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Teaching strategies in mathematics: differences in sign language use

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Teaching Strategies in Mathematics: Differences in Sign Language Use.

Master's Project

Submitted to the Faculty

of the Master of Science Program in Secondary Education

of Students who are Deaf or Hard of Hearing

National Technical Institute of the Deaf
ROCHESTER INSTITUTE OF TECHNOLOGY

By

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In Partial Fulfillment of the Requirements
For the Degree of Master of Science

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Approved: _____
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Abstract

Problem: The proposed project addresses a critical problem facing most schools serving Deaf students in grades Kindergarten through college- insufficient clarity of sign communication by teachers due to wide variation in sign abilities. Today a very small number of teachers of the Deaf use American Sign Language in the classroom. Most teachers use other variations of sign language such as (1) Pidgin Signed English, (2) Signed English, (3) Simultaneous Communication, (4) Total Communication. Clear and effective communication is critically important to both students' learning in school and their success in future careers.

Proposed Project Activities: This project will develop and implement a lesson plan for instruction of three different mathematical concepts. Three teachers who are each proficient in using one of three different varieties of sign language (native ASL, non-native ASL, and Signed English) will be selected to teach the same math lesson to selected students. Sample problems will be selected that could vary conceptually in the instructional presentation due to different sign language methods. This project will examine these research issues using first-year deaf students on the Gallaudet and NTID college campuses.

Intended Outcomes: The target outcome is to indicate which mode of sign language is the most instructionally clear and effective for use in the mathematics classroom. From this information, instructional implications and recommendations will be developed to educate current teachers of the Deaf and teacher preparation programs for educating the

Deaf throughout the country about the most clear and effective mode of sign language that can be used in the mathematics classroom.

1. The Need for the Project

Deaf students generally have difficulty with mathematics. They tend to have a lot of trouble with most aspects of deciphering math problems, mainly because of low reading levels. Knowing the vocabulary and being able to read the math problems and the directions are crucial to a student's success in solving them (Borron, 1975). In addition, deaf children often have weak inferencing skills, which makes clear communication even more vital. If information is not presented in a concise way, the student is not able to draw conclusions from what is presented in order to increase the amount of knowledge they acquire (Kidd, 1991).

Successful mathematics problem solving for deaf students also involves integration of three languages: American Sign Language (ASL), English, and the "language of mathematics" (the different meanings of words when used for mathematics). Successful synthesis of these languages becomes more important as the level of mathematics progresses from simple to more complex. When a student begins to struggle with the language being used in the classroom, it may interfere with their math learning. The more difficulties a student has with the level or type of sign communication used in the classroom, the more problems they will have solving mathematical questions (Hillegeist, 1991).

In the classroom, it is necessary for the material to be communicated in a way that is unambiguous so that the student can gain as much knowledge as possible. The student and teacher must have clear and effective communication so the student can be successful with understanding and learning the subject matter. Often a student does not have

enough knowledge about the vocabulary or content related to the math lesson to even be able to ask questions or to clarify when they are confused about something being presented (Kidd, 1991). This is because the sign communication in the classroom is not adequate enough to represent the ideas of the math lesson with clarity or in sufficient depth.

Long, Stinson, Kelly, & Liu state that teacher sign communication skills can range anywhere from "pure, linguistic descriptions of ASL to English-influenced signing". The differences between the types of sign communication can be identified in several different ways. One difference is whether the teacher uses grammar that is characteristic of ASL or grammar that is more English-like. Another aspect is whether a teacher uses signs that are accepted by native ASL users in the deaf community, or if they choose signs that are less accepted by deaf signers. Other elements that will identify the type of sign communication a teacher is using are their expressive and receptive sign communication ability and whether or not they are able to carry on a conversation at a normal rate using sign language (Long et al., 1999).

Hall (1978) suggests that in order for a student to be successful in mathematics, they must first be successful with English, memory, logical reasoning, and visual-spatial abilities. The issue of language mastery becomes a problem if a classroom teacher of the deaf does not use a method of communication that is clear, understandable, and adequate. Students who are not able to interact in the classroom using complex levels of language are consequently often unable to process higher-level mathematics problems. Additionally, if the classroom teacher is unable to use a form of sign communication that

students can easily use for analysis, students may have significant problems when trying to solve mathematics equations.

