

Effects of learning style and teaching strategies  
on knowledge of medical procedures

by

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## INTRODUCTION

During the past ten years, technological advancements in medicine have affected the field of early childhood special education. In the neonatal intensive care units across the country, neonatologists are saving the lives of more premature infants (Blackston, 1987). Twice as many very-low-birthweight infants (under 1500 grams) are surviving now as compared to 1960 (Blackston, 1987; Office of Technology Assessment, 1987). Many of these infants are released from the hospital still dependent upon the medical technology that saved their lives. With the aid of this technology, these children live longer today than previously anticipated (Goldberg, Faure, Vaughn, Snarski, & Saleny, 1984; Masters, Cerreto, & Mendlowitz, 1983; Perrin, Ireys, Shayne, & Moynihan, 1984; Stein & Jessop, 1984). About 20% of the infants from neonatal intensive care units have special needs (Healy, 1986). Dependent upon technology and in need of special education, these children are considered medically fragile.

The term medically fragile itself is obscure. Walker (1984) uses this term to refer to chronically ill children in schools and includes the child with normal intelligence and the handicapped child. Still other authors use the term medically fragile to refer to children needing special education in addition to intensive medical support (Edens et al., 1986; Viadero, 1987). This ambiguity confounds any attempt to estimate the size of the population. The majority of the literature reviewed records the incidence of medically fragile children between 5% and 20% of all children in the United States

(Gortmaker & Sappenfield, 1984; Haggarty, 1984), and it is generally agreed that this figure is on the rise. However, Viadero states no one has produced a reliable estimate of the number of medically fragile children.

These medically fragile children are initially served at home if they are in need of special education services. While children are in the home, parents carry out the necessary medical procedures (Blackston, 1987; Eiser & Town, 1987; Masters et al., 1983). When these children reach 3 years of age, they are eligible for classroom programs which means that the procedures required by children during school hours must be done by school district personnel (Blackston, 1987; Walker, 1984; Wood, Walker, & Gardner, 1986).

Questions regarding who should carry out these procedures in the schools have been addressed in the court system (Lilley & Shotel, 1987). Davis (1986) states, in the case Tatro versus State of Texas, that the United States Supreme Court ruled that Texas' Irving Independent School District had to provide clean, intermittent catheterization to Amber Tatro. This decision has been reinforced and broadened in other court cases (Edens et al., 1986). Edens et al. state that the reinsertion of a tracheostomy tube and other procedures such as ventilator monitoring and mucus suctioning are procedures necessary to insure the child's safety and are reasonably provided by school personnel. These children do have special needs that must be met in the classroom.

There is no doubt that medically fragile children are presently being served and will continue to be served by early childhood special

educators in homes and classrooms across the nation. The question remaining is how the medical needs of the children will be met. Currently, educators are not trained to perform at school the medical procedures being performed by the childrens' parents at home (Wood et al., 1986). Few materials on medical procedures are available to educators. A review of commercially available textbooks and audio-visual materials produced sparse results on only a few procedures (Bailey & Worley, 1984; Batshaw & Perrot, 1981; The Human Services Training and Technical Assistance Clearinghouse, 1986; Jones, 1985).

The State Department of Education in Iowa has recently formed a state task force to investigate issues involved in educating the medically fragile child. This task force is the outcome of the State Plan Advisory Council for Early Services. Through a survey completed by early childhood special educators, the advisory council identified a critical need in the state for increased knowledge of medical issues (Clary, Czach, & Pike, 1987). About 40% of teachers responding to the survey indicated a need for increased medical knowledge. It is clear educators are requesting information. There is the need to increase knowledge of procedures as well as the ability to implement these procedures. It is also apparent that publishers are not meeting these needs.

In summary, the literature has established the growing incidence of medically fragile children (Abbasi et al., 1984; Wood et al., 1986). Educational services to these children have been mandated by P.L. 94-142 (Garwood, 1986; Walker, 1984). Yet, many questions remain.

How will these children be served? How will their medical needs be met in the educational setting? The purpose of this study was to develop methods to train teachers serving medically fragile children. It was anticipated that a field test of such procedures would give future teachers a knowledge base from which to draw upon when serving a medically fragile child. In addition, this information might also be helpful to teacher trainers developing curricula for future teachers.

## LITERATURE REVIEW

## Medically Fragile: A Definition

The term medically fragile connotes a variety of perceptions. Bricker (1985) feels that there are dramatic differences within the medically fragile population and that great diversity exists in the definitions of this population. Walker (1984) uses the term "chronically ill" and focuses on the child with a serious medical condition such as diabetes, cystic fibrosis, asthma, spina bifida and muscular dystrophy. Other authors (Goldberg et al., 1984; Kleinberg, 1982) describe a population of chronically ill children with other handicapping conditions such as mental retardation. They conclude these children are medically unstable and require one or more major diagnostic or therapeutic interventions on a routine basis. Finally, the Office of Technology Assessment (1987) published a manual on the technology-dependent child which included all of these definitions. One definition that appears to be emerging from the literature is taken from the Office of Technology Assessment as follows:

"....one who needs both a medical device to compensate for the loss of a vital body function and substantial and ongoing nursing care to avert death or further disability" (p. 13).

The lack of conformity in defining medically fragile makes it difficult to estimate the size of the population. Wood et al. (1986) estimate the incidence of children with special medical needs to be between 5% and 20% of the general school population. This confirms the earlier findings of Gortmaker and Sappenfield (1984). In 1987,



the Office of Technology Assessment stated there were approximately 17,000 children dependent on technology. This does not include the chronically ill child as defined by Walker (1984). Currently, a reliable estimate of this population does not exist (Viadero, 1987). While there is disagreement regarding the definition and the size of the medically fragile population, the Office of Technology Assessment looked at four different segments of this population and found that each segment has increased and is continuing to increase. The Iowa state task force assigned to investigate issues regarding the education of medically fragile children is presently attempting to measure the size of this population in Iowa.

#### Educational Services

Prior to 1975, children with severe and profound disabilities, such as the medically fragile child, were not the responsibility of the public school system. Many of these children did not survive the neonatal period. Those who did survive remained in institutions (Blackston, 1987; Masters et al., 1983). Walker (1984) stated these children were either excluded, or received inappropriate and incomplete educational services. The Office of Technology Assessment (1987) concluded the technological advancements of the 1980s allowed medically fragile children to return to their home environment. As research accumulated which indicated that the course of developmental disabilities might be altered, support was given to intervention for these children. Management of the child's environ-

ment was viewed as one method to overcome biological predispositions to failure, and, thus, professionals sought to effect change through early intervention. As a result of public interest, the government began to support programs affecting education and child development (Guralnick, 1982).

From this movement concerning early intervention, Public Law (P.L.) 94-142 was conceived. This law reflects the assumption that all children can benefit from education. Noonan and Reese (1984) view at least partial impetus behind P.L. 94-142 as two court cases. These cases argued that the denial of public education violated constitutional rights of equal protection, statutory law and due process. Children were excluded from school on the premise that they were incapable of benefiting from a program of instruction. The courts ruled that all children were capable of benefiting from an education program of instruction and training techniques and that children could not be discriminated against because of their handicap. The end result was a series of legislative acts insuring this. Section 504 of the Rehabilitation Act of 1973 (P.L. 93-112) and its amendments in 1978 (P.L. 95-602) guarantee that a person cannot be discriminated against solely on the basis of their handicap. Then, in 1975, the Education for All Handicapped Children Act (P.L. 94-142) gave the financial assistance for each state to provide education for all children regardless of their disability (Noonan & Reese, 1984). This law provides for both educational services and related services needed by the child to benefit from the educational program.

With the financial impetus in place, each state began to interpret

these laws and develop their own guidelines and model programs. Professionals in the field of special education drew from their psychology and educational background to develop programs (Lehr & Haubrich, 1986). The resulting curricula were primarily based on a normal developmental model. Consequently, programming for a profound medically fragile child might be based on Piaget's theory regarding independent exploration as a premise to learning. Lehr and Haubrich feel this is not state-of-the-art programming for a child with limited mobility. Furthermore, they suggest state-of-the-art programming might include such things as education in schools attended by nonhandicapped children of the same age; a curriculum that might include the domains of domestic, leisure, community, communication, socialization and interaction; and, finally, the opportunity to learn skills in the environment in which they may be used. Tawney and Sniezek (1985) conclude that the current body of literature on the education of severe and profoundly handicapped children is limited to philosophical and curricular arguments and is not adequately supported by research.

In addition to the apparent lack of research upon which to base models and assumptions, professionals face yet another problem in the interpretation of the various aspects of P.L. 94-142. One of the issues currently being addressed by the court system is the term related services as it pertains to medically fragile children. When services for very young children are mandated by state law, medically fragile preschool children are initially served at home if they are in need of special education services. While children are in the home, parents carry out the necessary medical procedures. When these

children reach 3 years of age, they are eligible in many states for classroom programs which means these procedures must be completed at school. Questions regarding who should carry out these procedures in the schools and whether or not these procedures fall under the guise of related services have been addressed in the legal system.

#### Court Rulings

The most frequently cited case is the Irving Independent School District vs. Tatro (1984). This case has set a precedent in the definition of related services. Appeals were made by both parties at the various levels of the district court until the final decision was passed down by the United States Supreme Court. The Supreme Court ruled that Texas' Irving Independent School District had to provide clean, intermittent catheterization to Amber Tatro (Davis, 1986). This allowed Amber (a child impaired by spina bifida) to remain at school during the entire day. The Court opened the way for a broad interpretation of the related services clause. With this ruling, restrictions were placed on the types of services which could be withheld on the premise that they were medical services and not related services.

This decision has been reinforced and broadened in other court cases (Edens et al., 1986). In the Department of Education, State of Hawaii vs. Dorr (1984), the United States Court of Appeals for the Ninth Circuit stated that the Department of Education was responsible for tuition for Katherine Dorr since they had refused to provide a

public school placement. Katherine had cystic fibrosis and tracheomalacia which caused her windpipe to be floppy instead of rigid. Katherine breathed through a tracheostomy tube and needed emergency health intervention from time to time. The school district offered to provide only speech therapy and parent counseling to the family. At that time, Katherine was enrolled in a private child care center and her health needs were met by her mother during school. The family rejected this proposal based on the fact that Katherine was demonstrating ability to function in a classroom placement at the private child care center. The following school year, the school district placed Katherine in a special education classroom in the public school. Katherine's doctor trained the school staff in the necessary emergency health services for Katherine. He noted great reluctance on the part of the staff and recommended that the family not place Katherine in the public school setting. The Court ruled that the law assures every handicapped child the right to a free appropriate public education and the related services necessary to access this environment. They concluded that the need for care of the tracheostomy falls under school health services and must be provided by the school nurse or another qualified person.

In yet another case similar to the Tatro case, the United States Court of Appeals for the Third Circuit concluded that requiring Amber Tokarcik's mother to provide clean, intermittent catheterization in the school setting was not appropriate. In Tokarcik vs. Forest Hills School District (1981), the school district had asked that the mother continue catheterization during school

hours so Amber could remain in school. The district contended that Pennsylvania law did not require school nurses to catheterize students. The parents refused this option so the district offered to provide home tutoring. The Court ruled that this was in violation of the free and appropriate public school education due Amber and that clean, intermittent catheterization be carried out in school by the school nurse or other trained designee.

In two other cases, the Court did attempt to limit the scope of related services. In New York, the Commissioner of Education ruled that it was not the responsibility of the City School District of the City of Auburn to hire a nurse to monitor one child's health. This child was born with an incomplete diaphragm and abnormally developed lungs. The medical problems created by these conditions included pulmonary hypertension, borderline congestive heart failure, pulmonary fibrosis and gastro-esophageal reflux. This child breathed with the assistance of a ventilator through a tracheostomy and was fed and received medication through a gastrostomy tube. In addition, frequent suctioning of the lungs and throat and cardio-pulmonary resuscitation were necessary. The severity of the problems necessitated constant monitoring and accessibility to a person trained in life saving techniques. Due to changes in the financial arrangement between the family and the Department of Social Services, the family contended that the school district should hire a nurse to accompany their child to and from school and attend to the child's needs. The child could not attend public school without this service, thus, the family concluded that this fell under the guidelines of related

services and should be provided by the school district. The United States Court of Appeals for the Second Circuit stated that this case was qualitatively and quantitatively different from the Tatro case. The care this child needed was considered skilled nursing care and not within the realm of related services. Thus, in Detsel vs. the Board of Education of the Auburn Enlarged City School District (1986), the Court found in favor of the school district. Again affirming this decision in a 1986 case, the Court concluded that the level of the skill and the frequency far exceeded that of a support service. Therefore, the school district need not provide a nurse under the auspices of related services.

In conclusion, recent court rulings have interpreted the term related services to include the necessary medical procedures to allow a child to access the educational setting. There is no question that medically fragile children will be in the public schools. It is also apparent that public school personnel will be responsible for carrying out the necessary medical procedures required by the children during school hours. Therefore, it is evident that effective training procedures to increase knowledge of medical issues, as well as the ability to implement such procedures, is essential.

#### Process for Training

Since training of the various medical procedures must occur to accommodate medically fragile children in public schools, it is important to identify the best process for training. For each medically

fragile child, the content is so critical that it is mandatory the training materials be as effective as possible.

To determine optimal training techniques research, literature on instructional strategies and learning style provides the background necessary. Didactic techniques such as lecture are generally used to convey information at the preservice level. Sometimes the use of audio-visuals are added in an effort to facilitate learning. Yet, much of the literature states other techniques are more facilitative of learning. Hutson (1981), in his discussion of inservice techniques, condones the use of active learning, self-instructional techniques, demonstrations, freedom of choice and situations similar to real life. He states that most teachers employ problem-solving as their preferred learning style. This learning style responds well to active learning, self-instruction, demonstrations and supervised trials and feedback.

All of these inservice techniques discussed by Hutson (1981) relate to learning as a process, in addition to stressing the characteristics of the learner. Students learn more efficiently when the method of teaching closely approximates their individual learning style (Davidman, 1984). Atkins (1978) concludes that most students can learn 90% of the material 90% of the time if the method and media used are adjusted to the students' learning style. Therefore, if students are taught according to their style, they are more likely to learn.

Many authors (Atkins, 1978; Blai, 1982; Kolb, 1981; Sprinthall & Theis-Sprinthall, 1983) feel the method of teaching interacts with the personality of the student being taught and produces different



learning results. In addition, Kolb states that people develop definite styles that emphasize some learning abilities over others. For example, he defines four learning styles. They are Concrete Experience, Abstract Conceptualization, Active Experimentation and Reflective Observation. A person with a high score in Active Experimentation learns best when engaging in activities as opposed to listening to a lecture. However, a person with a high score in Reflective Observation prefers learning situations such as lecture. A person with a high score in Abstract Conceptualization learns best in a directed and impersonal learning environment. Finally, a person with a high score in Concrete Experience learns best through specific examples in which they can become involved. It is important to consider these learner characteristics as well as process in order to match the students' learning style to the most effective teaching method. Finally, training should respond to an assessed need (Hutson, 1981).

#### Summary

School districts are attempting to make decisions about the education of medically fragile children. Lehr and Haubrich (1986) conclude it is important first to determine if the related service is necessary for the child to benefit from special education. If it is necessary, then it must be determined if the service can be provided in such a way that neither highly specialized training or knowledge is required. Whether or not a service is excluded is

determined by who provides the service and not the type of service provided (Vitello, 1986). Thus, it appears that each decision needs to be made on an individual basis.

