NUTRITION KNOWLEDGE ASSESSMENT OF PRESCHOOL CHILDREN

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(ABSTRACT)

A game with food and nutrition related pictures was developed to provide an opportunity for a classroom teacher to interview preschool children for assessment of nutrition knowledge concepts. Specifically, knowledge of vegetable concepts which included identification of the food, the food group, the source, preparation methods and use by the body was measured. The assessment was administered to five groups of children (ages two and one-half to five years) in preschools and child care centers in Reston, VA by high school early childhood education students. The assessment was designed to meet current criteria that assessment be teacher administered, provide useful information to the teacher, reflect the typical activities of children in the classroom and be one of a variety of assessments used. The assessment was successfully administered by the high school students working as teacher aides. The assessment gave teachers useful information about each class and individual children which could be used in curriculum planning. The assessment fit into the usual classroom activities, in this case, a games and manipulatives learning center. The assessment provided more in-depth information about children's knowledge than multiple choice tests used in previous research on nutrition knowledge, because the teachers recorded children's responses to open-ended questions. Children's responses indicated elementary understanding of food and nutrition concepts suggesting that classroom teachers need to make greater use of the variety of nutrition education materials available.

Dedication

During the time when I was working on my research, I read with great sadness about the death of a teacher who had greatly influenced my life, and this thesis is dedicated to her memory.

Much that I know about being a professional woman I learned as a freshman at Virginia Tech from Laura Jane Harper:

Professionals are committed.

One needs commitment and a professional attitude to be a professional, not a fancy title. I'll always remember about her cleaning lady.

Families and children are most important.

One's religious faith is an important part of one's life and a woman can be a deacon in the Baptist church.

A professional woman should always be impeccably groomed.

As a women I can do anything I work hard enough for.

A leader's door is always open and a leader always has time to listen.

J.P.

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Many thanks to the centers who loaned me their children and gave of their employees' time, to my high school students who went "above and beyond," to Edyth Wheeler Ph.D. whom I consulted on early childhood assessment, to Rick Clark who developed pictures for the game, to my colleagues at South Lakes who covered classes for me, to Dr. Hertzler who has the patience of Job, and to Dr. Brochetti and Dr. Stewart for their support.

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Chapter 1

Purpose

Curriculum planning and assessment form a circular process into which a single assessment needs to fit. An early childhood educator who recognizes the importance of including nutrition in the curriculum for a particular classroom chooses nutrition education activities and materials and plans lessons. The educator then teaches one or more specific units as well as integrating nutrition into the total program in the classroom. Ideally the educator assesses the knowledge the children possess initially and again after teaching particular concepts. Curriculum planning and assessment should become a continuous integral process in order to meet the needs of individual preschool children in that classroom. Needs that are discovered in assessment are addressed as the curriculum is refined. There is a need for practical methods classroom teachers can use to assess what children already know about nutrition and what they learn in the class.

The purpose of this study was to develop a protocol for assessing knowledge of nutrition concepts with children three to five years old. Education literature currently stresses the importance of meaningful assessment conducted by the classroom teacher, but contains few specifics on assessing content knowledge. Nutrition literature contains several examples of knowledge assessments, but none which address the needs of the classroom teacher working with preschool children. Criteria for assessment have been set forth and are used as guiding principles in developing the assessment in this study.

This study involved the development of an assessment tool, evaluation of the use of the tool with a sample of preschool age children, a test of reliability of the assessment tool and an analysis of the children's responses.

Chapter 2

Review of Literature

Preschool Nutrition Education

The importance of nutrition education for young children has been expressed by many groups concerned with the well-being of U.S. citizens. The American Dietetic Association (1) recommends that day-care programs provide mealtimes with a positive emotional climate and nutrition education that includes food experiences and parent involvement. In a survey of state education agencies it was found that all states mandate nutrition education in K-12 public schools in some form as either a discrete subject or along with other subjects such as work and family studies, science or health (2). The U.S. Department of Agriculture through the Nutrition Education and Training (NET) Program has awarded grants to state education agencies for development of nutrition education programs which may include the preschool level (2). Head Start mandates nutrition services in its programs (3).