Students who are able to interact fully during classroom instruction tend to acquire more knowledge from the material presented than those who have difficulty integrating due to confusions or breakdowns in sign communication. Direct involvement and clear communication gives students the sense that they are more in control of their learning and of the classroom environment in which they are participating. Additionally, students who feel that they are able to participate fully in their own education are more willing to learn content materials (Long et al., 1999).

There is a strong need for improvement in mathematics instruction to students who are deaf (Pagliaro, 1998). One way change can occur is to simply use a method of sign communication that will enable students to benefit most from their mathematics education. This proposed study would investigate the most effective method of sign communication to use in deaf math classrooms. The desired outcome is to give students the opportunity to make the most of their math education. Having teachers utilize the clearest form of sign communication can effectively do this. Students will be better able to process and understand classroom information if the level and method of communication used is clear and effective.

Kidd (1993) states that further research on deaf students' performance is necessary in order to better understand how teachers can make communication more clear and efficient in the classroom. The currently proposed study would address this problem and explore several possibilities for improving the quality and quantity of communication

in deaf classrooms. The results will give deaf programs throughout the United States a more definite answer to the continuing question of which method of sign communication is best to use in mathematics classrooms.

2. The Significance of the Project

There are deaf students throughout the United States who are not getting the quality of education they deserve. A portion of this is due to the fact that they are not able to communicate effectively with their teachers. As a result, there are many students who are not able to decipher the information needed to fill in the gaps of their education. Students need to be able to interact freely and comfortably with their teachers and with the other students in class in order to acquire and synthesize classroom information to the best of their abilities (Kidd, 1991).

If the proposed project is done and it is determined that there indeed is one method of sign communication that is most effective to use in deaf mathematics classrooms, there is the potential that the results will benefit both deaf students and the instructors who teach them. If the language barrier is more adequately addressed, deaf students will be better able to process mathematics lessons on higher levels. Furthermore, it should facilitate the students' abilities to learn and integrate the English language, sign language, and "mathematics language".

There is also potential for the results of this study to benefit mathematics teachers who teach deaf students. If teachers are able to communicate more effectively with the students in their classes, they can teach more content during a school year. When

students are able to communicate with their teachers without language barriers, they can more easily process higher-level math concepts. Simply knowing that teachers are able to convey information in a way that is more easily understood by students is a great advantage itself.

The results of this project could be included in the curriculum of teacher preparation programs. The individuals who are enrolled in such programs would have an advantage in knowing the best method of sign communication to use when they begin teaching deaf students. The results could also be shared with current teachers of the deaf through in-services. The changes that result could allow teachers of the deaf to improve the quality and quantity of math instruction in order to better prepare deaf students for future college and job-related tasks.

Deaf students face many difficulties in solving mathematics problems. Math is a very important part of a student's education. Mathematics is used in many careers today, and Pagliaro (1998) showed that an individual with the ability to successfully utilize mathematical concepts is also likely to have more choice in the career path they would like to follow. They will also have a higher likelihood of advancing to higher levels in the workplace. A solid educational background in mathematics will provide deaf students with an abundance of career choices (Pagliaro, 1998). It is important to be able to offer the best education possible to deaf students. The proposed study will determine which method of sign communication is the most effective to use in the classroom. The results of this applied educational study could be extremely beneficial for deaf students and teachers involved in deaf mathematics education.

3. The Quality of the Project Design

The proposed project will address the question of which method of sign communication is more effective to use with deaf students in the math classroom. The design consists of a two-part study. Study 1 will involve finding the most striking differences between the methods of sign communication used by 1) a native American Sign Language (ASL) user, 2) a non-native ASL user, and 3) a Signed English user. Study 2 incorporates analysis to find which of the above methods is most successful to use with deaf students in a mathematics classroom. The objectives and hypothesis below relate to both parts of the proposed project.

Objectives

(1) To examine how math teachers who are native ASL users conceptually communicate compared to those who are non-native ASL users and signed-English users.

(2) To examine deaf students' understanding and math knowledge gain from math teachers' representation of three different sign communication abilities: native ASL, non-native ASL, and Signed English.