The implications are numerous. Early childhood special education teachers are planning programs for a wider range of children than in the past. Teachers are being forced to become acquainted with medical procedures and personnel and to seek pertinent information in a manner that is relevant to the needs of the children. Early childhood special education teachers must become advocates for children in the field of education, medicine and governmental policies.

In summary, the research has focused on various segments of this population and the appropriate educational intervention. However, there is no doubt that medically fragile children are presently being served and will continue to be served in early childhood special education classrooms across the nation. It is now important for educators to determine the best training methods to prepare future teachers to meet the expanding needs of medically fragile children.

## PURPOSE

The purpose of this study is to develop training materials for medical procedures and conduct field tests to see if these procedures are effective. This study will address learning style of the participants as well as training approaches. It is hypothesized that the training materials developed will increase the knowledge of medical procedures for the subjects in the study. In addition, the process used to train subjects in medical procedures will make a difference. The addition of videotaped instruction will enhance the level of knowledge. Finally, this researcher hypothesizes that learning style will interact with the process. Generally, those subjects preferring a more concrete or active learning style will exhibit larger gains on the posttest as a result of the videotaped instruction. Those subjects preferring a more abstract or reflective learning style will exhibit larger gains on the posttest as a result of the lecture.

## METHODS

## Human Subjects Approval

The Iowa State University Committee on the Use of Human Subjects in Research reviewed this project and concluded that the rights and welfare of the human subjects were adequately protected, that risks were outweighed by the potential benefits and expected value of the knowledge sought, that confidentiality of data was assured and that informed consent was obtained by appropriate procedures.

## Subjects

Subjects were undergraduate students recruited from the Colleges of Education and Family and Consumer Sciences at Iowa State University. Seven professors agreed to distribute a letter explaining the research study and a consent form to undergraduate students in the following courses: Elementary Education 360 and Child Development 102, 129, 255, 371X, and 455. In addition, six of the seven professors agreed to award extra credit points for satisfactory completion of the research project. A total of 108 undergraduate students agreed to participate by returning their signed consent forms to their professor. Of these subjects, 73 completed all phases of the research project. Subject characteristics, including sex, major and year in school are listed in Table 1.

Over half of the subjects professed to be future teachers with 23% (n = 17) of those reporting a major in special education. Some

Table 1. Subject characteristics

	Lecture Group 1		Video Group 2		Control Group 3		Total	
	Number	%	Number	%	Number	%	Number	%
<b>Sex</b>								
Male	0	0	3	12	0	0	3	4
Female	21	100	21	88	28	100	70	96
<b>Year in school</b>								
Freshman	5	24	7	29	5	18	17	23
Sophomore	4	19	1	4	7	25	12	16
Junior	10	48	7	29	10	36	27	37
Senior	2	9	9	38	6	21	17	23
<b>Major</b>								
Child Development	5	24	5	20.8	5	18	15	20
El Ed	5	24	9	37.5	7	25	21	29
Sp Ed	5	24	5	20.8	8	28.5	18	25
Other	6	28	5	20.8	8	28.5	19	26

subjects stated previous knowledge of the content areas through classes and experience in the medical and special education fields. A total of 63% of all subjects reported having taken fewer than five courses, while 23% reported having taken five or more courses pertaining to special education. In addition, 67% of the subjects reported fewer than five experiences, while 1% reported five or more experiences in the medical and special education fields.

#### Training Content

An informal telephone survey was conducted of the 15 Area Education Agencies in Iowa to determine which medical procedures were required most often. This survey revealed that suctioning and tube

feeding were the most common procedures being performed by school district personnel in Iowa. Consequently, training materials were developed on the medical procedures for tube feeding and suctioning.

The training video tape on suctioning and tube feeding was developed with the cooperation of two families from the central Iowa area. The two families were contacted by phone initially to determine their willingness to participate. A letter describing the purpose of the study and the use of the video tape was sent to each family. The families expressed their intent to allow a video tape to be made of their children and viewed for the purpose of training by signing the consent form.

#### Instruments

Data were collected from four sources: learning style inventory, demographic form, and pretest and posttest on the medical procedures for tube feeding and suctioning. The Learning Style Inventory (Kolb, 1976) was used to assess the learning style of each subject. All other instruments were developed by the investigator.

#### Learning style

Kolb (1976) states "The learning style inventory is a simple self-description test, based on experiential-learning theory" (p. 2). It is designed to measure strengths and weaknesses of each individual. The Learning Style Inventory designed by Kolb consists of nine sets of words listed in four columns. The individual is instructed to rank each word by assigning a numerical value according to how well

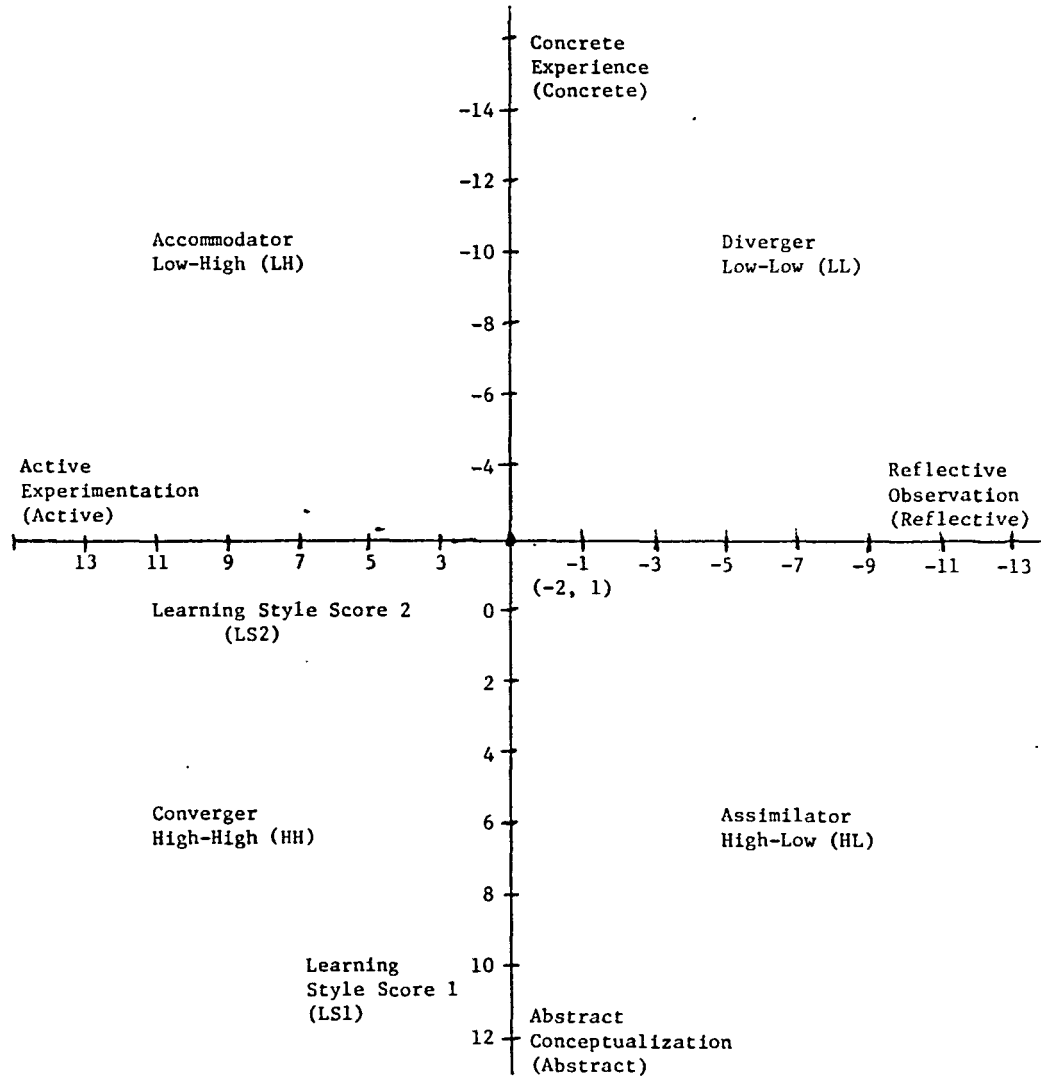
the individual thinks that word fits with how the individual would go about learning something. Each row of words is given a numerical ranking from one to four. A word receiving a numerical value of four describes how that individual learns best, whereas a word receiving a value of one describes the learning characteristic that is least like the individual. The inventory was scored by adding predetermined rows in each of the four columns. These four columns result in one score in each of the following areas: Concrete Experience, Reflective Observation, Abstract Conceptualization and Active Experimentation (CE, RO, AC, AE). These four scores are then subtracted in the following manner: AC-CE and AE-RO. A positive score on the AE-RO equation indicates the individual's style is more active, whereas a negative score indicates the individual's style is more reflective. A negative score on the AC-CE equation indicates more Concrete learning style as opposed to a positive score which would indicate a more Abstract style. These two scores may be used to determine into which quadrant the individual's preferred style of learning falls. The four quadrants are identified as Accommodator, Diverger, Converger and Assimilator. These four styles indicate whether the learner (a) emphasizes the use of ideas or theories in a practical manner (Converger), (b) views concrete situations in many ways (Diverger), (c) consolidates a wide range of information into a logical form (Assimilator), or (d) learns primarily from hands on experiences (Accommodator). The Learning Style Inventory is included in Appendix A. The reliability and validity was adequate for the purpose of this study (Kolb, 1976).





A graphical representation of the learning style quadrants appears on page 20c. Learning Style Score 1 (LS1) is represented by the vertical axis. This score indicates whether a person is more abstract or concrete in their approach to learning. The horizontal axis denotes the continuum for Learning Style Score 2 (LS2). This axis represents a reflective versus active learning style. Using LS1 and LS2 medians, each subject was categorized into one of the four learning style quadrants. To achieve equal numbers of subjects in each quadrant, three subjects falling on the median score were randomly moved and two subjects were discarded. Each quadrant then included 18 subjects. The quadrants were named Low-High (LH), Low-Low (LL), High-High (HH), and High-Low (HL). The first word represents the score a subject receives on LS1, while the second represents the score a subject receives on LS2. A subject scoring in the LH quadrant received a low LS1 score (Concrete) and a high LS2 score (Active).

Learning Style Quadrants



### Demographic form

In addition, questions were included on the demographic form which provide information on each subject such as previous experience or classes related to the research project. The demographic form was attached to the Learning Style Inventory and is included in Appendix A.

### Pretest and posttest

These instruments were written objective tests designed to measure the subjects' knowledge of tube feeding and suctioning. Each test contained 43 multiple choice questions regarding these two medical procedures. The tests included questions regarding factual information such as "A rubber Foley catheter is used for \_\_\_\_\_?" as well as process and procedural information such as "When tube feeding a child, one should follow these steps." A field test was conducted to insure that the questions were readable and understandable prior to this study. Six individuals not included in the study were asked to take the test and discuss their understanding and interpretation of the test. The same questions were used for both the pretest and posttest. Reliability (KR-20) was estimated for all three groups on the pretest to be 0.34 and on the posttest to be 0.74. The test is included in Appendix A.

## Procedure

### Pretest

Subjects were instructed to complete the pretest by checking out a test form and completing that form in the Child Development Office at some point during a two-week time period. All subjects completed the pretest in approximately 40 minutes.

After all subjects had completed the pretest, they were randomly assigned to one of three treatment groups. Three weeks after the completion of the pretest, treatment occurred in the following manner for each of the three groups.

### Group 1

Group 1 was trained on two medical procedures: tube feeding and suctioning. The training consisted of a lecture, diagrams, and written descriptions of the two procedures. These training materials were compiled from a variety of sources (Hamilton, 1985; Jones, 1985; Brunner & Suddarth, 1982; Western Hills AEA). Each subject in Group 1 received a packet containing a step-by-step description of how to perform the two procedures. The packet also contained diagrams of gastrostomy, jejunostomy and duodenostomy tubes and a diagram of a suctioning machine. In addition to the handouts, a lecture detailing the tube feeding and suctioning procedures was delivered by this researcher. The lecture included the general purpose of each procedure, equipment needed, the step-by-step procedure and the possible medical complications. Lecture notes

and examples of the handouts are included in Appendix B. The training session lasted one hour.

### Group 2

The subjects assigned to this group received the same diagrams and written descriptions of the two procedures as Group 1. Group 2, however, viewed a video tape where an individual demonstrated with a child the two procedures, tube feeding and suctioning. These demonstrations contained the same information as the lecture given to Group 1. The handouts and video tape script are included in Appendix B. The training session lasted one hour.

### Group 3

This group received no training.

### Posttest

Five weeks after the training sessions concluded, all subjects completed the posttest. The questions on the posttest were in the same order as they had been on the pretest. All subjects finished the posttest on the specified date. Each subject completed the Learning Style Inventory and demographic form at that time.

## RESULTS

## Data Analysis

The data were analyzed using a multiple regression model with the posttest scores serving as the dependent variable. In the full model, pretest score, learning style score 1 and 2 as measured by Kolb's Learning Style Inventory (1976), and the interaction of each learning style score with treatment group were the independent variables. The median for the two learning style scores was used to divide all subjects equally into the four learning style quadrants to produce three coding variables as alternatives to the independent but continuous learning style 1 and 2 variables for a later post hoc analysis. Four models were included to view the effects of the independent variables. Model 1 included only the pretest, continuous learning style scores and the interaction of those learning style scores with treatment groups in order to test the additional effects of treatment group membership of the full model on posttest scores. Model 2 was compared with the full model to test the effect of treatment by learning style interaction. It included only treatment group, pretest score and the learning style scores as predictors of posttest scores. Model 3 was used to test the main effects of learning style and included treatment group, pretest score and the interaction of learning style and treatment. Model 4 was used to test the effect of pretest scores on posttest scores and included all variables of the full model except pretest. The squared multiple correlations of Model 1 through 4 described above were compared to the full model to

determine if they were significantly different. A post hoc comparison was made to determine the specific effects of group membership, i.e., the control versus the combined treatment groups, using the Scheffé method. Means were reported for all variables. Posttest means were also plotted for treatment groups. Posttest means were plotted for subjects categorized by high learning style scores or low learning style scores on each of the learning style measures. Finally, the data were analyzed using a two-way analysis of covariance with posttest scores serving as the dependent variable, and the classification of Low-Low, Low-High, High-Low, and High-High learning style scores as the independent variables, and the pretest serving as the covariate. Treatment effects were not examined in this analysis.

#### Treatment Effectiveness

A multiple regression analysis was used to determine the significance of pretest score, learning style score 1 and 2, and the interaction of each learning style score with training condition as predictors of posttest score. In the full model, pretest scores were significantly related to posttest scores,  $F(9, 63) = 25.59$ ,  $p < .0001$ . Learning style score 2 and the interaction of learning style score 2 and training condition were the other variables that were significantly related to posttest score,  $F(9, 63) = 13.99$ ,  $p < .0004$ ,  $F(9, 63) = 10.98$ ,  $p < .0015$  and  $F(9, 63) = 4.67$ ,  $p < .0345$ , respectively. Subsequent models were included to view the effects of each of the independent variables. The squared multiple correlations of each of the models

were compared to the full model to determine if they were significantly different. Appendix F includes the squared multiple correlations.

