became involved in the study of the process of thinking and learning using constructivist strategies (Papert, 1980). Children advance personal knowledge of their environment and formulate understanding in constructivism (Martin-Stanley, & Martin-Stanley, 2007). This engages students adapting their knowledge into tangible thoughts and construction of a concept facilitated by technology (Papert & Harel, 1991, Bers, et. al, 2002). The constructionist approach

engages students in a problem or situation to which they can relate. Solutions to the problem necessitates that students propose and organize a resolution, and employ objects (e.g., robots) to test their solutions (Papert, & Harel, 1991). The management and examination of solutions are the foundation for knowledge construction as students acquire understanding (Jonassen & Strobel, 2006).

In an attempt to evaluate the effectiveness of new technology in education Benitti reviewed articles of newly issued works on the use of robotics in schools, in order to:

“ (a) identify the potential contribution of the incorporation of robotics as educational tool in schools, (b) present a synthesis of the available empirical evidence on the educational effectiveness of robotics as an educational tool in schools, and (c) define future research perspectives concerning educational robotics.” (Benitti, 2012).

His evaluation proposed that educational robotics frequently act as a component that improves learning, however, this is not consistent. He found that there are investigations that have shown circumstances in which there were no advances in knowledge, thus leading to the need for more research (Benitti, 2012).

Methodology

The quantitative research approach has been chosen for this study because this endeavor seeks to determine if a specific treatment influences the learning of how to add and subtract positive and negative fractions (Creswell, 2014). To accomplish this, two groups will be established. One group will receive robots as a manipulative to assist in solving word problems and the group other will not. Pretests and posttests will be used to ascertain the amount of understanding and knowledge gained by students during the study.

Twenty to thirty participants will be selected after school district and parental permission has been obtained. The study will use the naturally made groups that are formed by their class schedules. Obtaining a sample from all seventh grade students randomly to include every individual that is enrolled in a seventh grade mathematics class is not feasible because of cost, time and existing school schedule. A quasi-experiment will be employed for this reason.

Creswell states this number will provide sufficient data to reach the level of theoretical saturation (Creswell, 2014).

The research questions for this investigation are:

1. To what extent can robotics be used as an effective manipulative in mathematics education?
2. To what extent can robotics improve seventh grade students understanding of fractions?
3. To what extent does robotics improve student's ability to perform computations on positive and negative fractions?
4. To what extent does robotics improve s student's ability to visualize abstract mathematical concepts?
5. What characteristics of robot based learning systems empower children and improve their perspective on their future?
6. What features of robot based learning change views about self-esteem by increasing their confidence levels?
7. Which robotic education platforms do students prefer when working with different systems to solve science, technology, engineering and mathematics problems?

The activity that participants will be asked to complete involves solving word problems that focus on calculating distance. Two groups of students that have been placed in the same mathematics level by the school district will be asked to calculate solutions to questions that have been created by the regular classroom teacher over a three day period. On the first day a pretest will be administered by the classroom teacher to both groups (see appendix A). The two sets of students will be provided number lines during this examination. On the second day the control group will receive traditional instruction that is normally provided by the classroom teacher, a number line and word problems only. The treatment group will receive a robot challenge from the classroom teacher, a number line and the same word problems, however these students will write software that controls the robot to perform the tasks outlined in the word problems. The

robot challenge will use the VEX robotic platform because the software allows students to code distance without having to convert these figures from the number of degrees the motor turns as is the case with other educational robotic platforms. The teacher, having completed training in how to write software will provide individual students with a robot and laptop in order to perform the tasks outlined in the challenge (see appendix B). On the third day both groups will be provided with number lines and the same posttest that has been prepared by the regular classroom teacher (see appendix C). At the conclusion of the activity students that used the robots as a manipulative will complete a survey that asks them questions about their experience with the robots. Creswell states that this is the most efficient method (Creswell, 2014). For this data collection an electronic survey instrument, Qualtrics, will be used due to its wide acceptance in the industry (Appendix D). The survey content is adapted from a study conducted by Carnahan (2014).