Teaching young children to make nutritious food choices is important because of the connections between nutrition and learning, the fact that children are starting to make their own choices, and indications that diets of preschool children may not be optimal for a lifetime pattern. Cognitive performance has been linked to nutrition in several studies (4). In a study of control over food choices, Anliker et al. (5) found that 14% of three year olds chose their own breakfasts, 57% chose their snack foods and 30% planned lunches with another family member. More than 80% of children in the U. S. Department of Agriculture's 1985 and 1986 Continuing Surveys of Food Intakes by Individuals consumed more fat and saturated fat than recommended (6).

The amount of time many children spend in child care settings presents a challenge for early childhood educators to include nutrition education in the curriculum. In this country 12 million children under six years of age have both or their only parent in the workforce and utilize some form of child care (7). Many other children are in part-day preschool programs. A study by Wright et al. (8) of parents' perceptions of the role of the child care facility in food behavior showed that a majority of parents felt home is more influential in affecting food behaviors, but school is also an important influence. For example, 41% of parents indicated home and school were equally influential for learning food likes, and 33% considered home and school equally influential in teaching children to sit still while eating and in other table manners. Parents believed school had more influence in the area of classifying foods, and 34% believed school and home equally influential in teaching that “foods make healthy bodies.” A high percentage of parents

believed that they were responsible for teaching appropriate food choices and that nutrition should be taught at preschool or day care.

The preschool or child care center where young children are spending large amounts of time is an effective setting for learning nutrition and increasing preference for foods that are nutritionally beneficial. Coulson (9) commented on children's readiness to accept the authority of adults on matters of food and eating. Several studies detailed below have shown that knowledge of nutrition has increased after nutrition education programs for preschoolers (10, 11, 12). Birch (13) found that preschool children's preferences could be increased when foods were used as rewards or with non-contingent adult attention. Birch (14) also found that familiarity with foods was the most important factor in food preferences of three-year-olds. Phillips (15) concluded that children's preferences and ability to identify vegetables was related to whether the vegetables were served frequently at home or at the day care center. The day care center or preschool can be a critical factor in influencing children's food habits.

Overview of Assessment

The meaning and usage of the word assessment has evolved in recent years in the education field. In guidelines published by the National Association for the Education of Young Children (NAEYC) (16, p. 21) assessment is defined as "…the process of observing, recording, and otherwise documenting the work children do and how they do it, as a basis for a variety of educational decisions that affect the child." In recent years the term assessment has often been used along with the terms authentic, alternative, performance or portfolio in order to distinguish between assessment that meets NAEYC's or similar criteria and the standardized tests traditionally used to measure children's abilities and achievements. When Southern Early Childhood Association (17, p. 14) issued assessment criteria, the following selected criteria were stated:

- Assessment must be valid. It must provide information related to the goals and objectives of each program.
- Assessment should not include standardized tests, which are . . . multiple choice.
- Assessment must involve repeated observations.
- Assessment must use a variety of methods. Gathering a wide variety of information from different sources enables informed and professional decisions.

The wording perhaps reflects the strength of feeling about the need for assessment that complements a developmentally appropriate early childhood curriculum. Developmentally appropriate practice is instruction that is suitable for children's individual physical, intellectual and emotional capabilities. Generally developmentally appropriate curriculum involves children learning through a variety of interdisciplinary activities. Authentic assessment attempts to emphasize and portray the way in which children process information, construct new knowledge and solve problems, rather than focusing on the products of learning such as the correct answers

(18). A comparison by Chittenden, reported in Gullo (18), follows:

Conventional assessment:	Authentic assessment:
tends to be summative	ongoing
closed, objective measurements	open-ended formats
single setting	variety of contexts
teacher proof	mediated by teachers
verify practice	inform practice

In this paper the terms assessment or authentic assessment are used to mean assessment that meets the guidelines of NAEYC. The full text of the NAEYC Guidelines for Appropriate Assessment is included in Appendix A.

Development of Curriculum

Curriculum is defined as "an organized framework that delineates the content that children are to learn, the processes through which children achieve the identified curricular goals, what teachers do to help children achieve these goals, and the context in which teaching and learning occur." (16, p.21) Planning a curriculum is the first step in educating young children about nutrition. Ideally, curriculum and assessment are integrated with educators doing an initial assessment of children's knowledge and abilities and readjusting a planned curriculum. Assessment of children's development and learning followed by readjustment of the curriculum should be a continuous process.