#### Model 1

Model 1 tested the additional effects of treatment group membership of the full model on posttest scores. It included only the pretest, continuous learning style scores and the interaction of those learning style scores with training condition. Again in this model, pretest scores were significantly related to posttest scores,  $F(7, 65) = 20.77, p < .0001$ . In addition, learning style score 2 and the interaction of this variable with training condition emerged as significant predictors of posttest score,  $F(7, 65) = 12.09, p < .0009$ ,  $F(7, 65) = 7.89, p < .0065$  and  $F(7, 65) = 7.90, p < .0065$ , respectively. The squared multiple correlation comparison of the full model with Model 1 determined that the effect of training condition made a significant contribution in predicting posttest scores,  $F(2, 63) = 14.16, p < .05$ . Pretest scores were significantly correlated with posttest scores ( $r = .46, p < .0001$ ).

#### Model 2

Model 2 tested the effect of training condition by learning style interaction. This model included training condition, pretest score and the learning style scores as predictors of posttest scores. In comparing the squared multiple correlations of the full model and Model 2, the interaction effects of learning style and training condition were found to be significant,  $F(4, 63) = 2.97, p < .05$ .



Learning style score 2 and pretest score made significant contributions to this model,  $F(5, 67) = 3.51$ ,  $p < .0655$  and  $F(5, 67) = 26.33$ ,  $p < .0001$ , respectively.

### Model 3

Model 3 contained training condition, pretest score and the interaction of learning style and training condition to test the main effects of learning style. Pretest score made a significant contribution to the model,  $F(7, 65) = 27.02$ ,  $p < .0001$ . The interaction of learning style and training condition were not significant predictors in this model. However, in comparing the squared multiple correlations of the full model and Model 3, significant differences were noted,  $F(2, 63) = 6.99$ ,  $p < .05$ . It was determined that learning style had a main effect.

### Model 4

Model 4 included all variables of the full model except pretest. This model was used to test the effect of pretest scores on posttest scores. Learning style score 2 and its interactions with treatment were the most significant predictors in this model,  $F(8, 64) = 13.68$ ,  $p < .0005$ ,  $F(8, 64) = 9.06$ ,  $p < .0037$  and  $F(8, 64) = 5.56$ ,  $p < .0215$ , respectively. In comparing the squared multiple correlations of the full model and Model 4, pretest score was the most significant predictor of posttest score,  $F(1, 63) = 25.59$ ,  $p < .05$ .

Figure 1 shows changes in the mean scores on pretest and posttest for the three training conditions. Pretest scores for the three conditions were not significantly different; however, posttest

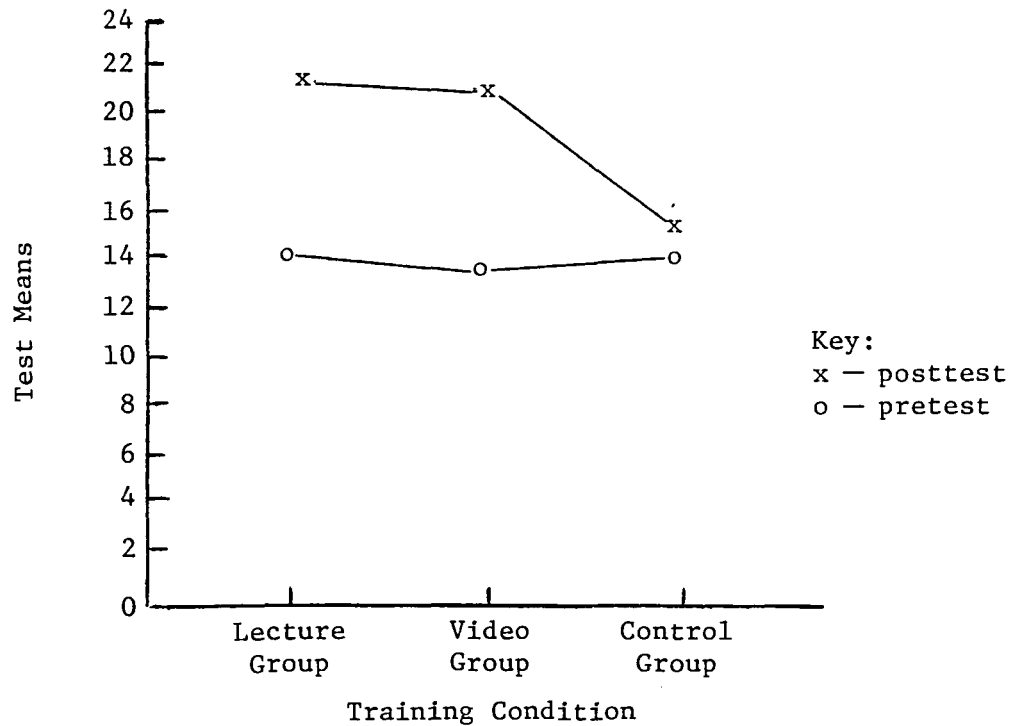


Figure 1. Pretest/posttest means by training condition

scores for the control group were lower than the scores of each of the two training conditions. There were no significant differences in the posttest scores between the two training conditions. Subjects in the lecture group exhibited similar posttest scores as subjects in the video tape group. Post hoc comparison using the Scheffé method yielded significant differences at the .05 level between the posttest scores of the combined training conditions and the control group. Table 2 includes descriptive statistics for pretest and posttest scores for each training condition.

Table 2. Pretest/posttest statistics by training condition

	N	Pretest		Posttest	
		M	SD	M	SD
Lecture	21	14.43	4.02	21.45	5.06
Video	24	13.92	3.49	21.22	6.12
Control	28	14.00	3.30	15.22	3.55
Combined	73	14.1	3.51	18.97	5.68

#### Effects of Learning Style

The median score on the two scales of Kolb's Learning Style Inventory (1976) were used to classify subjects into the four learning style categories. Subjects with scores above the median on the Abstract/Concrete scale were classified as having an Abstract learning style, while those below the median were classified as having a Concrete learning style. On the Reflective/Active scale, subjects with scores above the median were classified as having an Active learning style, while those below the median were classified as having a Reflective learning style. The effect of Abstract versus Concrete learning style (LS1) on posttest scores is illustrated in Figure 2. As hypothesized, those subjects scoring high on LS1, or preferring a more Abstract style, exhibited higher posttest scores as a result of participating in the lecture group. It was anticipated that those subjects scoring low on LS1, or preferring a more Concrete style, would exhibit higher posttest scores as a result of participating in

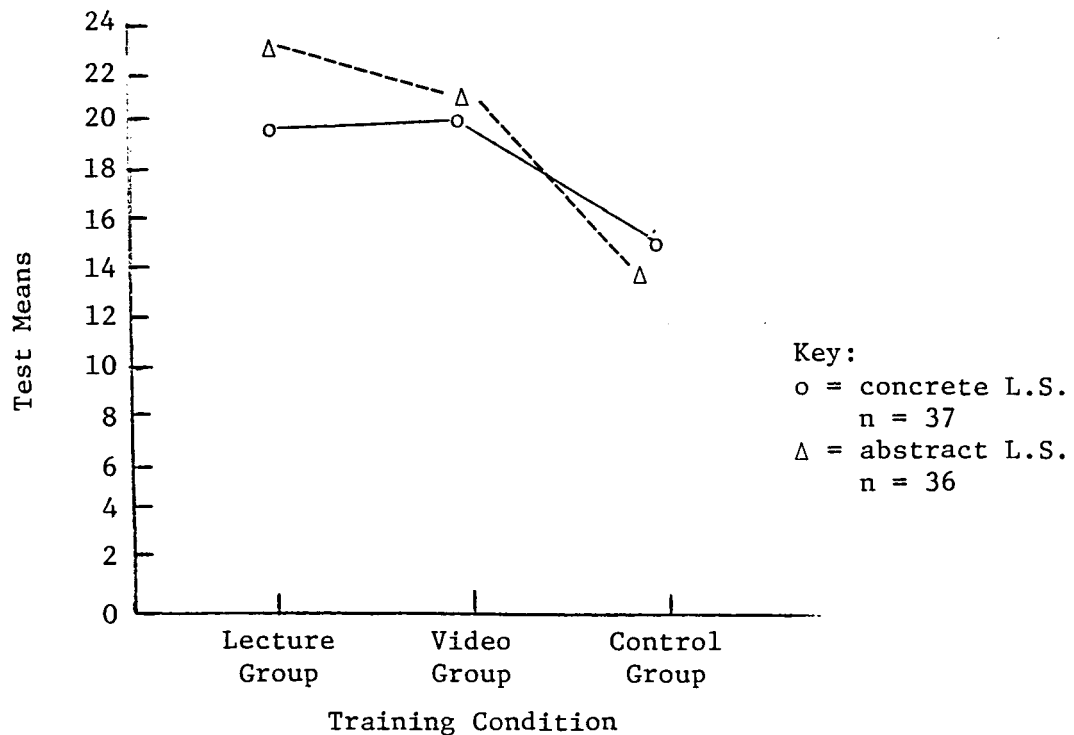


Figure 2. Posttest means by learning style score 1

the video training session. However, subjects in the video training condition preferring a more concrete style demonstrated posttest scores similar to the subjects preferring a more abstract style from that group.

Figure 3 shows the effect of Reflective versus Active learning style (LS2) on posttest scores. Subjects in the lecture group indicating a preference for a more Reflective learning style, or a low LS2 score, exhibited higher posttest mean scores than subjects preferring a more Active learning style, or high LS2 scores. Members of the video group scoring high on LS2, or preferring a more Active style, did exhibit greater posttest gains as a result of participating in the video training as predicted. It was anticipated that subjects

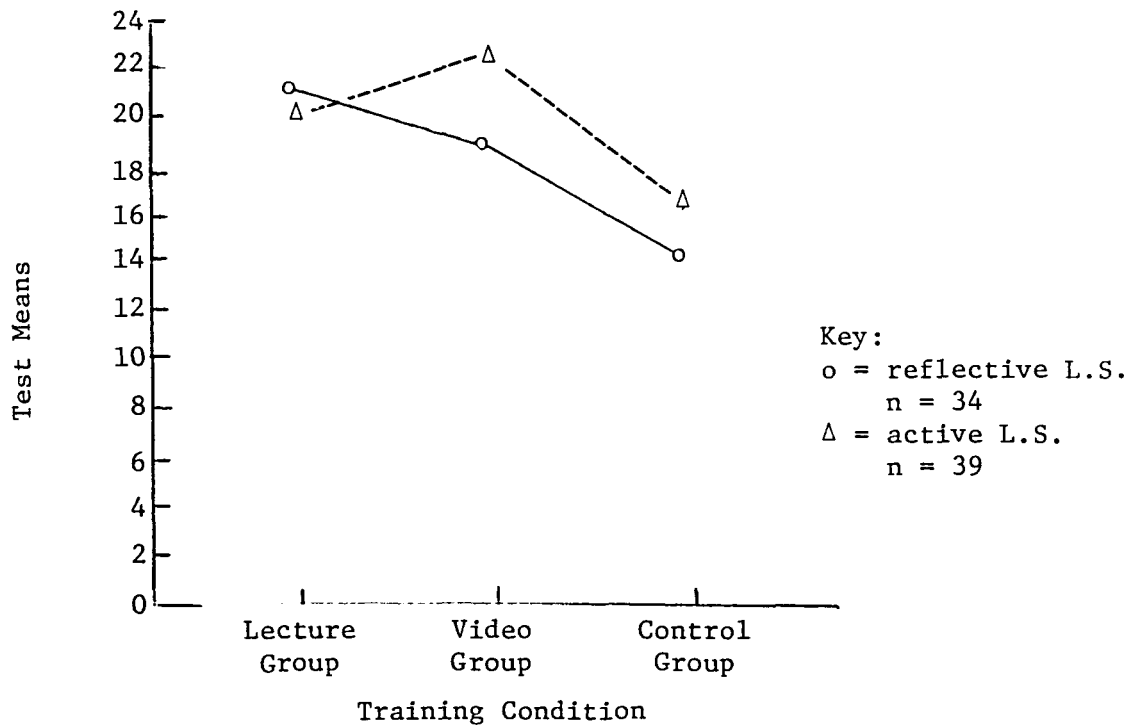


Figure 3. Posttest means by learning style score 2

preferring a Reflective learning style would demonstrate greater posttest mean scores in the lecture group than in the video group.

The multiple regression model was used to determine whether the proportion of variance accounted for by LS1 and LS2 was significant. A comparison of the squared multiple correlation between the full model and the model testing the effect of learning style produced significant differences,  $F(2, 63) = 6.99$ ,  $p < .05$ . However, findings from the full multiple regression model indicated that LS1 did not make a significant contribution to the model, but indicated that LS2 accounted for a significant portion of the variance,  $F(9, 63) = 13.99$ ,  $p < .0004$ . Learning style did exhibit a main effect as seen in

Figures 2 and 3. The means, medians, and standard deviations for Learning Style are reported in Table 3.

Table 3. Statistics used to determine learning style group membership

	M	SD	Median
Lecture group			
LS1	-2.24	5.33	-3.00
LS2	1.33	6.26	3.00
Video group			
LS1	-2.52	4.92	-2.76
LS2	1.00	5.68	1.00
Control group			
LS1	0.38	4.99	0
LS2	1.08	6.25	2.00
Overall			
LS1	-1.49	4.99	-2.52
LS2	1.12	5.76	1.00

#### Interaction Effects

The interaction effects of learning style and training condition on posttest scores was found to be significant,  $F(4, 63) = 2.97$ ,  $p < .05$ . Again, LS2 itself and in the interaction with training condition accounted for a large amount of variance in the full model. The median for the two learning style scores was used to divide all subjects equally into the four learning style quadrants to produce three coding variables as alternatives to the continuous learning style variables. Figure 4 displays the posttest means for each of the three training conditions in each of the four individual learning style

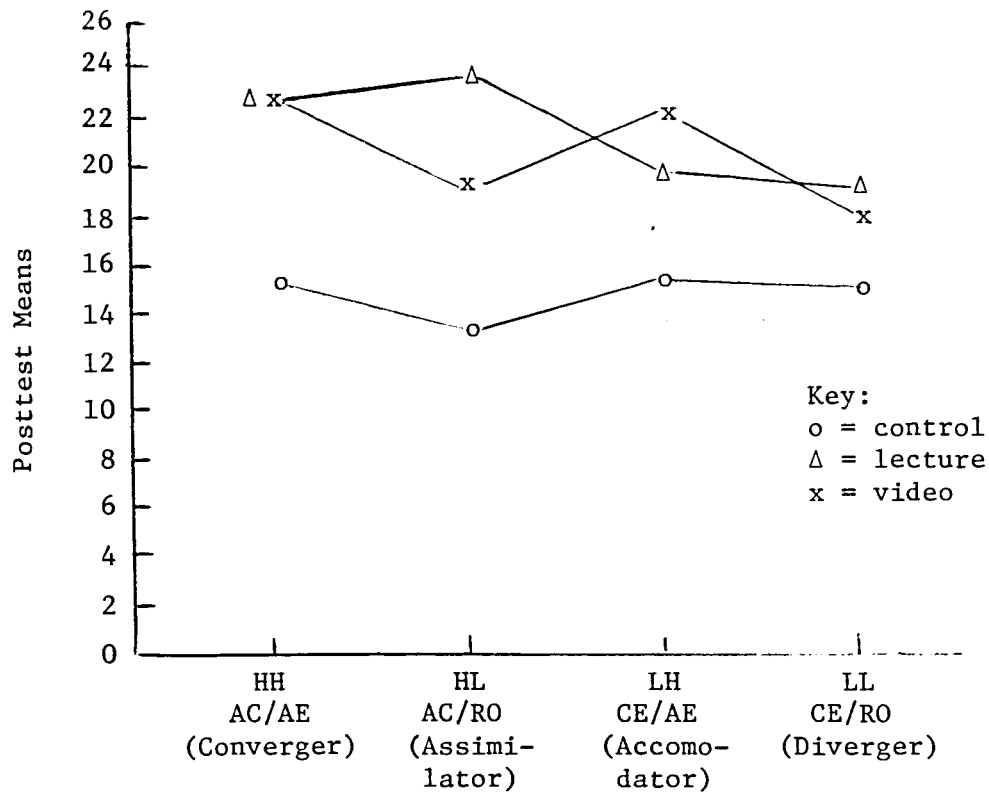


Figure 4. Learning style quadrants

quadrants as determined by learning style medians. Each of the four quadrants had 18 subjects in it. As can be seen from the graph, LS2 was indicative of posttest success. Individuals scoring high on Active Experimentation in the video tape group scored better or at least as well as individuals in the lecture group, as shown in the High-High (HH) and Low-High (LH) quadrants. Active Experimentation represents a more active learning style that would relate better to a video tape presentation. Individuals scoring high on Reflective Observation (a style more conducive to lecture) from the lecture group scored better or at least as well as individuals from the video

tape condition as seen in the High-Low (HL) and Low-Low (LL) quadrants. Accommodators (LH quadrant) displayed higher posttest mean scores when in the video tape condition than Accommodators in the lecture group. Individuals falling in the HL quadrant or Assimilators exhibited higher posttest mean scores from the lecture group than did Assimilators from the video tape group. Convergents (HH) and Divergers (LL) manifested similar posttest score means in both training conditions. The means and standard deviations for each interaction effect are reported in Table 4.