In order to consider potential issues, the following items are addressed. The passing of time in this experiment is short to reduce any undue influence on the outcome beyond the experimental treatment, mortality or maturation (Creswell, 2014). Any participant with extreme scores will be eliminated to decrease the chance of regression (Creswell, 2014). Diffusion of treatment will be removed due to the fact that the robot activity will take place for only one day (Creswell, 2014). Due to the nature of seventh grade students the robot activity will be offered to the control group upon completion of the experiment so that resentful demoralization and compensatory rivalry is abolished (Creswell, 2014). In order to address issues due to testing and instrumentation the pretest and posttest numbers have been changed with the basic structure of the examination remains intact (Creswell, 2014).

Appendix A

Pretest

Name: _____

Section: _____

Date: _____

Please write the correct response in the space provided.

1. When a robot travels $\frac{1}{6}$ of a meter then $\frac{3}{6}$ of a meter, how many total meters has it moved? _____

2. When a robot travels $\frac{2}{3}$ of a meter then $\frac{3}{8}$ of a meter, how many total meters has it moved? _____

3. When a robot travels $\frac{5}{8}$ of a meter then backwards $\frac{1}{5}$ of a meter, how many total meters has it moved? _____

4. When a robot travels $\frac{8}{10}$ of a meter then backwards $\frac{3}{6}$ of a meter, how many total meters has it moved? _____

Appendix B

Robot Challenge

Name: _____

Section: _____

Date: _____

Please write the correct response in the space provided.

1. Program your robot to travel $\frac{1}{6}$ of a meter then $\frac{3}{6}$ of a meter. How many total meters has it moved? _____

2. Program your robot to travel $\frac{2}{3}$ of a meter then $\frac{3}{8}$ of a meter. How many total meters has it moved? _____

3. Program your robot to travel $\frac{5}{8}$ of a meter then backwards $\frac{1}{5}$ of a meter. How many total meters has it moved? _____

4. Program your robot to travel $\frac{8}{10}$ of a meter then backwards $\frac{3}{6}$ of a meter. How many total meters has it moved? _____

Appendix C

Posttest

Name: _____

Section: _____

Date: _____

Please write the correct response in the space provided.

1. When a robot travels $\frac{5}{6}$ of a meter then $\frac{4}{6}$ of a meter, how many total meters has it moved? _____

2. When a robot travels $\frac{1}{3}$ of a meter then $\frac{4}{8}$ of a meter, how many total meters has it moved? _____

3. When a robot travels $\frac{2}{8}$ of a meter then backwards $\frac{3}{5}$ of a meter, how many total meters has it moved? _____

4. When a robot travels $\frac{7}{10}$ of a meter then backwards $\frac{1}{6}$ of a meter, how many total meters has it moved? _____

Appendix D

Survey

A. What is your age _____

B. I am a Boy / Girl / other circle one

C. Most of my grades are:

A	B	C	D	F
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Circle one

Put an X next to the statement you agree with most.

	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
I like using robots					
I learned using robots					
I want to use robots again					
I don't like robots					
Using robots allowed me to work with other students					
Robots were distracting					
Using robots made me pay attention to the lesson					

Using robots made me participate					
--	--	--	--	--	--

Write a brief response:

- A. What did you like about using robots?
- B. What would you change about today's lesson?

(Carnahan, 2014).

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Leonard Sheehy
Randolph Middle School
Informed Consent Forms

Dear Parent/Guardian:

I am a graduate student in the Educational Technology Department at New Jersey City University as well as a technology teacher at Randolph Middle School. I will be conducting a research project under the supervision of Dr. Christopher Carnahan as part of my doctoral thesis concerning the effectiveness of educational robotics to enhance mathematics instruction. I am requesting permission for your child to participate in this research. The goal of the study is to determine to what extent robotics can be used in the classroom to improve mathematics comprehension.