The three methods of sign communication (native ASL, non-native ASL, and Signed English) will be applied as treatments during the second part of the project. The main goal of study 2 is to determine the most effective method for student interaction and

learning within the deaf classroom. Specific to the two above-mentioned objectives, three hypotheses will be tested in the second stage of this project:

1) The deaf native signing teacher will have strong receptive skills, which will lead to high student interaction and engagement. They will also have high clarity of signing skills and would appear to need a lesser amount of visual media to support their lesson.

2) The hearing signed-English user will have lower ability in receptive skills, which will result in a lesser amount of student interaction and engagement. They will also have a low level of clarity of their signing skills and will most likely need a large amount of visual media to support their lesson.

3) The non-native hearing signer will have receptive skills somewhere in between the deaf native signer and the hearing signed-English signer, which will lead to an amount of student interaction and engagement that is also somewhere in between. They will also have clarity of signing skills that is between the abilities of the deaf native signer's skills and the hearing signed-English signer's skills, which would suggest a need for supportive visual media that is also somewhere in between.

Methodology

Study 1 (First Objective)

The first study will address objective one, as mentioned on page seven. This part of the project will involve observations of three to five deaf Teachers of the Deaf (TODs) in the natural classroom setting who are native ASL users, three to five hearing TODs in

the natural classroom setting who are non-native ASL users, and three to five hearing TODs in the natural classroom setting who are Signed-English users. Several methods will be used to determine the level and type of sign skill for each teacher previous to observing them in the classroom. The deaf teachers will be asked questions about their background, such as if their parents are deaf or hearing and if their education was obtained at a residential school. They will also complete a self-assessment of their own sign skills and, if possible, take the Sing Communication Proficiency Interview (SCPI). The hearing teachers will also be asked questions about their background. We will ask questions such as if they come from a hearing family and if they had any interactions with deaf individuals early in life or not. They will complete a self-assessment of their own sign skills as well and, if possible, take the SCPI. Each teacher that we observe, whether deaf or hearing, will preferably have five years of mathematics classroom teaching experience.

The most prominent differences (up to ten) will be determined between the way the deaf teachers communicate classroom information using sign communication and the way hearing teachers (both groups) communicate classroom information using sign communication. These major differences will be subsequently examined in a controlled classroom situation as part of study 2 (second objective) to determine which method is more effective. Effectiveness will be related to student improvement -i.e., students' improvement from pre-test to post-test scores.

Some possible differences in the methods the teachers use to communicate ideas through sign language are:

amount of fingerspelling used

substitution of fingerspelling for a word that has a sign

improper use of a sign

utilization of signing space

comparison body posture

multiples portrayed correctly

correct reference/use of pronouns

order of signs grammatically correct

classifiers

conceptually inaccurate signs

Key for Tables

$T_{D\ Native}$ = treatment video of deaf native ASL signer
$T_{H\ ASL}$ = treatment video of hearing non-native ASL signer
$T_{H\ SE}$ = treatment video of hearing signed-English signer
R = Random assignment
$O_{\#}$ = Observation (number)
$T_{\#}$ = Treatment (number)

Teacher Observations

Sign Expression	Student Engagement Present?	Used Supplementary Visuals?

Data Collection for Study 1

All observations of the teachers' sign abilities will be videotaped. The teachers' sign expressions will then be evaluated for language differences by a panel of two deaf and two hearing sign language experts. Interrater reliability will be calculated to be sure that the four raters' assessments are consistent in the context of the same criteria. The most prominent differences (up to ten) will be noted for each of the three teacher groups (listed previously). These differences will be tested to see which method is the most effective in the next part of the project.

All complementary visual media used by the teachers while teaching a classroom math lesson will also be documented. This could include things such as overheads, charts, and other supplementary things hanging on the classroom walls. Another thing that will be noted is the amount of student engagement that occurs while the teacher is going over materials. Student engagement will be defined as the amount of interaction and participation by students during a math lesson. Student engagement may be influenced by the quality of the teacher's expressive and receptive skills. This information will be gathered to determine other areas of research that need to be pursued and will be included in the future recommendations section.