Table 4. Statistics of learning style and treatment group interaction

	M	SD
Learning style 1 and lecture	-0.64	2.99
Learning style 2 and lecture	0.38	3.35
Learning style 1 and video	-0.97	2.98
Learning style 2 and video	0.38	3.18

#### Two-way analysis of covariance

Finally, the data were analyzed using a two-way analysis of covariance with posttest score as the dependent variable and pretest score serving as the covariate. The independent variables were the classifications of learning style scores into the four learning style quadrants (Low-Low, Low-High, High-Low, and High-High). The results of this analysis indicated when pretest score was constant, learning style and its interaction with treatment still had important



main effects. Learning style by itself was not a significant predictor and did not contribute significantly when pretest scores were covaried out.

Initially, correlations between pretest, posttest, learning style score 1 and 2, and the interactions of learning style scores and training conditions were completed. The correlational matrix is included in Appendix E.

## DISCUSSION

## Treatment Effectiveness

The results of the data analyses demonstrate treatment was effective. There were significant differences on posttest scores between the training conditions and control group. Both training conditions exhibited significant differences in pretest and posttest scores, while there were no significant differences in pretest and posttest scores for the control group. The two procedures taught during the training were technical medical procedures that are not typically part of a curriculum in teacher training programs in Iowa. Yet, from the informal survey of the 15 Area Education Agencies in Iowa and the review of the literature, it is evident that classroom teachers are currently or soon will need to be performing these procedures in local school districts (Blackston, 1987; Wood et al., 1987). Therefore, it is important to determine effective training strategies for teachers working with these children.

There were no significant differences between the posttest scores for the two types of training conditions. The subjects trained in the lecture group did equally as well as the subjects trained in the video tape group. The content and length of the two training sessions were similar to insure their effects were constant over both conditions. In addition, the pretest and posttest were highly correlated, indicating that individuals scoring high on the pretest would score high on the posttest. The pretest mean scores for the two training conditions were not significantly different and since pretest and posttest scores were

highly correlated, significant differences would not be expected on posttest mean scores between the two training conditions.

The results of this exploratory study would tend to support the medical procedures training model developed by Western Hills AEA (no date). In examining the questions on the posttest that addressed the process and not just factual information, individuals in the video-taped training sessions tended to answer those questions correctly, whereas individuals in the lecture training session did not. This may indicate that the type of treatment was indeed important to convey process information, but not necessarily factual information. The authors of the training materials from Western Hills AEA suggest a discussion of each procedure and then a demonstration by trained personnel followed by a reciprocal demonstration by the trainee.

#### Effects of Learning Style

The learning style of the students were related to posttest scores. Subjects preferring a more Abstract style exhibited higher posttest means as a result of participating in the lecture group. As Kolb (1981) predicted, the abstract learner did learn best in the directed and impersonal learning environment of the lecture. Subjects from the lecture group preferring a more Concrete style exhibited lower posttest means as expected. It is interesting to note, however, that there were no significant differences in posttest means between subjects preferring

the more Concrete style and subjects preferring the more Abstract style in the video training session. According to Kolb, the concrete learner would have displayed higher posttest scores than the abstract learner in the video training condition.

The Abstract versus Concrete learning style accounted for a small portion of the variance in the full model. The Reflective versus Active orientation learning style was a better predictor in the full model.

Subjects participating in the lecture group preferring a more Reflective learning style did exhibit higher posttest scores as hypothesized. Kolb (1981) described the Reflective learning style as one that would learn by watching and listening. This style does address the format used for a lecture presentation and would justify the resulting posttest gains displayed by subjects using the Reflective style in the lecture group. However, contrary to Kolb's theory of learning style, subjects in the lecture group preferring a more Active style exhibited similar posttest scores. More significant differences between learning styles in posttest scores were shown under the video training condition. Subjects preferring the Active learning style did score significantly higher on the posttest than did subjects preferring the Reflective learning style. Kolb describes the Active learning style as one that has a practical concern for what works and learns by doing. Since the actual performance of the two medical procedures on children during training was not realistic in this study, the video-taped training session was considered to be the best alternative for the active learners.

The two-way analysis of covariance concluded that treatment did produce a differential effect after the initial posttest scores were adjusted for the level of knowledge on pretest, as well as learning style and its interaction. When pretest scores were held constant, learning style and its interaction with training condition still had an important main effect.

#### Interaction Effects

As the literature implied (Atkins, 1978; Blai, 1982; Kolb, 1981; Sprinthall & Theis-Sprinthall, 1983), learning style and training condition did interact to produce different results depending on the type of training and the preferred learning style of the subject. As indicated earlier, Reflective versus Active learning style scores and their interaction with training condition were significant predictors in the model. Individuals in the video tape group scoring high on Active Experimentation displayed posttest scores at least as high as, or higher than individuals scoring high on Active Experimentation from the lecture group. In examining Reflective Observation, it is noted that individuals scoring high in this category from the lecture group scored better or at least as well as individuals from the video tape condition. Reflective versus Active learning style scores in each instance did interact with training condition and resulted in the predicted outcomes for both the lecture group and the video tape group according to Kolb's Learning Style.

Distinct differences in posttest scores were noted depending

upon the learning style and the training condition. Individuals falling into the Accommodator and Assimilator style exhibited greater differences in posttest scores between the two training conditions than did individuals from the Converger and Diverger styles. Kolb (1981) defines an Accommodator as a person benefiting from hands-on experiences. He also states that Accommodators rely on other people for information rather than their own analysis. The video training condition appears to address these needs of the Accommodator: Accommodators in the video group did score higher on posttest scores than did Accommodators in the lecture group. The style of Assimilators may be closely aligned with the lecture training condition. Kolb states that Assimilators have the ability to take a wide range of information and put it into a logical form for their own use. As hypothesized, individuals in the lecture group falling into the Assimilator quadrant exhibited greater posttest scores than did individuals in the video tape group. The learning characteristics of Convergents and Divergents, as described by Kolb, do not delineate the style or format of a lecture or video tape presentation. In this study, there were no distinct differences between the lecture group and video tape group for both Divergents and Convergents.

#### Implications

Considering that medically fragile children will be served in the public school as mandated by P.L. 91-142 and further reinforced by the court system (Edens et al., 1986), public school personnel need

to determine policies regarding medical procedures. It is important to specify who will perform medical procedures required by the child during the school day. It is equally imperative to identify appropriate procedures for each child and to specify who will train school personnel to perform these procedures (Western Hills AEA). This study indicates that in addition to who will train school personnel to perform medical procedures, it is important to determine how school personnel can best be trained. This study demonstrates that the lecture and video demonstration were effective methods for training subjects with a Reflective and Active learning style, respectively. However, individuals with Concrete and Abstract learning styles did not exhibit clear differences between the lecture and video training conditions.

Learning style and the interaction of learning style and training condition are important factors in deciding upon the most effective training of medical procedures. Several authors (Atkins, 1978; Davidman, 1984; Hutson, 1981) concur that students learn more efficiently when the method and media used are matched with their individual style of learning. It is evident that special educators are requesting knowledge of medical issues (Clary, Czack, & Pike, 1987). It is also imperative that school personnel be knowledgeable of various procedures in order to serve the medically fragile population. The lives of these children depend upon the appropriate implementation of these medical procedures. Therefore, the field of early childhood special education needs to examine learning style and its effects on training for individuals. Certainly, the manner in which a teacher

implements and completes a medical procedure will impact the child's education and future existence.

#### Limitations

This study is limited in generalizability due to its small sample size and the small geographical area from which the sample was drawn. The sample may also be biased because of the students who chose to participate. Many of the students were from the College of Education and the College of Family and Consumer Sciences. Due to their chosen field of specialty, the students may have differentially had a personal interest in the material presented in this study and, therefore, invested more in it.

The nature of the investigation would not allow for the actual demonstration of knowledge of the two procedures (suctioning and tube feeding) with children before and after treatment. Therefore, the written objective pretest and posttest were used as alternatives. Assessment of the acquisition of knowledge on such intricate skills as tube feeding and suctioning would be more accurately done through the use of a demonstration. These skills do not lend themselves to a written assessment.

#### Suggestions for Future Research

This study was exploratory in nature and suggests several areas for future research as well as procedures for use in future research. Future research which examines learning style may want to collect



information about learning styles prior to the random assignment of subjects to insure equal numbers of subjects in each of the four learning style quadrants to each of the training conditions. If possible, assessment of the level of knowledge of medical procedures should be measured in some form other than a written objective test. It would be interesting to investigate whether or not teachers' attitudes towards medically fragile children affected their level of knowledge of medical procedures.

#### Summary

It is evident from this study that the interaction of learning style and training condition is an important factor in determining the best training for each individual. Maximum achievement can be encouraged by examining an individual's learning style and planning a course of action that most effectively match that learning style.

The results of this study indicate there may be an optimal course format under certain conditions for certain students. A person preferring a Reflective learning style in this study did perform better when trained in a lecture format. An individual preferring an Active learning style did perform better when trained in the video tape condition.

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APPENDIX A.

LEARNING STYLE INVENTORY, DEMOGRAPHIC FORM, AND TEST

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## Kolb Learning Style Inventory

50a

This inventory is designed to assess your method of learning. As you take the inventory, give the highest rank to those words that best describe the way you learn and the lowest rank to the words that least describe your learning style.

You may find it hard to rank these words. But keep in mind that there are no right or wrong answers—all the choices are equally acceptable. The aim of the inventory is to describe your *style* of learning, not to evaluate your learning ability.

---

### Instructions

There are nine sets of four words listed below. Rank each set of four words, by assigning a "4" to the word that best characterizes your learning style, a "3" to the word that next best characterizes your learning style, a

"2" to the next most characteristic word, and a "1" to the word that is least characteristic of you as a learner. *Be sure to assign a different rank number to each of the four words in each set; do not make ties.*

1.	<input type="checkbox"/> discriminating	<input type="checkbox"/> tentative	<input type="checkbox"/> involved	<input type="checkbox"/> practical
2.	<input type="checkbox"/> receptive	<input type="checkbox"/> relevant	<input type="checkbox"/> analytical	<input type="checkbox"/> impartial
3.	<input type="checkbox"/> feeling	<input type="checkbox"/> watching	<input type="checkbox"/> thinking	<input type="checkbox"/> doing
4.	<input type="checkbox"/> accepting	<input type="checkbox"/> risk-taker	<input type="checkbox"/> evaluative	<input type="checkbox"/> aware
5.	<input type="checkbox"/> intuitive	<input type="checkbox"/> productive	<input type="checkbox"/> logical	<input type="checkbox"/> questioning
6.	<input type="checkbox"/> abstract	<input type="checkbox"/> observing	<input type="checkbox"/> concrete	<input type="checkbox"/> active
7.	<input type="checkbox"/> present-oriented	<input type="checkbox"/> reflecting	<input type="checkbox"/> future-oriented	<input type="checkbox"/> pragmatic
8.	<input type="checkbox"/> experience	<input type="checkbox"/> observation	<input type="checkbox"/> conceptualization	<input type="checkbox"/> experimentation
9.	<input type="checkbox"/> intense	<input type="checkbox"/> reserved	<input type="checkbox"/> rational	<input type="checkbox"/> responsible



Demographic Form

Please complete the following information:

SS # \_\_\_\_\_ Major \_\_\_\_\_  
 Year in school \_\_\_\_\_ Sex \_\_\_\_\_ Option \_\_\_\_\_  
 Course for which you wish to receive credit \_\_\_\_\_

Please check each area in which you have had coursework.

anatomy                       medical terminology  
 physiology                     special education  
 prenatal dev.                 techniques for working with  
 biology                              children with handicaps  
 nursing                             programming for multi-handicapped  
 other (please list)

Please check each area in which you have had experience.

anatomy                       medical terminology  
 physiology                     special education  
 prenatal dev.                 techniques for working with  
 biology                              children with handicaps  
 nursing                             programming for multi-handicapped  
 other (please list)

To: Students  
From: Penny Milburn

This test covers two medical procedures (tube feeding and suctioning of the nose and mouth) necessary for some children currently in special education classrooms. The test is designed to measure your knowledge of these procedures prior to instruction and it is anticipated that you will not be able to answer all questions correctly. Do not become discouraged. Please read each question and respond to the best of your ability.

Directions

1. Record your social security number in the blank marked SS#.
2. Record the course for which you wish to receive credit in the blank marked class. (Ex. El Ed 455).
3. Mark all answers on the answer sheet. Do not mark on the test form.
4. Do not take over 40 minutes to complete the test.
5. Return all forms to the secretary.

The results of this test will be kept confidential and will not affect your grade in this class. Upon completion of the study your instructor will be notified and you will receive credit for the course you designated. Thank you for participating.

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This test covers two medical procedures (tube feeding and suctioning of the nose and mouth) necessary for some children currently in special education classrooms. The test is designed to measure your knowledge of these procedures. Some of you may draw upon the training you received to answer these questions. Some of you did not receive any training. Do not become discouraged. Please read each question and respond to the best of your ability.