Each child will be asked to take a pretest, participate in a robotics activity and finally take a posttest. There will be no risk to students. I have worked with the classroom teacher to create these tests to be similar to what is used as formative assessment in the class. Any child who expresses a desire not to participate will be provided with an alternative lesson. To preserve each child’s confidentiality children will not be asked to place their name on the work they complete. All data will be used in this study only.

Your decision whether or not to allow your child to participate in this study will have absolutely no effect on your child’s standing in his/her class. At the conclusion of the study a summary of the group results will be made available to all interested parents. If you have any questions or concerns please contact me at 973-366-8700 ext. 5195 or nsheehy@rtnj.org.

Sincerely,

Leonard Sheehy

Please indicate whether or not you wish to have your child participate in this study by checking the appropriate

statement below and returning this letter to your child's teacher by February 1, 2016.

I grant permission for my child _____ to participate in this study.

I do not grant permission for my child _____ to participate in this study.

Parent/Guardian Signature

Signature of Principal Investigator

Date

Date

**NEW JERSEY CITY UNIVERSITY
INSTITUTIONAL REVIEW BOARD**

DISPOSITION FORM

Leonard Sheehy

Principal Investigator

Co-Principal Investigator (if applicable)

7 N Dell Ave

Address of Principal Investigator

Address of Co-Principal Investigator

Kenvil, NJ 07847

City, State, and Zip Code

City, State, and Zip Code

201-988-6693

Telephone # - Fax # - E-mail address

Telephone # - Fax # - E-mail address

Title of Research: Robotics as a manipulative in mathematics instruction.

ADMINISTRATIVE DISPOSITION

PART 1: Your Claim for Exemption for the research study identified above has been reviewed. The Action taken is indicated below:

APPROVED FOR EXEMPTION AS CLAIMED: CATEGORY#

Note: Anything that conceivably changes the exempt status of this study must be presented to the IRB for approval before the changes are implemented. Such modifications should be sent to the IRB Office at the address above.

1. That the materials you submitted to the New Jersey City University IRB provide a complete and accurate account of how human subjects are involved in your project.
2. That you will carry on your research according to the procedures described in those materials.
3. That you will report to IRB any changes in your procedures that would remove the project from the exempt category and make it subject to IRB review.

4. That if such changes are made, you will submit the project for IRB review.
5. That you will immediately report to the IRB any problems that you encounter while using human subjects.

NOT APPROVED.

FULL REVIEW: _____ APPROVED

FULL REVIEW: _____ APPROVED WITH MODIFICATIONS FULL

REVIEW: _____ DENIED

DENIED: _____

See the attached Committee Action Letter for additional comments.

Chair, IRB

Date

Last Name: File _____
No.: _____
Project: _____

NOTICE OF EXEMPTION FROM IRB REVIEW

The project identified below has been declared exempt from review by the IRB under the provision of Federal Regulations 45 CFR 46.101(b).

Your Research is exempt under category

This exemption is based on the following assumptions:

1. That the materials you submitted to the New Jersey City University IRB provide a complete and accurate account of how human subjects are involved in your project.
2. That you will carry on your research according to the procedures described in those materials.
3. That you will report to IRB any changes in your procedures that would remove the project from the exempt category and make it subject to IRB review.
4. That if such changes are made, you will submit the project for IRB review.
5. That you will immediately report to the IRB any problems that you encounter while using human participants.

Name of Chief Investigator: _____

Name of Co-Investigators: _____

Title of Project: _____

Conditions: _____

Note: For Categories 2 & 3, a consent form is not needed for subjects asked to complete an anonymous questionnaire.