Study 2 (Objective Two)

Objective two involves assessing students' comprehension of different teachers' sign language use. Three mathematical concepts will be selected for examination. These are angle measure, similar, and congruent. The goal is to compare the effectiveness of

teaching these math concepts with the different methods used by (1) deaf TODs who are native ASL users, (2) hearing TODs who are non-native ASL users, and (3) hearing TODs who are Signed-English users. The purpose is to document the differences in teaching effectiveness based upon the level of knowledge and use of ASL while instructing students. Three math concepts (angle measure, similar, congruent) were carefully selected in a way that would result in different expressive sign language use depending on whether the teacher uses native ASL, non-native ASL, or Signed English.

Three teachers will be selected for the project; one deaf TOD who is a native ASL user, one hearing TOD who is a non-native ASL user, and one hearing TOD who is a Signed-English user. The three teachers will each teach the same lesson involving the three difficult math concepts (angle measure, similar, congruent). Each teacher will teach using the most prominent differences that were found in their representative teaching group (native/non-native ASL users and signed-English users). Each teacher's lesson will be scripted and videotaped so the lesson content will be comparable for all theree teachers, as well as consistent each time it is shown to all the groups of students. However, each teacher will determine the way they use sign communication to represent the script. The videotaping will be done in a studio using only the textbook and a whiteboard with a black dry erase marker. There will be no additional materials allowed. This will ensure that we are measuring only the teachers' use of sign communication, and not additional use of visuals or the amount or depth of the language they choose to use.

Three Treatment Groups

There will be three groups of deaf students, with each group consisting of 20 students (60 total). Each group will be randomly assigned to view one of three video taped sign versions of the math lesson. They will all be entering first year college students who graduated recently from high school. They will be students who are in their first quarter at NTID, which will eliminate much of the influence the college curriculum has had on their learning experiences. Ten of the students in each of the three groups will have a hearing loss in the range of 70 dB or more, and the other ten will have a hearing loss that is less than 50 dB. The students will be randomly assigned by hearing category (deaf or hard-of-hearing). Background information will be collected on each student, in the form of math and English skill test scores, and Language/Communication Background Questionnaire (student self-assessment of sign skill ratings).

Students will be randomly assigned to one of three groups that will be balanced for deaf and hard-of-hearing.

The same videotaped lessons will also be shown to three groups of 20 (60 total) entering first-semester college students at Gallaudet who have recently graduated from high school. These groups of students will be selected and placed into treatment groups in the same way.

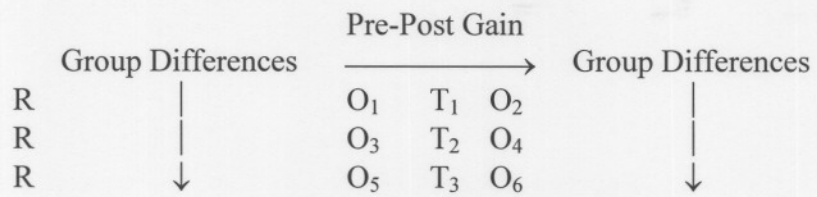
The following tables illustrate the design for the independent and dependent variables for this study.

Independent Variables

3 treatment levels

	$T_{D\ Native}$	$T_{H\ ASL}$	$T_{H\ SE}$
NTID	20 students (10 D, 10 HH)	20 students (10 D, 10 HH)	20 students (10 D, 10 HH)
Gallaudet	20 students (10 D, 10 HH)	20 students (10 D, 10 HH)	20 students (10 D, 10 HH)
Total # for each treatment	40 students (10 D, 10 HH)	40 students (10 D, 10 HH)	40 students (10 D, 10 HH)

Dependent Variables



Evaluation of Results

Teacher effectiveness for each of the three teacher types will be measured by student performance on math problems related to the lesson. This will be done in the form of 15 math problems, five problems for each of the three math concepts taught in the lesson. Solving the problems by the correct process will require the use and understanding of each of the three math concepts. These 15 problems will be evaluated

on a "partial credit" basis. In addition to being graded for answers, the problems will be evaluated by looking at the process the student uses to solve each problem. Evaluation of each problem will be broken down into steps, each step will be a part of the process of solving the problem. The student will be evaluated as to whether they did or did not use the correct steps in the process for solving each problem. If the student is missing a step, they will not be given credit for that part. If they include extra, incorrect steps, their penalty will be having one of the points they have already earned taken away. The final step to be evaluated is the final answer. If the student does the entire process wrong but gets the correct final answer, they will not be given credit for the final answer. Each problem may have more than one method for solving it. Criteria will be established for each problem before starting the evaluation stage of the student's achievement scores.