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TEST

1. A tube surgically implanted in the stomach is a \_\_\_\_\_.
  - a. duodenostomy tube
  - b. gastrostomy tube
  - c. jejunostomy tube
  - d. catheter tube
  
2. For oropharyngeal suctioning the catheter should be inserted \_\_\_\_\_.
  - a. no more than 1 inch
  - b. 2-3 inches
  - c. at least 4 inches
  
3. Curdled milk flowing back into the syringe at the beginning of a feeding would indicate \_\_\_\_\_.
  - a. dumping syndrome
  - b. the formula should be discarded
  - c. aspiration pneumonia
  - d. the tube is properly placed
  
4. Oropharyngeal or nasopharyngeal suctioning requires \_\_\_\_\_ water.
  - a. sterile
  - b. sterile distilled
  - c. tap
  - d. warm
  - e. cold
  
5. A rubber Foley catheter is used for \_\_\_\_\_.
  - a. catheterization
  - b. duodenostomy
  - c. gastrostomy
  - d. both a and c
  - e. both b and c
  
6. Suctioning removes \_\_\_\_ from the respiratory tract.
  - a. oxygen
  - b. secretions
  - c. mucus
  - d. both b and c
  - e. all of the above

7. Which statement best describes how to start the suction action when using a suctioning machine.
- place the fingers over the holes in the tubing and catheter
  - place the thumb over the vent hole in the connecting tube
  - turn on machine and connect the connecting tube and sterile catheter
  - none of the above
8. Tube feeding is indicated when the child has difficulty with \_\_\_\_\_.
- normal motor movements
  - feeding himself
  - aspiration
  - all of the above
9. The flow of food through the tube can be regulated by \_\_\_\_\_.
- adjusting the clamp
  - raising and lowering the tube
  - pumping the syringe
  - adjusting the plug
10. A child should be allowed to rest \_\_\_\_\_ between suctioning periods.
- no more than 1 minute
  - 1-3 minutes
  - 4-6 minutes
  - at least 10 minutes
11. The first step in administering a tube feeding to a child would be \_\_\_\_\_.
- instilling formula
  - injecting air to insure patency
  - inserting fluid filled syringe to the clamped tube
  - none of the above
12. A suction catheter is lubricated with \_\_\_\_\_.
- water
  - vaseline
  - mineral oil
  - water soluble jelly
  - saline solution
13. Jejunostomy and duodenostomy tubes empty directly into the \_\_\_\_\_.
- small intestine
  - stomach
  - large intestine
  - esophagus

14. The best position for nasal<sup>55</sup>pharyngeal suctioning is \_\_\_\_.
- on the stomach
  - on the back
  - side lying
  - semi-reclined
15. Which of the following statements describes the appropriate procedure to prevent distention.
- suction intermittently for 10-15 seconds
  - introduce food fresh from the refrigerator
  - lower the feeding syringe below the child's stomach thus decreasing the rate of flow
  - raise the child's head above the rest of the child's body thus promoting good air exchange
16. When orally suctioning a child the preferred position is \_\_\_\_.
- on the back
  - on the stomach
  - side lying
  - semi-reclined
17. The permanent opening created by the surgery to adequately nourish a child is a(n) \_\_\_\_.
- ostomy
  - tracheostomy
  - foramen ovale
  - stoma
18. To avoid irritation and trauma to the tissues, suction is applied to the catheter \_\_\_\_.
- during insertion of the catheter
  - during removal of the catheter
  - during a spasm of coughing only
  - when you sense an obstruction
19. The following cannot occur in a tube fed child.
- peristalsis
  - vomitting
  - distention
  - none of the above
  - all of the above
20. Which one of the following methods would not prevent the introduction of air into the feeding tube.
- attaching the syringe to the tube prior to removing the clamp.
  - attaching the syringe to the tube, filling the syringe with tap water and removing the clamp
  - removing the plug, attaching the syringe to the clamped tube and filling the syringe
  - Keeping the syringe tilted during feeding
  - Keeping the syringe at least 1/4 full during feeding

21. The purpose of using water<sup>56</sup> while suctioning is to \_\_\_\_.
- clear the suction catheter
  - loosen the child's secretions
  - insure patency of the catheter
  - both a and c
  - both a and b
22. Appropriate positions for tube feeding might be \_\_\_\_.
- in the arms of an adult
  - lying down
  - semi-reclined
  - both a and c
  - all of the above
23. Suctioning \_\_\_\_.
- decreases pneumonia
  - increases coughing
  - elicits the gag reflex
  - all of the above
  - none of the above
24. As a general guideline the appropriate amount of time for a tube feeding would be \_\_\_\_.
- 10-20 minutes
  - over 30 minutes
  - under 5 minutes
  - 1-2 hours
25. Any feeding introduced into the feeding tube should be \_\_\_\_.
- fresh from the refrigerator
  - warmed in the microwave
  - left to set out for 30 minutes prior to feeding
26. During suctioning you would \_\_\_\_.
- ask the child to cough forcibly
  - ask the child to speak
  - wear sterile gloves
  - both a and c
  - all of the above
27. To promote digestion the child should be placed in the following position after feeding.
- semi-reclined
  - on the back
  - on the side
  - on the stomach

28. Which statement best describes backflow.
- the flow of mucus secretions back through the oral and nasal passages
  - the flow of stomach contents up the esophogus
  - the flow of stomach contents back into the syringe when a child coughs
  - the flow of secretions through the catheter when the child coughs
  - the flow of stomach contents and/or formula into the syringe and tube upon beginning the feeding
29. A feeding tube may be sucked into the stomach \_\_\_\_.
- if the purse string suture is removed
  - from distention
  - from peristalsis
  - if the bubble is deflated
30. When suctioning a child it is important to wear \_\_\_\_.
- disposable gloves
  - a mask
  - a gown
  - all of the above
  - none of the above
31. Food introduced into a feeding tube from the refrigerator causes \_\_\_\_.
- peristalsis
  - hiccups
  - distention
  - both a and b
  - both b and c
32. Oral or nasal suctioning is used when a child \_\_\_\_.
- is physically handicapped
  - has difficulty breathing
  - is unable to produce an effective cough
  - both b and c
  - both a and c
33. Which of the following indicate suctioning is needed.
- rapid breathing
  - restlessness
  - intercostal retractions
  - both a and c
  - all of the above



Place the following statements in sequential order. Record your answers in rows 34 to 38 of your answer sheet. Blacken the A space if the step is first in the sequence, the B space if it is second, etc.

When tube feeding a child one should follow these steps.

34. Remove the clamp.
35. Attach the syringe to the feeding tube.
36. Pour the formula into the syringe when its 1/4 empty.
37. Remove the plug.
38. Fill the syringe with 30-40 cc of tap water.

Place the following statements in sequential order. Record your answers in rows 39 to 43 of your answer sheet. Again, blacken the A space if the step is first in the sequence, the B space if it is second, etc.

When suctioning a child one should follow these steps.

39. Close the suctioning hole in the connecting tube with the thumb on one hand.
40. Insert the catheter
41. Dip the catheter in tap water, drawing water through it to clear it.
42. Twirl the catheter between your fingers while pulling it out.
43. Draw tap water through the catheter tip.

APPENDIX B.

LECTURE NOTES, VIDEO TAPE SCRIPT, AND TRAINING MATERIALS

Lecture Notes

## Tube feeding

We will discuss three types of tube feeding.  
Refer to overheads and diagrams #1 and #2.

1. Gastrostomy -- tube directly into stomach
2. Duodenostomy -- tube directly into duodenum
3. Jejunostomy -- tube directly into jejunum

The procedures used to feed children with any of these three tubes are the same.

The purpose of tube feeding is to provide a direct route for feedings. Tube feeding provides adequate nutrition with minimal effort on the part of an infant who is unable to suck or swallow for long periods of time. It is a safe method of feeding for the child with chronic lung problems and children who have difficulty with aspiration. The surgeon inserts a flexible plastic tube or rubber Foley (you may encounter others, i.e., Malcott) Catheter into the appropriate portion of the gastrointestinal tract. Initially a suture is placed tightly around the tube to prevent leakage of the stomach contents and to keep the tube in place. This suture is referred to as a purse string suture as it allows some movement on the part of the feeding tube. (Instructor refer to overhead #3.) The permanent opening created by the surgery is referred to as the stoma. As you can see from the diagram, the tube is inserted through the stoma. Typically, once the feeding tube is established, a Foley catheter is used and a suture is not necessary. This catheter or feeding tube is held in place by the bubble you see in the diagram. The bubble is inflated with water and pulled against the inside of the abdominal wall to secure it. The remainder of the feeding tube will extend through the opening (stoma). Approximately 12" of the catheter or feeding tube will extend outside of the abdomen. The feeding tube will move back and forth in the opening and can be pulled out of the opening if caught on a chair or pulled by another child, etc. Therefore, caution is necessary. Place the tube inside the child's slacks or tape it to the abdomen with nonallergenic tape. Do not place it in the diaper. The stoma site (where the tube goes into the inside of the abdomen) is usually left open to air, although some physicians recommend it be covered with sterile gauze. The opposite end of the flexible rubber tube is clamped shut with a small metal clamp, a C-clamp and/or a plastic plug which may be inserted in the end of the feeding tube.

Necessary equipment

1. Prescribed formula or feeding. This may be blended food if prescribed by the doctor. Blended food promotes normal physiological functions.
2. 2 oz. asepto syringe or disposable bulb syringe.
3. 4x4 gauze sponges (if prescribed by dr.), tape

4. Bath towel or linen protector
5. Plastic graduate pitcher labeled with name and dated
6. I.V. stand when administering by drip
7. Tap water, 100 ml.

#### Considerations

1. Check label of formula for expiration date. Discard solution if more than 24 hours old. Bacterial growth increases rapidly after 24 hours.
2. Make sure formula (or in the case of blended food — feeding) is at room temperature. Allow refrigerated formula to set out for 30 minutes prior to feeding. Cold feedings may cause cramping. Do not warm by direct heat or microwave as this can alter the composition of the formula.
3. If student complains of feeling too full after feedings, first administer feedings at a slower rate. Feeding too rapidly interferes with normal peristalsis (the contractile muscular movement that carries food along the digestive tract) and causes distention (extremely expanded stomach). You may also encounter problems with the feeding coming back into the tube or going up the esophagus (backflow). If the child has hiccups, this may indicate the feeding was too cold or the rate of flow was too rapid. Elevating the tube (refer to overhead #3) toward child's head (or about 4" above abdominal wall) allows a slow gravity induced flow and may alleviate these problems. When vomiting or distention occur, check with physician and/or parent about giving smaller, more frequent feedings. This may help child to develop more tolerance to feedings.
4. Observe the child with duodenostomy or jejunostomy for signs and symptoms of dumping syndrome, i.e., nausea, vomiting, diarrhea, cramps, sweating, fainting. Dumping syndrome results from sudden duodenal or jejunal distention and rapid shifting of body fluids to make the intestinal contents isotonic. In other words, the pressure on the inside and outside of the duodenal or jejunal walls is the same. Therefore, osmosis could not occur. The formula cannot be absorbed by the intestines and as a result is rushed through the intestines and discarded. Dumping syndrome is a common side effect of duodenostomy or jejunostomy tubes. It can be alleviated by smaller, more frequent feedings.
5. Observe stoma site for back flow during feeding. Formula will flow back around feeding tube when stoma is not properly sealed.
6. Label the child's equipment with name and date. Change syringe and/or feeding set every 24 hours. Change graduate pitcher every 7 days or as directed. These procedures help reduce the risk of cross contamination and infection.
7. Rinse equipment with cold water after each use. Dry graduate pitcher thoroughly. This reduces the risk of bacterial growth.

Procedure

1. Feed as prescribed by attending physician.
2. Wash hands and gather equipment.
3. Measure out formula and allow to set until room temperature.
4. Talk about the procedure to the child so the child is aware he/she is going to be fed.
5. Position student in semi-fowler's (semi-reclined) or sitting position. This promotes digestion and helps prevent back flow up the esophagus. It may also be helpful to have the child's head upright to prevent vomiting. A caretaker may wish to hold an infant to promote social interaction.
6. Attach syringe to clamped feeding tube. If the tube is plugged, attach the syringe after removing the cover or plug. This prevents introducing air that might cause distention, discomfort and cramping. Hold syringe in an upright position and fill with 30-40 ml. of tap water.
7. Remove the clamp and allow water to flow through tube. Apply gentle pressure to bulb of syringe or reposition child if solution will not flow freely. This assures that the tube is open.
8. Pour formula into the syringe when the tap water measures about 20 ml. Tilt the syringe to approximately a 45° angle as the solution flows (refer to overhead #3). This allows air bubbles to escape as the food flows in.
9. Continue to add feeding when about 1/4 of it remains in syringe until prescribed amount is instilled. Increase or decrease rate of flow by raising or lowering the syringe (overhead #3). Depending on the amount and consistency, feeding will take about 10-20 minutes to instill.
10. When feeding is complete, flush the tube with 50 ml. of water. This removes particles and formula from the tube and prevents clogging.
11. Clamp the tube or elevate the tube if left open to air when water is in the tip of the syringe. Remove the syringe and check the clamp to make sure it is secure or attach the plug. The tube should be plugged or clamped when not feeding. This helps to prevent leakage.
12. Child should remain in the same position (semi-reclined) for 30 minutes to prevent leakage, vomiting and to enhance normal digestion.
13. Observe stoma for leakage again, and if prescribed, place anti-microbial ointment around stoma.
14. Clean equipment by rinsing with cold water. Dry graduate pitcher.
15. Document amount, tolerance, time and child's reaction to feeding.

Possible problems

- I. Vomiting — causes
  - Improper location of tip of tube — contact parent or dr.
  - Rate of flow too rapid — lower syringe
  - Too much formula—overfeeding — contact parent or dr.

Excessive volume of air flowing in — tilt syringe during flow and be sure syringe does not run dry while feeding

Position of child — position on right side for 30 minutes following feeding as an alternative to leaving in semi-fowler position.

II. Diarrhea — causes

Rate of flow too rapid

High concentration of formula — contact parent or dr.

Normal stools for the tube-fed child would be soft consistency.

III. Edema (swelling) — high sodium in formula — contact parent or dr.

IV. Weight — under- or overweight — contact parent or dr.

Closing comments

Children being tube fed may also receive oral feedings to promote normal oral-motor development and to work toward possible removal of the feeding tube at a later date. These procedures are general guidelines. Each child is an individual and all individual characteristics need to be taken into consideration. Parents and/or physicians need to be consulted for specific instructions for each child.

Suctioning

Suctioning removes secretions (mucus) from the airway. Suctioning may be applied to the oralpharyngea), nasopharyngeal, or tracheal passages. Pharynx is the back of the throat, trachea is your windpipe. (Refer to overhead #1.) The purposes of suctioning are:

1. To maintain a patent (open, free flowing) airway in a child who has difficulty breathing or has limited swallowing abilities. It also assists the child who has difficulty clearing the airway through coughing.
2. To remove mucus, secretions and/or other fluids from the mouth, nose and pharynx. This will decrease the possibility of pneumonia which might result from aspirating these fluids.
3. To prevent or relieve labored breathing (dyspnea) and promote pulmonary gas exchange therefore supplying adequate amounts of oxygen to the body.