Signed

Chair of IRB at New Jersey City University

Date

INITIAL, REVISED OR CONTINUATION

PART II: NOTICE OF IRB REVIEW AND APPROVAL

The project identified below, for which you requested review and approval by the NJCU Institutional Review Board for the Protection of Human Participants in Research, has now been reviewed and approved. This approval is based on the assumption that the materials you submitted to the NJCU IRB c/o Grants and Sponsored Programs contain a complete and accurate description of all the ways in which human subjects are involved in your research.

This approval is given with the following conditions:

1. That you will conduct the research according to the plans and protocol you submitted.
2. That you will immediately inform the IRB of any injuries to subjects that occur in the course of your research.
3. That you immediately inform the IRB of any problems that arise in the course of your research.
4. That you will immediately inform the IRB of any changes that you make in the protocol of the research.



5. That you will give each person who signs the consent document a copy of that document, if you are using such documents in your research.
6. That you will retain all signed consent documents for at least three years after the termination of the research.

Failure to comply with these conditions will result in the withdrawal of this approval.

Approved

Not Approved

Note: _____

Name of Principal Investigator: Leonard Sheehy

Title of Project: Robotics as a manipulative in
mathematics

Period of Approval: February 1, 2016 – February 1, 2018

Additional Conditions: _____

One month before the end of the period of approval, you must file with the IRB a new application for revised or continuation of your research project.

NJCU Institutional Review Board Chair

Date

**NEW JERSEY CITY UNIVERSITY
INSTITUTIONAL REVIEW BOARD**

File # _____

APPLICATION FOR REVIEW OF RESEARCH

1. TYPE OF APPROVAL REVIEW REQUESTED (CHECK ONE):

FULL REVIEW

EXPEDITED

EXEMPT REVIEW

2. PRINCIPAL INVESTIGATOR: Leonard Sheehy

DEPARTMENT: Educational Technology

PHONE: 201-200-3078

TITLE OF RESEARCH: Robotics as a manipulative in
mathetics

CO-INVESTIGATORS: _____

3. PURPOSE OF RESEARCH (INDEPENDENT PROJECT, MASTER'S THESIS, AND COURSE WHICH INCLUDES COURSE TITLE, SEMESTER AND INSTRUCTOR'S NAME.) ETC.

Doctoral Thesis, Assessment and evaluation, Dr. Carnahan

4. IF YOU ARE A STUDENT RESEARCHER PLEASE PROVIDE THE FOLLOWING:

MAILING ADDRESS: 7 N Dell Ave

CITY/STATE/ZIP: Kenvil, NJ 07847

TELEPHONE: 201-988-6693 EMAIL: nsheehy@rtnj.org

FACULTY SPONSOR NAME: Dr. Carnahan

DEPARTMENT OF SPONSORING FACULTY: Educational Technology

EXT. 3078 FAX : _____ EMAIL: edd@njcu.edu

FACULTY SPONSOR SIGNATURE: _____

DATE: _____

5. HAS THIS RESEARCH PROJECT BEEN CONSIDERED PREVIOUSLY BY THE IRB? YES NO

IF YES, GIVE LAST APPROVAL DATE: _____

6. SOURCE OF FUNDING (IF APPLICABLE):

UNIVERSITY GRANTS: PLEASE INDICATE WHICH GRANT PROGRAM: (FOUNDATION, SBR)

EXTRAMURAL FUNDS: PLEASE INDICATE AGENCY NAME: _____

TITLE: _____

AWARD NUMBER: _____ DATE : _____

7. ARE YOU WORKING WITH A RESEARCHER FROM ANOTHER INSTITUTION? IF SO, BE AWARE THAT YOUR CO-
INVESTIGATOR MUST ALSO SUBMIT YOUR JOINT PROPOSAL TO THE IRB AT THE INSTITUTION THAT EMPLOYEES HIM/HER.

| YES | NO

8. WHAT IS THE OBJECTIVE OF THE RESEARCH?

_____ The object of the research is to determine if robotics is an effective manipulative when teaching
seventh grade _____

students addition and subtraction of positive and negative fractions.