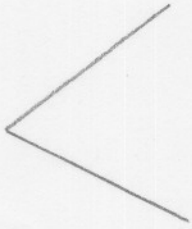
Factorial analysis of variance (ANOVA) with repeated measures on the dependent variable will be used to examine group and pre/post-test differences.

Sample Pre-test/Post-test

An example of a math question for each of the three mathematical concepts is given here. One is given in detail, with an example of how it will be graded according to the process for solving it.

Concept 1

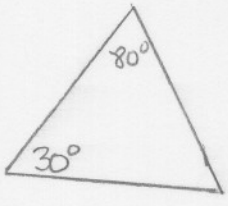
Math problem for the math concept ANGLE MEASURE:



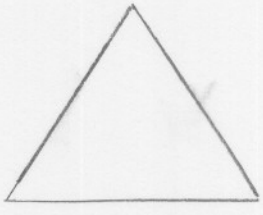
What does *ANGLE MEASURE* mean?
What is the measure of the angle above?

Concept 2

Math problem for the math concept SIMILAR:



Triangle 1

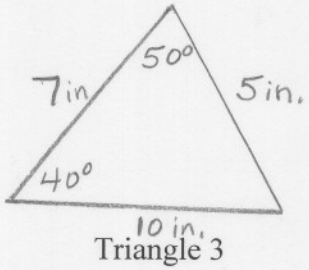


Triangle 2

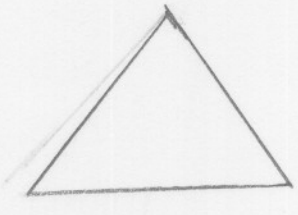
Write the definition of *SIMILAR*.
Demonstrate that Triangle 1 and Triangle 2 are similar
Conclusion: Write how you know that Triangle 1 and Triangle 2 are similar.

Concept 3

Math problem for the math concept CONGRUENT:



Triangle 3



Triangle 4

Write the definition of *CONGRUENT*.
Demonstrate that Triangle 3 and Triangle 4 are congruent.
Conclusion: Write how you know that Triangle 3 and Triangle 4 are congruent.

Sample Grading

Example of grading the solution for the problem related to SIMILAR:

10points possible
definition
1 pt. for using the words "all angles in the triangle"
1 pt. for stating the words "corresponding angles"
1 pt. for using the words "both triangles" or "triangle 1 and triangle 2"
1 pt. for using the word "congruent"
1 pt. for complete and correct definition of SIMILAR (all three corresponding angles of both triangles are congruent)
process
1 pt. for $\angle 1 = \angle 4$
1 pt. for $\angle 2 = \angle 5$
1 pt. for $\angle 3 = \angle 6$
conclusion
1 pt. for stating that the angles of triangle 1 are congruent to the angles of triangle 2
1 pt. for stating that therefore triangle 1 and triangle 2 are similar

This is only one of the several possible ways that the student could answer. Basically, the student will be given full or partial credit for the answer if it matched any number of pre-determined answer possibilities. The student will get credit if their wording is different but they are expressing the same concept(s). Also, the student will NOT be given credit for a correct answer unless they have all of the other concepts in the steps for solving the problem.

The same 15 math problems will be given to all students in each of the six groups. They will solve the problems (to the best of their ability) before the lesson is taught, and

again after the lesson is taught. The pre-test and post-test will be evaluated using the same criteria. Teaching effectiveness will be measured by the percent increase from the pre-test score to the post-test score of each problem-set.

Sample Script

This is a short sample of the script for teaching SIMILAR to the research subjects. Teachers may use sign communication in whatever way they wish to represent the ideas in the script. However, they may not use the whiteboard to write down anything except words (no pictures, diagrams, etc.). They may write words on the board only **after** they have already communicated the word(s) or concept(s) through the air using their choice of sign communication.