The first step in planning a curriculum is an understanding of child development. A nutrition curriculum for preschoolers needs to take into account the way in which preschool children think and view the world around them. Piaget described three- and four-year old children as using pre-operational thinking (19). This is an egocentric stage; the child can only see his or her own viewpoint. According to the theories of Piaget, a child could classify concrete objects such as foods into groups but not understand abstract ideas such as digestion.

Contento (19) interviewed preschool and elementary children about foods. The pre-operational children considered all edible items to be foods; there was no distinction between snacks and foods. Vitamins were seen as only the pills that made people strong and healthy. They believed that food goes into the stomach and stays there unchanged or else somehow goes to the tissues in an unchanged form. Children's likes and dislikes affected the perceptions of "good for you" foods. They were able to name "good for you" foods but with no explanation. Contendo made several suggestions for educators based on the research and Piagetian theory. Food grouping based on common nutrients requires a higher level thought process than possessed by younger preschoolers. Contendo believed preschool children are not able to understand nutrients and their effect on the body. Since preschool children do not see snacks as separate category of food, a curriculum should include all types of food.

Coulson (9) reported that preschool children (ages 3 1/2 to 5) were able to identify foods in an interview, classify most as fruit or "not fruit", and comment on whether the foods were "good for you". Classification errors decreased with age. Spontaneous comments revealed ideas about texture being one of the criteria for fruit classification (hence the incorrect responses about orange juice) and parents as a source of information (spoken and modeled) about whether a food was a healthy choice. Cookies and cakes were cited as "not good for you" foods. The children also indicated the extent of knowledge about digestion by drawing a picture of food in the body. Food went in to the "tummy" (usually not a discrete organ) and sometimes all over the body, but children showed little understanding of what actually happened to the food.

Health education in preschool is considered valuable by Natapoff (20) who explains that while pre-operational children will not understand the prevention concept, the reasons for health practices, or the relation of eating today to body fitness in the future, they may "begin to accumulate a knowledge base which will become part of future belief systems." The vague, general health related ideas of the pre-operational child will become part of a coherent belief system around nine years of age (Piaget's concrete operations period).

Rickard et al. (21) suggest play as a basis to learning about healthful eating, because play is intrinsically motivated and actively engaged in by young learners. Play provides the opportunity for children to construct knowledge, make and test mistakes, assimilate new knowledge and engage in social interaction. Goals for the program developed by these researchers included

> (a) explore and find joy and pleasure in a variety of movement activities, and taste and find the joy and pleasure in eating a variety of foods from the different food groups; (b) experiment with combinations of movement activities, and experiment with new foods and methods for preparing and seasoning them and (c) learn to change physical activities, food choices and the environment to increase enjoyment and to enhance health, fitness, and well-being. (21, p. 1125)

The following are selected guidelines from NAEYC Guidelines for Curriculum Content (14, p. 29-31) with application to the teaching of nutrition.

- Curriculum is consistent with prevailing professional opinion and research on learning theory (currently a developmental, interactive, constructivist approach to learning).
- Curriculum content is designed to help children develop in all areas--social, emotional, cognitive, and physical. Nutrition educators recognize food as a very social aspect of our society and that many food choices are based on emotions. Preschool nutrition activities need to take into account these aspects of all parts of a child's development. Hertzler (22) described the many ways that food experiences may promote physical development because of the health benefits and growth related to foods eaten and also promote development of small motor skills.
- Curriculum goals are realistic and attainable for most children in the designated age range for which they were designed. Several nutrition educators have described the process of choosing developmentally appropriate objectives based on needs related to good health and cognitive and

physical development of children (3, 23, 24, 25).
●Curriculum allows for emphasis on a particular topic such as nutrition and in particular vegetables in the current study, while allowing for integration across other disciplines. The purpose of integrating curriculum is to reflect the natural way children learn and also to help children make connections between what they learn at home and in the program and between what they learn in school and the real world. Food and nutrition activities are easily integrated into all aspects of preschool education as discussed below.