Suctioning needs to be an aseptic (clean) procedure. We will be discussing some precautionary measures that will insure that suctioning is an aseptic procedure. Suctioning is done when prescribed by a physician. It is important to note that these are some general guidelines on this procedure. For each individual child, the parent and physician should be consulted to determine how often to suction and the exact procedure to be used. We will discuss primarily oral-pharyngeal and nasopharyngeal suctioning. These procedures are done by using a suctioning machine. This machine has a flexible rubber catheter and a collection area. (Refer to overhead #2.) The dials on the suction machine should be set by the school nurse at the setting prescribed by the child's physician. These dials indicate the amount of pressure used in the suctioning process and this may vary depending

on the child. The typical setting might range from 80-120mm Hg. The classroom teacher would not set the dials but simply check to verify the appropriate setting.

#### Necessary equipment

1. Suction machine
2. Sterile suction catheter
3. Connecting tubing
4. Paper cups
5. Tap water
6. Tissues
7. Paper towels
8. Gloves (clean, vinyl disposable)
9. Cotton tipped applicator

#### Essential steps

1. Gather all equipment. Connect connecting tube to suction source. All this equipment should be readily available as suctioning is frequently done on an emergency basis. Therefore, in many situations the connecting tube would already be on and you would not have to do this.
2. Determine the need for suctioning by observing the child. If the child has irregular or shallow breathing, if the child is turning blue (check nail beds and skin outlining mouth), if the child is restless, if the child has an increased respiratory rate, or rapid breathing, or if the child has congestion that is impairing breathing and cannot be coughed up, then suctioning is indicated. Some children will sound gurgly or bubbly. Some children will exhibit nasal flaring (nostrils open widely when breathing). Many times, the teacher might notice the child using many other muscles to breathe. Examples might be using accessory muscles such as a pronounced raising and lowering of the shoulders or rib cage. Another area to watch is the soft tissue in the area of the neck just below the Adam's apple and above the collar bone. When this area is extremely concave during inhalation, this is referred to as intercostal retraction. Intercostal retraction is another example of the use of accessory muscles to help move air through a blocked airway. A child using accessory muscles is attempting to achieve more lung expansion, however, by using accessory muscles, the cost in terms of physical energy being used is great. Other children will need to be suctioned before a meal or snack.
3. Explain the entire procedure to the child the first time. Thereafter, just tell the child you are going to suction him/her. Place the child in a semi-reclined position for nasopharyngeal suctioning. For oral suctioning, position the child on his/her side with head slightly lowered. This position aids in pooling and draining secretions. It also helps to promote productive cough and lung expansion to help clear the bronchi.

4. Wash hands thoroughly.
5. Turn on suction machine and close the vent hold in the connecting tube to activate the suction. Check to make sure you have strong suction by holding connecting tube close to your hand. If no suction, check all connections for loose fits or leaks. Check dials to make sure they are set properly as prescribed by physician. The suction you feel will not be very strong.
6. Put on gloves. Next connect the sterile suction catheter to connecting tube on the suction machine. Wearing the glove keeps the catheter clean and protects you from contact with the secretions.
7. Place catheter tip in the basin and draw tap water through it. This ensures patency of the system and lubricates the catheter. The tip of the catheter has two small holes to draw the secretions into the collection bottle.
8. For oral suctioning, insert the tip of the catheter along the side of the mouth to the back molars and then down the throat. Insert the catheter about 2-3" down the throat. For nasal suctioning, elevate the tip of the nose and insert catheter along the floor of the nose. When suctioning through the nose, first measure the distance between the tip of the child's nose and the ear lobe to determine how far to insert the catheter. This will ensure that the catheter will reach the nasopharynx. Catheter can be lubricated with water or KY jelly to ease insertion into the nose. Insertion of the catheter into the nose and mouth will be very easy. The catheter is often well-lubricated by mucous and secretions. It may become slick and slimy and thus easily slide into the pharynx with ease. Some resistance may be felt when the catheter reaches the top of the nose. At that point, you can feel the catheter move toward the exterior wall of the nose and then turn down toward the pharynx. During nasal suctioning, alternate nostrils when inserting catheter to ensure cleaning of both nostrils and to minimize trauma to either side. The nostrils may need to be cleaned prior to insertion of the catheter. This can be done with a cotton swab.

Always leave the vent (hole) in the catheter open when inserting.

If an obstruction (blockage) is encountered, do not force catheter. Simply remove and insert at another angle. Coughing is encouraged when the catheter is being inserted since coughing expels mucus blocking the bronchi.

9. Close vent with the thumb of one hand while slowly withdrawing the catheter as you roll it between your thumb and forefinger of the other hand. This prevents trauma to tissues by distributing the pressure of the suction. If the catheter appears to "grab" as your vacuum cleaner might, remove thumb from vent to stop suction. If the catheter is allowed to remain in one place,



the mucous membrane will be drawn against it and damage will occur. The mucous membrane may be swollen and tender and may bleed easily. This should be avoided if at all possible as it compounds the problem of the obstructed airway. Swelling and tenderness increases and the child's airway continues to be obstructed. Suctioning should always be intermittent, gentle and under fingertip control. Do not jab the catheter up and down. Sometimes you need to work gently, probing farther and farther back until the designated area is reached. Remove secretions from the child's facial area as they occur to prevent them from being aspirated at the child's next breath.

10. Dip catheter in and out of basin, drawing tap water through it to clean it. This will clear the catheter of thick sticky secretions which obstruct the catheter and decrease the suction. This should be done intermittently during the suctioning process to keep the catheter clear and free. If the catheter becomes clogged with secretions, suctioning will not be effective.
11. Suction no longer than 10-15 seconds at a time and allow 1-3 minutes between suctioning periods. Suctioning removes oxygen as well as secretions from the respiratory tract. The interval between suctioning periods allows the child to breathe. Prolonged suctioning can also produce irregular heartbeat (cardiac arrhythmias) or cardiac arrest. The reason for this is suctioning stimulates the vagus nerve slowing the heart rate to dangerous levels (bradycardia). Continue suctioning in this manner until respirations are quiet and gurgling or bubbling has subsided.
12. Turn off suctioning machine, detach catheter from tubing and wrap tubing in paper towel. Discard catheter. A new catheter should be used each time you suction. The connecting tube should be changed as recommended by the child's physician and school nurse.
13. Respirations should be quieter and occur with less effort for the child.
14. Empty and rinse collection bottle. Remove and discard gloves. Wash hands.
15. Document the following:
  - Amount, color and consistency of secretions
  - Coughing
  - Dyspnea \_\_\_\_\_
  - Cyanosis (turning blue) \_\_\_\_\_ prior to suctioning
  - Frequency of suctioning
  - Any bleeding
  - Child's response

#### Special considerations

If suctioning causes bleeding, stop immediately and observe until bleeding stops. Inform parent or physician later. Catheters have two small holes at the end of the tube. These holes actually suck in the secretions. Catheters come in different sizes. A

larger catheter may be indicated for thicker secretions and a smaller catheter for thin secretions.

Video Tape Script

This is Tyler. Tyler has a gastrostomy tube because he has a great deal of difficulty with aspiration pneumonia.

This is Molly. Molly is fed through a gastrostomy tube. She didn't have a suck reflex and had a great deal of difficulty with swallowing due to her obvious neuromuscular involvement. That is why a gastrostomy tube was inserted into Molly's stomach. Molly and Tyler will show you how easy it is to feed a child with a gastrostomy tube. First, let's look at the equipment used.

Here you see the 2 ounce asepto syringe used to introduce the formula into the tube. In addition, you see two small cups on the tray. These are used for holding the water. Approximately 100 ml. or about 4 ounces of water is introduced into the tube. The formula is generally prescribed by the physician. Sometimes, blended food may be introduced into the tube. This promotes normal physiological functions. Other items used might be a 4 x 4 gauze sponge to protect the stoma if prescribed by the doctor. Tape, to keep the gastrostomy tube close to the child's stomach and prevent it from being pulled out. A bath towel or linen protector. A plastic graduate pitcher, labeled with the child's name and dated, to contain the formula during the process. An IV stand may be necessary when administering the formula by drip.

There are many things to consider when tube feeding a child. First of all, check the label of the formula for the expiration date. Discard the solution if it is more than 24 hours old. Bacterial growth

continues rapidly after 24 hours. Make sure the formula is at room temperature. In the case of a blended food, make sure that it is at room temperature also. Allow refrigerated formula to set out for 30 minutes prior to feeding. Cold feedings may cause cramps. Do not warm by direct heat or microwave as this can alter the composition of the formula. As you can see, Molly's mother took the formula out of the cupboard, shook it up, opened it and it was ready to feed.

If the child complains of feeling too full after feedings, first administer feedings at a slower rate. Feeding too rapidly interferes with normal peristalsis. This is the contractile muscular movement that carries food along the digestive tract. Feeding too rapidly also causes distention which is an extremely expanded, tightened stomach. You may encounter problems with the feeding coming back into the tube or going up the esophagus. This is called backflow and here you see an example of backflow. If the child has hiccups, this may indicate the feeding was too cold or the rate of flow was too rapid. Elevating the tube about 3 or 4 inches above the child's head allows a slow gravity induced flow and may alleviate these problems. Here you see what elevating and lowering the tube does to the rate of flow. When vomiting or distention occur, check with the physician and/or parent about giving smaller, more frequent feedings. This may help the child to develop more tolerance to the feedings.

Observe the child with duodenostomy or jejunostomy for signs and symptoms of dumping syndrome. Dumping syndrome would include nausea, vomiting, diarrhea, cramps, sweating, and/or fainting. Dumping syndrome results from sudden duodenal or jejunal distention

and rapid shifting of body fluids to make the intestinal contents isotonic. In other words, the pressure on the inside and outside of the intestinal walls is the same. Therefore, osmosis could not occur. The formula cannot be absorbed by the intestines and as a result is rushed through the intestines and discarded. Dumping syndrome is a common side effect of duodenostomy or jejunostomy tubes. It can be alleviated by smaller, more frequent feedings.

Observe the stoma site for backflow during feeding. Formula will flow back around feeding tube when stoma is not properly sealed.

Label the child's equipment with name and date. Change the syringe and/or feeding set every 24 hours. Change the graduate pitcher every 7 days or as directed by the family or physician. These procedures help reduce the risk of cross contamination and infection.

Always rinse equipment with cold water after each use. Dry the graduate pitcher thoroughly. This reduces the risk of bacterial growth.

Now to the actual procedure. Again you will note that the child is always fed as prescribed by the attending physician.

First, wash your hands and make sure that all your equipment is gathered as we have done. Measure out the formula and allow it to set until room temperature.

Talk about the procedure to the child so the child is aware he/she is going to be fed.

Position the child in semi-fowler's or semi-reclined position.

Lying down might be another appropriate position for the child. These positions promote digestion and help prevent backflow up the esophagus. A caretaker may wish to hold an infant to promote social interaction. Social interaction is a necessary part of feeding time when the child has a gastrostomy tube.

Here you see the tube. As you can see, it is very flexible. This is the stoma site. This is where the tube goes directly into the stomach. The stoma site may look red and irritated to you, but there is no cause for alarm.

The first step is to attach the syringe to the clamped feeding tube. If the tube is plugged, attach the syringe after removing the cover or plug. This process prevents introducing air that might cause distention, discomfort and cramping. Hold the syringe in an upright position and fill it with 30-40 ml. of tap water.

Next remove the clamp and allow water to flow through the tube. If you are using a bulb syringe, apply gentle pressure to bulb of the syringe, or you might reposition the child if solution will not flow freely. This process assures that the tube is open.

Next pour the formula into the syringe when the tap water measures about 20 ml. Tilt the syringe to approximately a 45° angle as the solution flows. This will allow the air bubbles to escape as the food flows in.

Continue to add formula when about 1/4 of it remains in syringe. You might increase or decrease the rate of flow by raising or lowering the syringe. Depending upon the amount and consistency, the feeding will take about 10-20 minutes to instill.

When the feeding is complete, flush the tube with 50 ml. of water. This removes particles and formula from the tube and prevents clogging.

Clamp the tube, or elevate the tube if it is going to be left open to air, when water is in the tip of the syringe. Remove the syringe and check the clamp to make sure it is secure, or attach the plug in the end of the tube. The tube should be plugged or clamped when not feeding. This helps to prevent leakage.

When the feeding is complete, the child should remain in the same position for approximately 30 minutes. This would be a semi-reclined position. This helps to prevent leakage and vomiting and enhances normal digestion.

The process is complete and the child is happy.

Now document the amount of feeding that you gave the child.

This is Tyler. If you listen to his breathing, you will note that you hear a lot of gurgling sounds. Tyler is having a great deal of difficulty breathing today. It's apparent that he needs to be suctioned. We're going to look at the suctioning process for Tyler, but first let's look at the equipment necessary to do this.

This is the suctioning machine used for Tyler. You can see the collection bottle and the connecting tube. In addition to this, we will need a sterile suction catheter. Also, some paper cups and tap water will be important. Tissues and paper towels might be necessary to help with this process. Sometimes it may be important for us to use gloves and a cotton tipped applicator. Many times, all this equipment will be readily available as suctioning is frequently done on an

emergency basis. The connecting tube would already be on the suctioning machine.

First, you need to determine the need for suctioning by observing the child. If the child has irregular or shallow breathing, if the child is turning blue, or if the child is restless, you may need to suction. Check the nail beds and skin outlining mouth to see if the child is turning blue. Other indicators might be an increased respiratory rate, or rapid breathing, or if the child has congestion that is impairing breathing and cannot be coughed up, then suctioning is indicated. As you can see, Tyler has this problem today. Some children will sound gurgly or bubbly like this. Other children will exhibit nasal flaring which is simply a widening of the nostrils when the child breathes. Many times, the teacher might notice the child using many other muscles to assist in breathing. Examples might be using accessory muscles such as a pronounced raising and lowering of the shoulders or rib cage. Another area to watch is the soft tissue in the area of the neck just below the Adam's apple and above the collar bone. When this area is extremely concave during inhalation, this is referred to as intercostal retraction. Intercostal retraction is another example of the use of an accessory muscle to help move air through a blocked airway. A child using accessory muscles is attempting to achieve more lung expansion; however, by using accessory muscles, the cost in terms of physical energy being used is great. Other children will need to be suctioned before a meal or snack.

Before you suction a child for the first time, explain the



entire procedure to the child. Thereafter, just tell the child you are going to suction him/her.

Place the child in a semi-reclined position for nasopharyngeal suctioning or suctioning through the nose. You may need to begin gently and probe further and further until you reach the designated area. For oral suctioning, position the child on his/her side with head slightly lowered. This position aids in pooling and draining secretions. It also helps to promote productive cough and lung expansion to help clear the bronchial tubes.

Be sure to wash your hands thoroughly before beginning.

It may be necessary to put on gloves before connecting the sterile catheter to the connecting tube. Wearing the glove keeps the catheter clean and protects you from contact with the secretions. When you turn on the machine, the suction will not be great. It doesn't take a lot to remove the secretions from the nose and mouth.