- Define SIMILAR.
- Be sure to tell students what the symbol for SIMILAR is.
- The definition for SIMILAR is: all three corresponding angles of two triangles are congruent.
- Be sure to describe what corresponding angles of two triangles are and you may re-state the definition of CONGRUENT from previous in the lesson.
- You must show the following two triangles to help illustrate SIMILAR.
- Be sure to show the angles of each angle and show students where corresponding angles are.
- REMEMBER!!! You may NOT draw the triangles on the board at any time, but you can write words on the board after you have communicated them through the air using sign communication first.

The goal is to use this method to demonstrate that one of the three methods of instruction to deaf students is more/less effective than the others while teaching mathematics concepts. The ultimate goal is to give seminars and group instruction to all TODs on how to teach using the most effective method so that all deaf students will have

an equal opportunity to get the best math education possible. This method would also be included in all training programs where there is an opportunity for certification in the area of Deaf Education.

4. The Quality of the Project Evaluation

External and internal sources will be used to evaluate the quality of the project evaluation. This is to ensure that the evaluation will be consistent and accurate. The following factors will be considered when external and internal sources are determining the quality of the evaluation:

1. Whether the methods of evaluation are thorough, feasible, and appropriate to the goals, objectives, and outcomes of the proposed project.
2. Whether the methods of evaluation are appropriate and if they match the manner in which the project will be carried out.
3. Whether the methods of evaluation allow the effectiveness of project implementation strategies to be evaluated in a successful way.
4. Whether the methods of evaluation include the use of objective performance measures that are clearly related to the proposed outcomes of the project and will produce relative data as well as possible.

5. Whether the evaluation will provide additional information about procedures to use for duplicating the project or for performing the project in other settings.

The project outcomes will also be evaluated by student performance data –i.e., improvement in test scores from pre-test to post-test. Student interaction will not be measured from pre-test to post-test because the lesson will be shown on videotape, which does not allow for any student interaction.

5. The Quality of the Project Personnel

Primary Mentor

Ron Kelly is an associate professor in the Department of Research at the National Technical Institute for the Deaf, a college of Rochester Institute of Technology. His three degrees are: B.S. with Distinction in Social Science, with a minor in History, M.Ed. in Educational Administration, and Ph.D. in Educational Psychology and Measurements, all from the University of Nebraska at Lincoln. He served four years as chair of the Department of Educational and Career Research at NTID, nine years in the dual role as one of the Assistant Deans of NTID and as Director for the Division of Communication Programs at NTID. Prior to coming to NTID, Kelly was at the University of Nebraska-Lincoln, where he was involved in 19 grants and contracts, was a Graduate Faculty Fellow, and taught graduate courses in Educational Psychology. He also served at

Gonzaga University, where he taught graduate courses in research design, program evaluation, and statistics.

At NTID, Kelly's research interests have focused on problem solving, transfer of learning, and student captioning. From 1991-1996, Kelly was PI for two research and development grants investigating the benefits of student captioning for deaf students in collaboration with WGBH Education Foundation in Boston. The U.S. Department of Education funded both grants. He currently is Project Director and PI for a FIPSE grant on math word problem solving.

Kelly currently teaches graduate courses in a pre-service teacher preparation program at Rochester Institute of Technology- the Master of Science in Special Education Program for Deaf and Hard of Hearing Students. Kelly is a member of the American Educational Research Association, Sigma Xi, the Scientific Research Association, and the Association of College Educators for Deaf and Hard of Hearing Students.

Secondary Mentor

Keith Mousley is currently employed as an Assistant Professor of Mathematics in the Mathematics Department at the National Technical Institute for the Deaf, a college of Rochester Institute of Technology. He has been in this current position since 1989. In addition to Mousley's many responsibilities at NTID, he is currently on the Board of Directors for the Convention of American Instructors of the Deaf, a national organization for teachers of the Deaf (1997-Dec 2002).

Prior to his employment at NTID, Mousley taught math and science to high school students at two different residential schools in Pennsylvania (1982-1989).