9. DOES YOUR RESEARCH INVOLVE ANY OF THE FOLLOWING (CHECK ALL THAT APPLY)?

| MINORS

| PRISONERS

| PREGNANT WOMEN

| USE OF THE INVESTIGATORS' CURRENT STUDENTS AS SUBJECTS

| DRUGS OR OTHER CONTROLLED SUBSTANCES

| PSYCHOLOGICAL OR PHYSIOLOGICAL STRESS ABOVE THE LEVEL OF NORMAL EVERYDAY ACTIVITIES

| MISLEADING OR DECEIVING SUBJECTS ABOUT ANY ASPECT OR PURPOSE OF THE RESEARCH

| COLLECTION OF INFORMATION WHICH DEALS WITH SENSITIVE ASPECTS OF THE PARTICIPANTS' BEHAVIOR (ILLEGAL ACTIVITY, DRUG OR ALCOHOL USE, SEXUAL BEHAVIOR, ETC.)

| COLLECTION OF INFORMATION WHICH WOULD PLACE SUBJECTS AT RISK OF CRIMINAL OR CIVIL LIABILITY IF IT BECAME KNOWN

| COLLECTION OF INFORMATION WHICH COULD AFFECT SUBJECTS' FINANCIAL STANDING, EMPLOYABILITY, OR REPUTATION

- | EXAMINATION OF EXISTING DATA, RECORDS, DOCUMENTS, OR SPECIMENS THAT ARE NOT PART OF THE PUBLIC RECORD
- | CHILDREN INVOLVED IN YOUR RESEARCH WITHOUT SENSITIVE INFORMATION ABOUT THEMSELVES OR THEIR FAMILIES.
- | COLLECTING OR STUDYING EXISTING DATA, DOCUMENTS, RECORDS, PATHOLOGICAL SPECIMENS OR DIAGNOSTIC SPECIMENS WHICH ARE PUBLICLY AVAILABLE AND FROM WHICH PARTICIPANTS CANNOT BE IDENTIFIED BY ANYONE OTHER THAN THE INVESTIGATOR(S).

**IF ANY OF THE ABOVE ITEMS ARE CHECKED
YOUR PROPOSAL DOES NOT QUALIFY FOR AN EXEMPT REVIEW**

10. DESCRIBE THE DESIGN OF THE RESEARCH INCLUDING WHAT WILL BE REQUIRED OF SUBJECTS (ATTACH ADDITIONAL SHEET IF NECESSARY):

Students will be asked to take a pretest, participate in a robotics activity and take a posttest.