For oral suctioning, insert the tip of the catheter along the side of the mouth to the back molars and then down the throat. Insert the catheter about 2-3" down the throat. For nasal suctioning, elevate the tip of the nose and insert catheter along the floor of the nose. When suctioning through the nose, first measure the distance between the tip of the child's nose and the ear lobe to determine how far to insert the catheter. This will ensure that the catheter will reach the nasopharynx. The catheter can be lubricated with water or KY jelly to ease insertion into the nose. Insertion of the catheter into the nose and mouth will be very easy. The catheter is often well-lubricated by mucous and secretions. It may become

slick and slimy and thus easily slide into the pharynx. Some resistance may be felt when the catheter reaches the top of the nose. At that point, you can feel the catheter move toward the exterior wall of the nose and then turn down toward the pharynx. During nasal suctioning, alternate nostrils when inserting catheter to ensure cleaning of both nostrils and to minimize trauma to either side. The nostrils may need to be cleaned prior to insertion of the catheter. This can be done with a cotton swab.

Always leave the vent, or the hold in the catheter open when inserting the catheter.

If an obstruction or blockage of some sort is encountered, do not force the catheter. Simply remove it and insert it at another angle. Coughing is encouraged when the catheter is being inserted since coughing expels mucus blocking the bronchi.

When you have inserted the catheter, close the vent hold with the thumb of one hand while slowly withdrawing the catheter as you roll it between your thumb and forefinger of the other hand. You can see this process. This helps to prevent trauma to the tissues by distributing the pressure of the suction equally. If the catheter appears to "grab" as your vacuum cleaner might, remove the thumb from the vent to stop the suction action. If the catheter is allowed to remain in one place, the mucous membrane will be drawn against it and damage will occur. The mucous membrane may be swollen and tender and may bleed easily. This should be avoided if at all possible as it compounds the problem of the obstructed airway. Swelling and tenderness increases and the child's airway continues to be obstructed.

Suctioning should always be intermittent, gentle and under fingertip control. Do not jab the catheter up and down. Sometimes you need to work gently, probing farther and farther back until the designated area is reached. Remove secretions from the child's facial area as they occur to prevent them from being aspirated at the child's next breath.

Dip the catheter in and out of the water, drawing tap water through it to clean it. This will clear the catheter of thick sticky secretions which obstruct the catheter and decrease the suction. This should be done intermittently during the suctioning process to keep the catheter clear and free. If the catheter becomes clogged with secretions, suctioning will not be effective.

Suction the child no longer than 10-15 seconds at a time and allow 1-3 minutes between suctioning periods. Suctioning removes oxygen as well as secretions from the respiratory tract. The interval between suctioning periods allows the child to breathe. Prolonged suctioning can also produce irregular heartbeat or cardiac arrest. The reason for this is that suctioning stimulates the vagus nerve slowing the heart rate to dangerous levels. Continue suctioning in this manner until the respirations are quiet and the gurgling or bubbling has subsided.

Turn off the suctioning machine, detach catheter from tubing and wrap the tubing in a paper towel. Please discard the catheter. A new catheter should be used each time you suction. The connecting tube should be changed as recommended by the child's physician and school nurse.

Now the child's respirations should be quieter and occur with less effort for the child.

Empty and rinse collection bottle. Remove and discard gloves and wash your hands.

The final step is to document what you have noted about the child. The important things to note are the amount, color, and consistency of the secretions; whether or not the child was coughing a great deal; if the child was turning blue prior to suctioning and if there were periods of restlessness. Be sure to note shallow or rapid breathing, frequency of suctioning and any bleeding that may have occurred. Finally, the child's response to the suctioning process. Now that you have finished, both you and the child will rest easier.

Gastrostomy Tube Feeding Checklist  
A Training Guide

Student's Name \_\_\_\_\_ Date of Birth \_\_\_\_\_

Primary Health Care Provider \_\_\_\_\_ Position \_\_\_\_\_

Additional Health Care Provider \_\_\_\_\_ Position \_\_\_\_\_

This checklist is the procedure for feeding my child.

Parent Signature	Date		
	Training Date	Trainer	Comments
1. Feed as perscribed by attending physician			
2. Procedure: (demonstration) A. Wash hands B. Gather equipment: feeding solution, asepto or bulb syringe, 4X4 gauze sponges, tape, towel, graduate pitcher, and tap water.			
3. Measure out formula and allow to set until room temperature.			
4. Position student in semi-reclined or sitting position, unless contraindicated.			
5. Attach syringe to clamped feeding tube. Fill with 30-40 cc of tap water.			
6. Remove clamp and allow water to flow through until it reaches tip of syringe. Notify parent and/or physician if not patent.			
7. Pour feeding solution into the syringe. Continue to add solution. Increase or decrease rate of flow by raising or lowering the syringe.			
8. When feeding is completed flush the tube with 50 ml. of tap water.			

Suctioning Checklist  
A Training Guide

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Student's Name \_\_\_\_\_ Date of Birth \_\_\_\_\_

Primary Health Care Provider \_\_\_\_\_ Position \_\_\_\_\_

Additional Health Care Provider \_\_\_\_\_ Position \_\_\_\_\_

This checklist is the procedure for suctioning my child.

\_\_\_\_\_  
Parent Signature

\_\_\_\_\_  
Date

Training  
Date \_\_\_\_\_ Trainer \_\_\_\_\_ Comments \_\_\_\_\_

I. When to suction (Verbal Recall)		
A. Before meals and snacks		
B. When indicated by any of the following signs:		
1. Congestion you hear but student is unable to cough up. i.e. "gurgling sounds"		
2. Secretions you can see but are unable to remove with tissue or bulb suction. i.e. ear syringe type bulb		
C. Restlessness, increased respiratory rate, turning blue, irregular or shallow breathing, intercostal retractions, use of accessory muscles for breathing		
II. Procedure: (Demonstration)		
1. Wash hands (except in emergencies)		
2. Equipment should be assembled: suction machine, catheter, connecting tube, cup, tap water, Q-tip, gloves, tissues		

Training  
Date \_\_\_\_\_ Trainer \_\_\_\_\_ Comments \_\_\_\_\_

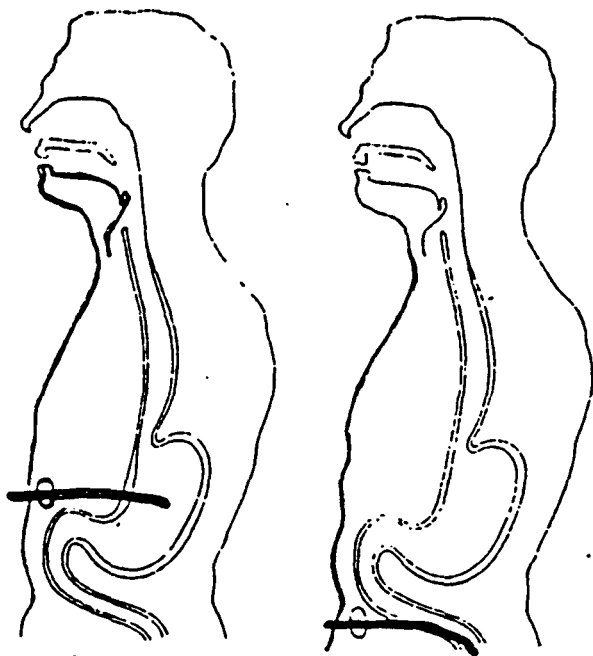
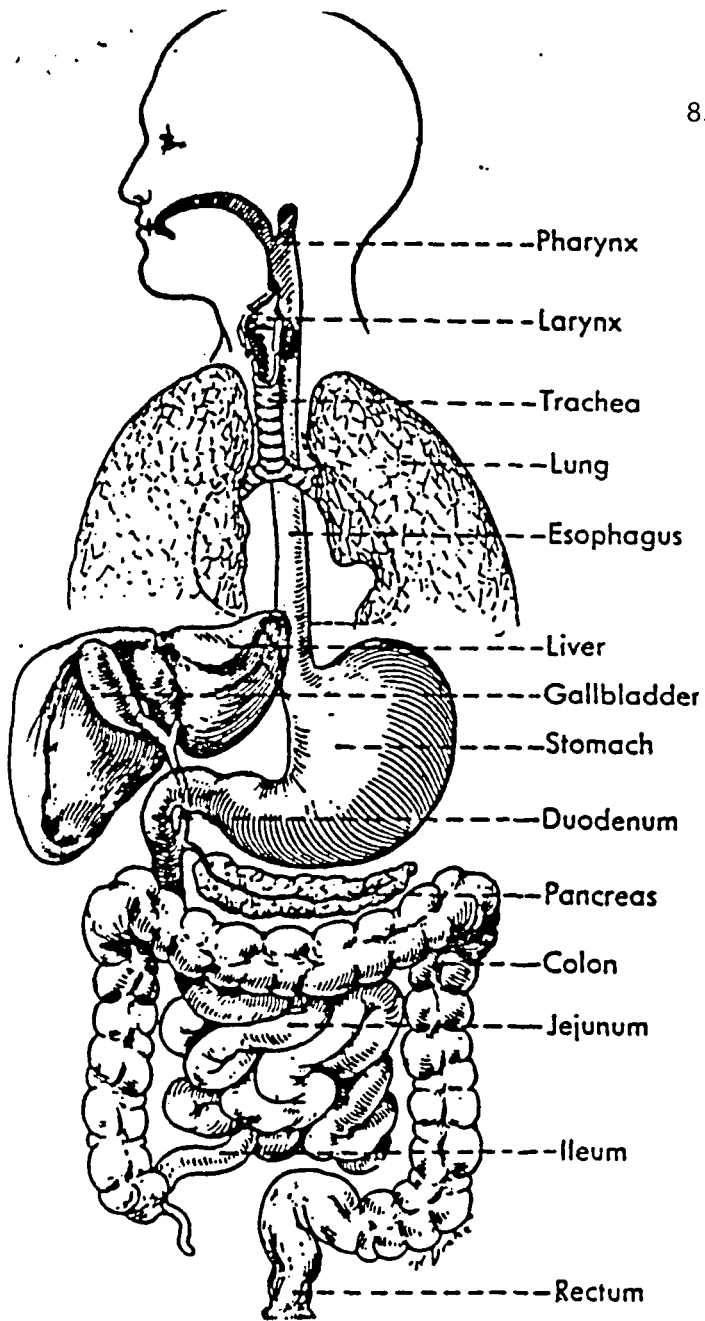
3. Position child in semi-fowler's position for nasal suctioning, or on the side for oral unless contraindicated. Turn on suction machine and check for strong suction. Check guage for appropriate setting.		
4. If no suction, check all connections for loose fits or leaks.		
5. Put on gloves. Connect sterile suction catheter to connecting tube.		
6. Draw tap water through catheter tip.		
7. Insert catheter a. for oral suctioning insert about 2-3" down throat. b. for nasal suctioning insert as measured from tip of child's nose to ear lobe.		
8. Close suctioning hole with one hand. Twirl catheter between fingers while pulling out of nose/mouth in a continuous motion.		
9. Dip catheter in tap water, drawing water through catheter to clean it.		
10. Suction no longer than 10-15 seconds at a time. Allow 1-3 minutes between suctioning periods.		
11. If suctioning causes bleeding stop and observe until bleeding stops.		
12. Stop suctioning if no more secretions can be seen or heard		