Mousley received his Masters degree in Deaf Education, with a specialization in mathematics, from Gallaudet University in 1982. Mousley's Bachelors degree is in Computational Mathematics from the Rochester Institute of Technology, which he received in 1980.

Graduate Student

Heather Rowley is a graduating student of the Master of Science program in Secondary Education of Individuals who are Deaf and Hard-of-Hearing at the National Technical Institute of the Deaf. In 1998 Rowley earned a Bachelors degree from the University of Central Florida, Orlando, in Speech and Hearing Sciences. She will be starting a position as a High School Mathematics teacher in a Deaf Institute in the fall of 2001.

Rowley is a member of the National Council on Teachers of Mathematics and is also a member of Convention of American Instructors of the Deaf. She will receive teacher certification from New York State and from the National Council on Education for the Deaf in the areas of Elementary Education of the Deaf, Secondary Education of the Deaf, and Secondary Mathematics Education.

6. The Adequacy of the Resources

Personnel

Heather Rowley

Substitute for professional leave throughout school year (30 days x $80/day)	$2,400
2 months summer salary to evaluate and summarize data	$6,500

Ron Kelly

1 month summer salary to evaluate and summarize data	to be calculated

Keith Mousley

1 month summer salary to evaluate and summarize data	to be calculated

Benefits for summer salaries @ 7.7%	to be calculated

Teachers to be videotaped for stage 1 evaluations

15 teachers x $100 each	$1,500

Teachers to teach lessons on videotape for treatment groups

3 teachers x $300 each	$900

Panel to evaluate videotapes

4 people x $1000 each	$4,000

Consultant for program evaluation (5 days x $400/day)	$2,000

Students who will be involved in treatment groups of project

$200 each student x 120 students total	$24,000

Travel

Plane fare

Rowley, Kelly, Mousley to deaf programs in states surrounding NY- total of 6 round trips ($700/ticket)	$12,600
3 trips to Gallaudet for experiment (for Rowley, Kelly, Mousley)	$6,300

Rental car

From airports to deaf programs (14 days total x $75/day)	$1,050

Hotel

For each deaf school visit (14 nights x $100/day, 1 room per person)	$4,200
Gallaudet (9 nights x $100/day, 1 room per person)	$2,700

Food	
Deaf school visits ($100/day each person, 20 days)	$6,000
Gallaudet ($100/day each person, 13 days)	$3,900
Supplies	
4 videotapes for observations	$16
Studio room for recording videotaped lesson treatments (1day)	$250
Rental of video camera and supplementary equipment (14 days x $75/day)	$1,050
Room for each of the treatments and pre/post-tests to be administered	
3 days at NTID and 3 days at Gallaudet ($250/day)	$1,500
Development and printing of pre/post-tests	$500
Copy costs for pre/post-tests	$300
Additional materials needed	$500
Subtotal	**$____**
Overhead	
Rated at 39% of salaries or 8% of total line item budget	$____
Total	$____

This project will require monetary support for the three main personnel, Rowley, Kelly, and Mousley that will be comparable to daily amount of pay at respective work places. There is also a need for monetary support for transportation and related travel costs when implementing the initial stages of the project involving observations and videotaping of various teachers of the deaf. Monetary reimbursement will be needed for the panel of deaf and hearing sign language specialists who will analyze the videos from the initial teacher observations and also for the teachers who are recorded for the three treatment videos. Students who are selected for the treatment phase of the project will each be paid a stipend.

Equipment needed would be a video camera, a studio room to record the treatment videos in, and a whiteboard with a black dry erase marker, all of which will be provided for us by NTID for short-term use. A room will be needed to administer the pre-test, implement the video treatments, and administer the post-test to each group at both NTID and at Gallaudet. Additional funds will be secured for any additional expenses that arise during the course of the project.

There is great potential for continued support on this project as this type of research can be done in various other content areas, such as English, science, social studies, life skills, and more. Similar research can also be done on various grade levels to see which level of teacher ASL skill and knowledge results in the most effective learning. One other type of research that may prove to be worthwhile is a longitudinal study of either the same level of teacher ASL skill and knowledge used over multiple years, or a combination of the various levels used over multiple years.

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