11. UNDER WHICH OF THE FOLLOWING CATEGORIES ARE YOU APPLYING FOR EXEMPTION?

1. RESEARCH CONDUCTED IN ESTABLISHED OR COMMONLY ACCEPTED EDUCATIONAL SETTINGS, INVOLVING NORMAL EDUCATIONAL PRACTICES, SUCH AS (I) RESEARCH ON REGULAR AND SPECIAL EDUCATION INSTRUCTIONAL STRATEGIES, OR (II) RESEARCH ON THE EFFECTIVENESS OF THE COMPARISON AMONG INSTRUCTIONAL TECHNIQUES, CURRICULA, OR CLASSROOM MANAGEMENT METHODS.
2. RESEARCH INVOLVING THE USE OF SOCIAL SCIENCE OR EDUCATIONAL TESTS (COGNITIVE, DIAGNOSTIC, APTITUDE, ACHIEVEMENT), SURVEY PROCEDURES, INTERVIEW PROCEDURES, OR OBSERVATION OF PUBLIC BEHAVIOR UNLESS (I) INFORMATION IS OBTAINED IN SUCH A WAY AS THAT THE PARTICIPANTS CAN BE IDENTIFIED DIRECTLY OR INDIRECTLY OR (II) THE PARTICIPANTS' RESPONSES, IF THEY BECAME KNOWN, COULD PLACE THE PARTICIPANT AT RISK OF CRIMINAL OR CIVIL LIABILITY OR BE DAMAGING TO THE PARTICIPANTS' FINANCIAL STANDING, REPUTATION, OR EMPLOYABILITY. (ALL RESEARCH INVOLVING SURVEY AND INTERVIEW PROCEDURES IS EXEMPT WHEN THE PARTICIPANTS ARE ELECTED OR APPOINTED PUBLIC OFFICIALS OR CANDIDATES FOR PUBLIC OFFICE. HOWEVER, CONFIDENTIALITY MUST BE MAINTAINED WHEN REQUIRED BY FEDERAL STATUTE.)
3. RESEARCH INVOLVING THE COLLECTION OR STUDY OF EXISTING DATA, DOCUMENTS, RECORDS, PATHOLOGICAL SPECIMENS, OR DIAGNOSTIC SPECIMENS, IF THESE SOURCES ARE PUBLICLY AVAILABLE OR IF THE INFORMATION IS RECORDED BY THE INVESTIGATOR IN SUCH A MANNER THAT PARTICIPANTS CANNOT BE IDENTIFIED.
4. RESEARCH AND DEMONSTRATION PROJECTS WHICH ARE FUNDED BY A FEDERAL AGENCY AND DETERMINED TO BE EXEMPT BY THE AGENCY HEAD AND WHICH ARE DESIGNED TO STUDY, EVALUATE, OR OTHERWISE EXAMINE: (I) PUBLIC BENEFIT OR SERVICE PROGRAMS; (II) PROCEDURES FOR OBTAINING BENEFITS OR SERVICES UNDER THOSE PROGRAMS; (III) POSSIBLE CHANGES IN OR ALTERNATIVES TO THOSE PROGRAMS OR PROCEDURES; OR (IV) POSSIBLE CHANGES IN METHODS OR LEVELS OF PAYMENT FOR BENEFITS OR SERVICES UNDER THOSE PROGRAMS.
5. EXEMPTION FOR COLLECTION OR STUDY OF EXISTING DATA: RESEARCH INVOLVING COLLECTION OR STUDY OF EXISTING DATA, DOCUMENTS, RECORDS, IF THESE DATA ARE NON-IDENTIFIABLE AND PUBLICLY AVAILABLE OR INFORMATION IS RECORDED BY THE INVESTIGATOR IN SUCH A MANNER THAT SUBJECTS CANNOT BE IDENTIFIED DIRECTLY THROUGH IDENTIFIERS LINKED TO THE SUBJECT (CODES LINKING NAMES TO DATA ARE CONSIDERED INDIRECT IDENTIFIERS).
6. EXEMPTION FOR STUDY OF THE DEPARTMENT OF HEALTH AND HUMAN SERVICES: UNLESS SPECIFICALLY REQUIRED BY THE STATUTE, RESEARCH AND DEMONSTRATION PROJECTS WHICH ARE CONDUCTED BY OR SUBJECT TO THE APPROVAL OF THE DEPARTMENT OF HEALTH AND HUMAN SERVICES, AND WHICH ARE DESIGNED TO STUDY, EVALUATE, OR OTHERWISE EXAMINE:
- (A) _____ PROGRAMS UNDER THE SOCIAL SECURITY ACT OR OTHER PUBLIC BENEFIT OR SERVICE PROGRAMS
- (B) _____ PROCEDURES FOR OBTAINING BENEFITS OR SERVICES UNDER THOSE PROGRAMS
- (C) _____ POSSIBLE CHANGES IN OR ALTERNATIVES TO THOSE PROGRAMS OR PROCEDURES
- (D) _____ POSSIBLE CHANGES IN METHODS OR LEVELS OF PAYMENT FOR BENEFITS OR SERVICES UNDER THOSE PROGRAMS.