A nutrition education curriculum developed for Head Start is interdisciplinary and includes lessons in language arts, social studies, science, math, music, art, physical development and social development (3). It includes many different teaching techniques such as games and puzzles, art experiences, cooking, and songs for a variety of settings. The curriculum developers felt that "nutrition education for preschoolers should be experiential in nature and should enable children to request and accept a wide array of nutritious food, as well as encouraging them to be willing to eat new and different foods." (3, p. 139) Another curriculum guide which meets the criteria is the *Preschool Nutrition Education Curriculum: Second Edition* published by the State of Florida Department of Education (26). The writing of the guide was funded by the Nutrition Education and Training Project mentioned earlier. Although not as comprehensive as the Head Start curriculum it contains a variety of developmentally appropriate activities and integrates nutrition with literature, art, science and other parts of the total preschool curriculum. Selected pages from one curriculum guide are included in Appendix B. Hertzler (22) suggests using prop boxes to encourage food-related dramatic play in settings such as a farm, grocery store or restaurant as a vehicle for children to learn nutrition concepts. In addition to activities listed above Herr (25) emphasizes the use of nutritious food in classroom special occasions, tasting of many foods prepared in different ways and frequent food preparation experiences.

Previous Studies Measuring Preschooler's Nutrition Knowledge

A variety of tools have been used for measuring preschool children's nutrition knowledge in research settings, but some of these methods are limited in utility for the classroom teacher or do not meet accepted guidelines for good assessment. Since teachers should be assessing many aspects of development and learning, it may not be practical for a teacher to remove children to a quiet place or to interview individually for a long period of time for any one assessment. Multiple choice tests do not meet the criteria described earlier. A description of methods and findings of several researchers follows.

Anliker et al. (27), who assessed three-year-old children's nutrition knowledge and analyzed parents' nutrition-related messages, found that the sample group of middle- to upper-class children not in school or day care had acquired a significant amount of nutrition knowledge. The children were able to correctly answer many questions related to food groups, food

transformations and food origins. The questions were asked by an interviewer and the children responded by selecting one of three color photographs (National Dairy Council food models). The interviewer asked the children to identify the foods in the photographs and corrected incorrect responses before proceeding with each question. The children were shown a selection of food models and were asked to make choices that would make a doll "grow big and strong." The children were also asked two open-ended questions about exercise and digestion. The children's knowledge was significantly related to the quantity, quality and specificity of messages given by parents.

Gorelick (10) tested a nutrition education program which was experiential in nature. Classroom teachers were provided nutrition education materials and were trained in using them. University students administered the knowledge tests to the children who ranged in age from three to five. Children showed an increase in knowledge in categories of identification of vegetables, fruits, and breads, handwashing and "good for you" foods. The measurement tools involved selecting actual foods from a "grab bag" and identifying them, classifying fruits and vegetables by sorting them into bins, and matching real foods with pictures. The children chose from several real objects to answer hygiene questions and picked foods that would be "good for" a doll from among several choices given. While these knowledge measurement tools matched the types of activities in the learning activities, the researchers noted the limitation of not having children answer open-ended questions and demonstrate their thinking. The types of activities used in this study would meet several criteria discussed earlier. The "grab bag", the sorting bins and the doll play would fit into the child's normal activities and would provide a variety of assessments.

Byrd (3, 28) administered a multiple choice test after preschool children ranging in age from three to five were exposed to parts of the Head Start nutrition curriculum mentioned above. The children were tested in groups of no more than five. Each child had a crayon and a booklet which had four drawings on each page. When asked a question such as "Put a circle around the food that helps our bones and teeth be strong," the child marked the food with the crayon. The children marked faces (smiling, frowning or expressionless) in a similar manner when asked questions such as "Mark the picture which tells how you feel about eating vegetables." Knowledge scores were not significantly improved. The researcher speculated that perhaps a highly experiential curriculum would not "promote performance on formal, quantifiable evaluation instruments such as the multiple-choice knowledge test" they used. Their theory would be supported by proponents of authentic assessment (17, 18). In addition teachers were asked to rate subjective attributes such as "The child tastes foods served" based on observations in the classroom. Desirable behaviors improved in both the control and experimental classrooms. This could be the result of ongoing nutrition instruction in control classrooms which would have been ongoing even if the class was not involved in the study.

Davis (29) tested a nutrition unit that used food models and finger puppets, pictorial recipe cards, songs and a board game. Activities were related to the concepts that foods contain nutrients and

the nutrients perform special functions in the body. Increased knowledge scores for children were reported, but the value of the findings is limited because statistical analysis and description of the test instrument were not included.