13. Rinse connecting tube with tap water. Turn off machine. Wrap catheter in paper towel and discard.

14. Empty and rinse collection bottle. Remove and discard gloves.

15. Wash hands.



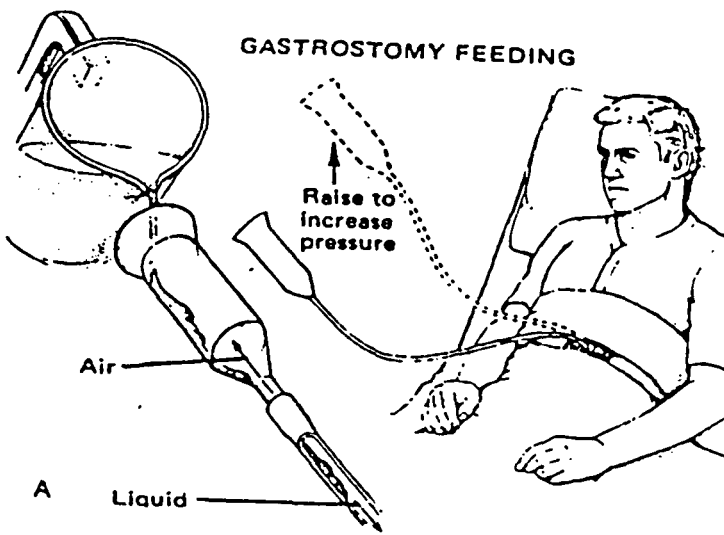


Gastrostomy

Jejunostomy

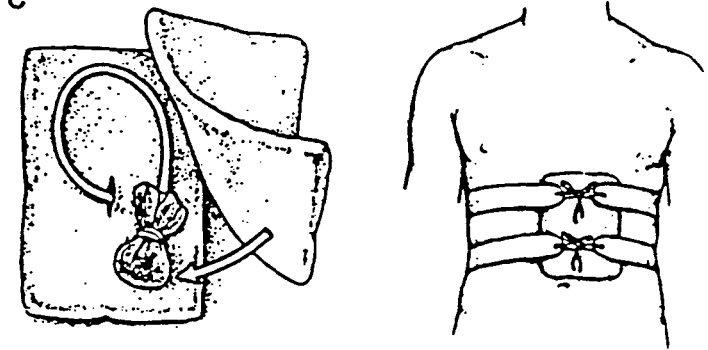
82

GASTROSTOMY FEEDING

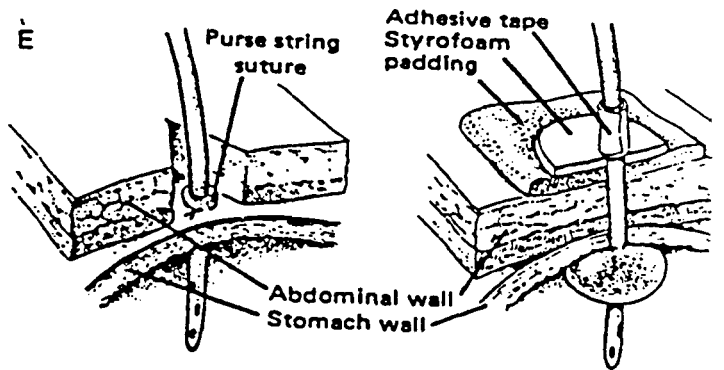


A

C



E



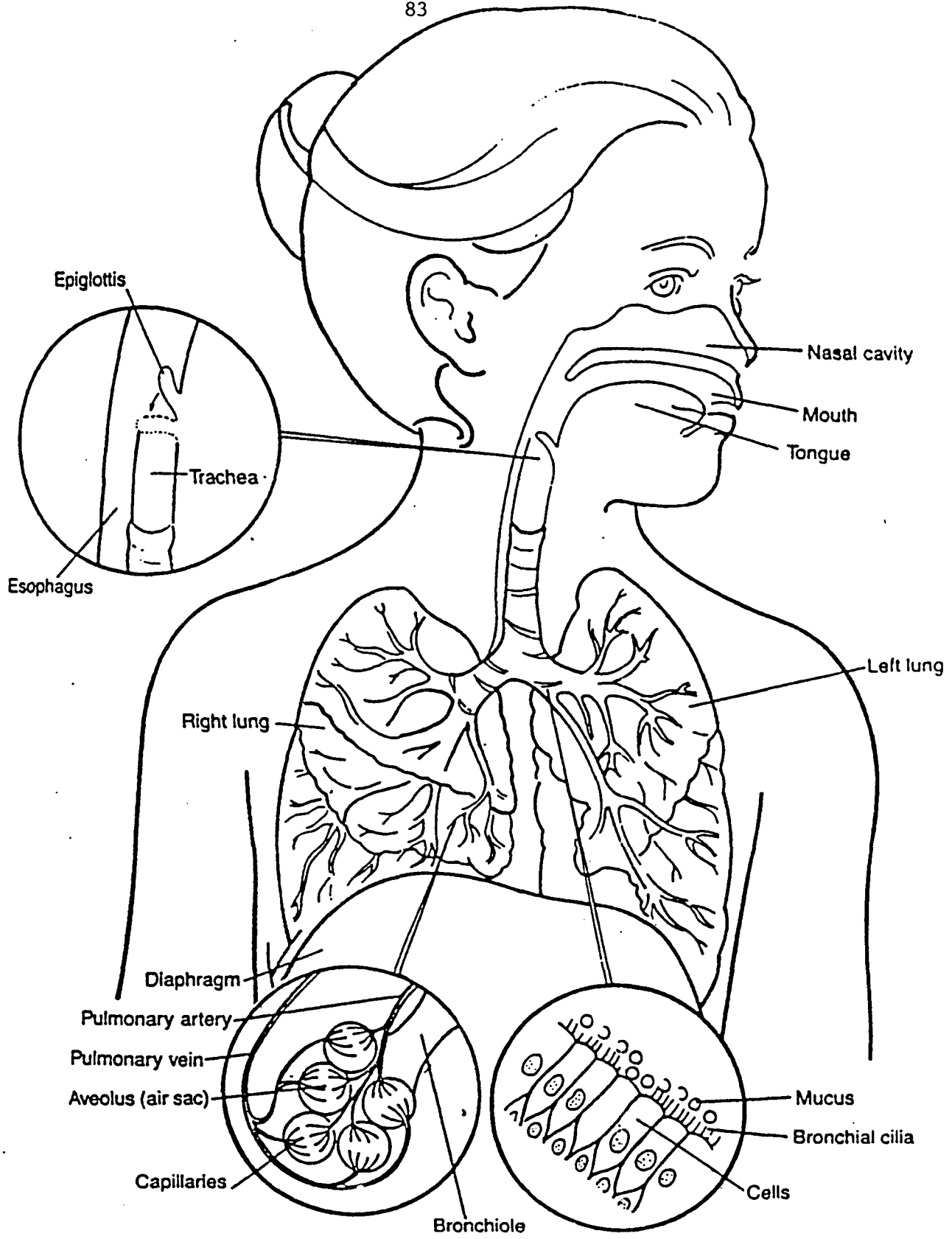
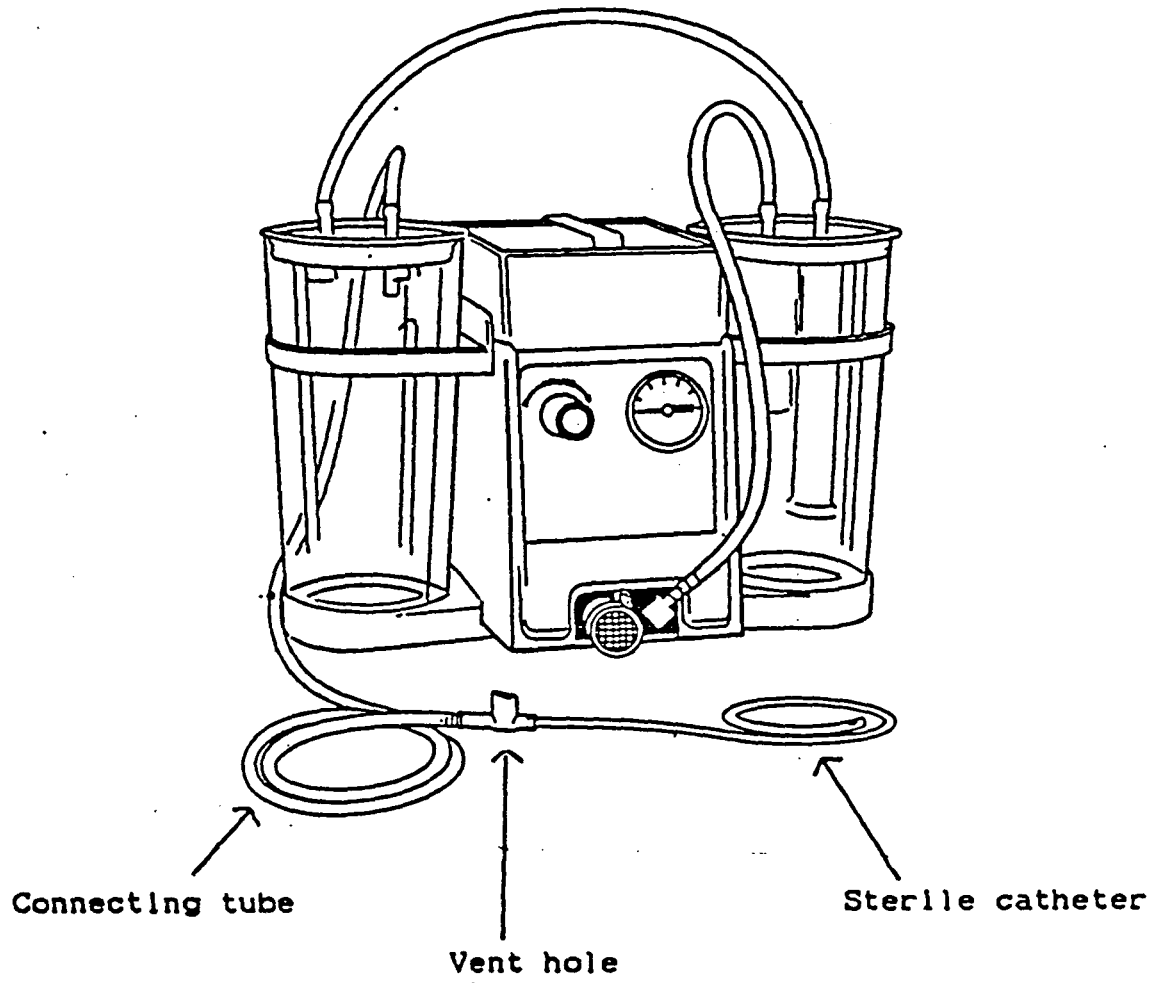


Figure 6-1 The respiratory system.

SUCTION MACHINE



APPENDIX C.

LETTERS TO STUDENTS AND STUDENT CONSENT FORM

Iowa State University *of Science and Technology* Ames, Iowa 50011-1030



Child Development Department  
101 Child Development Building  
Telephone 515-294-3040

Dear Student,

I am working on a masters degree in Child Development at Iowa State University. For my thesis I am conducting research to determine the best method for training teachers to meet the special needs of children who have medical problems. I feel knowledge about medical procedures and their implementation will increase teachers ability to successfully meet the needs of these children.

I would like you to participate in this study. This will involve the following commitment on your part:

1. Pretest- approximately 15 to 20 minutes.
2. Training- approximately 2 hours.
3. Posttest- approximately 15 to 20 minutes.

If you agree to participate, you can be assured any information about you or your performance will be kept strictly confidential. At no time will your name be used.

If you agree to participate please read and complete the following form and return it to your instructor. Please note that you are under no obligation to participate and that you can withdraw your participation at any time without affecting your grade. If requested, I will send you a summary of the results of the study. If you have any questions, please let your instructor know and she/he will let me know.

Thank you for your consideration.

Sincerely,

Penny S. Milburn

Robert Fuqua, Ph.D  
Associate Professor  
Major Professor

Iowa State University of Science and Technology Ames, Iowa 50011-1030



Child Development Department  
101 Child Development Building  
Telephone 515-294-3040

Dear Student,

I am working on a masters degree in Child Development at Iowa State University. For my thesis I am conducting research to determine the best method for training teachers to meet the special needs of children who have medical problems. I feel knowledge about medical procedures and their implementation will increase teachers ability to successfully meet the needs of these children.

I would like you to participate in this study. This will involve the following commitment on your part:

1. Pretest- approximately 15 to 20 minutes.
2. Training- approximately 2 hours.
3. Posttest- approximately 15 to 20 minutes.

If you agree to participate, you can be assured any information about you or your performance will be kept strictly confidential. At no time will your name be used.

Your instructor has agreed to award extra credit points to students completing this study. If you agree to participate please read and complete the following form and return it to your instructor. Please note that you are under no obligation to participate and that you can withdraw your participation at any time without affecting your grade. If requested, I will send you a summary of the results of the study. If you have any questions, please let your instructor know and she/he will let me know.

Thank you for your consideration.

Sincerely,

Penny S. Milburn

Robert Fuqua, Ph.D  
Associate Professor  
Major Professor

Iowa State University of Science and Technology

Ames, Iowa 50011-1030



Child Development Department  
101 Child Development Building  
Telephone 515-294-3040

### INFORMED CONSENT

Effective training methods for teachers serving medically fragile children

I \_\_\_\_\_, freely and voluntarily consent to participate in a research project conducted by Penny Milburn. I am aware of the purpose of the study and all procedures involved with the study and have had an opportunity to ask questions.

I understand that my test scores will not affect my grade in the course I am currently taking. The information collected by the researcher will be kept confidential. I understand that my name will not be associated in any way with the results of the research, and that there are no risks involved.

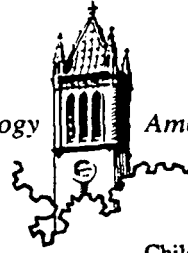
I understand that I may withdraw my consent and discontinue my participation in the study at any time. Such a decision will not affect my grade in class. However, I will not receive the extra credit points if I do not complete the entire study.

I have read and do understand the above information and have received a copy of this form.

\_\_\_\_\_  
Student

\_\_\_\_\_  
Date

Iowa State University *of Science and Technology* Ames, Iowa 50011-1030



Child Development Department  
101 Child Development Building  
Telephone 515-294-3040

### INFORMED CONSENT

Effective training methods for teachers serving medically fragile children

I \_\_\_\_\_, freely and voluntarily consent to participate in a research project conducted by Penny Milburn. I am aware of the purpose of the study and all procedures involved with the study and have had an opportunity to ask questions.

I understand that my test scores will not affect my grade in the course I am currently taking. The information collected by the researcher will be kept confidential. I understand that my name will not be associated in any way with the results of the research, and that there are no risks involved.

I understand that I may withdraw my consent and discontinue my participation in the study at any time. Such a decision will not affect my grade in class.

I have read and do understand the above information and have received a copy of this form.

\_\_\_\_\_  
Student

\_\_\_\_\_  
Date



APPENDIX D.

LETTER TO PARENTS AND INFORMED CONSENT

Iowa State University *of Science and Technology* Ames, Iowa 50011-1030



Child Development Department  
101 Child Development Building  
Telephone 515-294-3040

Dear

I am an early childhood special education teacher who has worked with children with special needs in the Johnston School District for the past 5 years. Many of the children I have taught have had special health needs as well. After searching unsuccessfully for information to assist me in providing for the health care needs of these children I decided this was an area needing further investigation. I saw a need to increase the awareness and knowledge that special education teachers have of the medical procedures these children require as well as the teachers ability to implement these procedures.

Currently I am working on a masters degree in Child Development at Iowa State University and pursuing my interest in this area. For my thesis I am conducting research to determine the best method for training teachers to meet the needs of these children. I feel knowledge about medical procedures and their implementation will increase teachers' ability to successfully meet the needs of these children.

Part of the training I am planning includes videotapes. I would like to video tape your child while a specific medical procedure is being performed. This video tape would be viewed by undergraduate students in the Child Development and Education departments at Iowa State University. The video tape would be for the purpose of this study alone. All information regarding your child would be kept strictly confidential and your child's name would not be used.

If you are willing for your child to be video taped for the purpose of this demonstration, please read and sign the enclosed consent form and return it in the enclosed envelope. Please note that you are under no obligation to participate and that you can withdraw at any time. If you wish, the video tape of your child can be viewed by appointment prior to its use in the study. If requested, I will send you a summary of the results. If you have any questions, please let me know.

Hopefully, this information will be beneficial to educators serving children with special health needs.

Thank you for your consideration.

Sincerely,

Penny S. Milburn

Robert Fuqua, Ph.D  
Associate Professor  
Major Professor

Iowa State University *of Science and Technology* Ames, Iowa 50011-1030



Child Development Department  
101 Child Development Building  
Telephone 515-294-3040

### INFORMED CONSENT

Effective training methods for teachers serving medically fragile children

I \_\_\_\_\_, freely and voluntarily consent to have my child, \_\_\_\_\_, video taped while being \_\_\_\_\_ I am aware of the purpose of this study and all procedures involved in this study and have had an opportunity to ask questions.

I understand that the video tape will be used to increase knowledge as well as familiarize students with the implementation of certain medical procedures. I understand that the video tape will be used only for the purpose of this study and that I may view this video tape prior to its use. I understand that my child's name will not be associated in any way with the results of the research, and that there are no risks involved for my child.

I understand that I may withdraw my consent and discontinue the use of this video tape in the study at any time.

I have read and do understand the above information and have received a copy of this form.

\_\_\_\_\_  
Parent/Legal Guardian

\_\_\_\_\_  
Date

APPENDIX E.  
CORRELATION MATRIX

Correlation Matrix

Pearson correlation coefficients/prob &gt; |R| under H0:RHO=0/N = 73

	PRESCORE	POSSCORE	LS1	LS2	INT1	INT2	INT3	INT4
PRESCORE	1.00 0.00	0.46 0.00	0.18 0.14	0.05 0.66	0.16 0.17	0.04 0.71	-0.06 0.60	-0.07 0.56
POSSCORE	0.46 0.00	1.00 0.00	0.14 0.23	0.19 0.11	-0.07 0.54	-0.01 0.91	0.20 0.09	-0.08 0.52
LS1	0.18 0.14	0.14 0.23	1.00 0.00	0.05 0.70	0.56 0.00	-0.05 0.71	0.56 0.00	0.08 0.49
LS2	0.05 0.66	0.19 0.11	0.05 0.70	1.00 0.00	-0.03 0.77	0.57 0.00	0.11 0.37	0.54 0.00
INT1	0.16 0.17	-0.07 0.54	0.56 0.00	-0.03 0.77	1.00 0.00	-0.11 0.36	-0.07 0.55	0.03 0.82
INT2	0.04 0.71	-0.01 0.91	-0.05 0.71	0.57 0.00	-0.11 0.36	1.00 0.00	0.04 0.75	-0.01 0.91
INT3	-0.06 0.60	0.20 0.09	0.56 0.00	0.11 0.37	-0.07 0.55	0.04 0.75	1.00 0.00	0.12 0.33
INT4	-0.07 0.56	-0.08 0.52	0.08 0.49	0.54 0.00	0.03 0.82	-0.01 0.91	0.12 0.33	1.00 0.00

APPENDIX F.

SQUARED MULTIPLE CORRELATIONS

Full Model	
Pretest score, LS1, LS2 and interaction	0.587949
Model 1	
Pretest score, LS1, LS2 and interaction	0.402669
Model 2	
Pretest score, LS1 and LS2	0.510146
Model 3	
Pretest score and interaction	0.496422
Model 4	
LS1, LS2 and interaction	0.420601