IF YOUR RESEARCH IS GIVEN EXEMPTION STATUS, THE FOLLOWING MUST BE STATED ON A COVER LETTER ACCOMPANYING ANY SURVEY OR QUESTIONNAIRES.

1. A STATEMENT THAT ALL PARTICIPATION IS VOLUNTARY
2. A STATEMENT THAT YOU ARE CONDUCTING RESEARCH AND THE REASON FOR IT (MASTER'S THESIS, PUBLICATION, ETC.)
3. PURPOSE OF THE RESEARCH - WHAT YOU ARE INVESTIGATING
4. A STATEMENT THAT ALL RESPONSES WILL BE KEPT ANONYMOUS AND CONFIDENTIAL

5. A STATEMENT THAT PARTICIPANTS NEED NOT RESPOND TO ALL QUESTIONS
6. IF PARTICIPANTS ARE YOUR OWN STUDENTS, A STATEMENT THAT CLASS STANDING WILL NOT BE AFFECTED IN ANY WAY BASED ON PARTICIPATION
7. THE NAME AND TELEPHONE NUMBER OF THE PRINCIPAL INVESTIGATOR (PI) AND FACULTY SPONSOR (IF APPLICABLE)

CLAIMS FOR EXEMPTION MAY NOT BE MADE FOR (A) RESEARCH INVOLVING CHILDREN, (B)

AIDS-RELATED RESEARCH, (C) RESEARCH INVOLVING SUBSTANCE OR CHILD ABUSE OR (D) RESEARCH TO BE CONDUCTED AT THE V.A. (RESEARCH UNDER THESE CATEGORIES IS SUBJECT TO SPECIAL FEDERAL GUIDELINES.)

ALL IRB APPLICANTS MUST COMPLETE QUESTIONS 12 – 18

12. DESCRIBE THE SUBJECTS WHO WILL BE PARTICIPATING (NUMBER, AGE, GENDER, ETC.)

Twenty five seventh grade students from a school located in a northern New Jersey suburban
school.

13. HOW WILL SUBJECTS BE RECRUITED? IF STUDENTS, WILL THEY BE SOLICITED FROM CLASS?

Students will be selected from an existing seventh grade mathematics class.

14. WHAT RISKS TO SUBJECTS (PHYSIOLOGICAL AND/OR PSYCHOLOGICAL) ARE INVOLVED IN THE RESEARCH?

There will be no risk to students. The researcher has worked with the classroom teacher to create a
pretest and posttest similar to what is used as formative assessment in the
class. ~~Robots will be used to enhance the~~
normal daily instruction an provide reinforcement.

15. IS DECEPTION INVOLVED IN THE RESEARCH? IF SO, WHAT IS IT AND WHY WILL IT BE USED?

No deception will be used.

16. WHAT INFORMATION WILL BE GIVEN TO THE SUBJECTS AFTER THEIR PARTICIPATION? IF DECEPTION IS USED, IT MUST BE DISCLOSED AFTER PARTICIPATION.

Participants will be told that they will remain anonymous and their results will be used for presentation and

publication. No deception will be used.

17. HOW WILL CONFIDENTIALITY BE MAINTAINED? WHO WILL KNOW THE IDENTITY OF THE SUBJECTS? IF A PRE AND POST TEST DESIGN IS USED HOW WILL THE SUBJECTS BE IDENTIFIED?

The researcher and classroom teacher will be the only one who know the identity of the identity of the

participants. No names will be collected.

18. HOW WILL THE DATA BE RECORDED AND STORED? WHO WILL HAVE ACCESS TO THE DATA? WHERE WILL IT BE STORED?

ALL DATA MUST BE KEPT FOR A MINIMUM OF THREE YEAR

The pretests and posttests will be administered on paper and scored by the researcher.

All data will be kept in a locked filing cabinet for three years. Only the researcher will have access.