Children (ages 4 to 7) in a study by Singleton (12) were instructed in the relation of nutrition and health (with emphasis on fat and heart health) from audiocassettes and picture books. A posttest consisting of closed-ended (yes, no, I don't know) questions did not show a significant improvement in knowledge. Open-ended questions which were analyzed by use of concept mapping showed a positive effect of the program. Concept mapping is a technique of recording all of a child's responses to open-ended questions and analyzing the text for links between concepts mentioned. The greater the number of links a concept has to other concepts, the more meaningful that concept is determined to be. This type of assessment certainly allows children to respond to open-ended questions and is a valuable research tool. Its value as an assessment used by a classroom teacher would be limited because of the amount of time necessary for the detailed analysis.

A Classroom Assessment of Nutrition Knowledge

While the principles of authentic assessment have been articulated, there is a void in the literature on use of authentic assessment of content knowledge in early childhood classrooms. Thus far the emphasis has been development, “readiness” (a generalized concept used to describe how prepared children are for academic instruction) and school program placement (16, 17, 18). In one of NAEYC's (30) newest publications, the chapter entitled “Transforming Health Curriculum” contains only one paragraph on assessing health knowledge and briefly suggests observing a child for healthy behaviors or using an checklist or picture card game. The techniques mentioned were not described. One of the conclusions made by Powers, Hamilton, Huntsinger and Zemel (31, p. 202) after analyzing nutrition lessons used in kindergarten classes was that “Evaluation research is needed to assess the effectiveness of nutrition education on knowledge, food cholices and family eating patterns that are consistent the Dietary Guidelines.”

The objective of the current study is to develop and administer an assessment tool to measure nutrition knowledge which is practical for use by a classroom teacher. Applicable sections of Guidelines for Appropriate Assessment of NAEYC (16) were used as criteria in developing the assessment.

Of the previous studies measuring nutrition knowledge of preschoolers mentioned above, only one (3) involved teachers as assessors. The teacher in an early preschool classroom has been described as the primary user of assessment information; therefore, teachers should be the primary assessors (16). The writer was also motivated by the distressing finding that although teacher's opinions on importance of nutrition were positive, nutrition knowledge of many day

care teachers appears to be low (32). This assessment was designed for use by high school students training as early childhood teachers and aides for use in assessing nutrition knowledge of preschoolers with an interview while playing a game. The high school students were juniors and seniors ranging in age from 16 to 18.

In order to meet the criteria outlined by NAEYC (16) that assessment involve repeated observations and use a variety of methods, a teacher assessing nutrition knowledge before or after a teaching unit should use a variety of techniques of which the assessment in this study could be one. Other assessments might include an interview in the socio-drama area of the classroom, an interview while making food with playdough, observations of food habits at meal and snack time, games and puzzles other than the one used in this study, or teacher records of conversations or circle time discussions. Classroom teachers are being encouraged to observe children regularly, intentionally and in different settings and keep portfolios which might include teacher notes of observations. Suggestions to facilitate record keeping include use of index cards stored in key areas of a classroom or a small notebook that a teachers keeps in a pocket or around one's neck. (33, 34)

Multiple choice, pencil (or crayon) and paper tests used in several studies described above are specifically mentioned as inappropriate assessments for young children in SECA's position statement above and are not mentioned as appropriate assessment in the NAEYC Guidelines. The game in this study includes pictures which provide an opportunity to ask questions of the preschool children in a familiar setting. Tammivaara and Enright (35, p. 232) have summarized characteristics of questioning techniques used with children in gathering ethnographic information. They advise that children are more comfortable answering questions while they are "*doing* something *with* something. Thus, the emphasis is on adding in a step to an already ongoing activity rather than creating new interactional demands for students and teachers. Embedding ethnographic questions within universally familiar *game* routines may provide alternative interview settings." Using a game playing situation meets the NAEYC guideline (16, p.32) which states, "Assessment relies primarily on procedures that reflect the ongoing life of the classroom and typical activities of the children. Assessment avoids approaches that place children in artificial situations or impede the usual learning and developmental experiences." The game in the current study was designed to be used like other games in a classroom but affords the classroom teacher the opportunity to ask questions of the child.

The purpose of this study was to develop a protocol for assessing knowledge of nutrition concepts with children three to five years old. The assessment developed and administered in the current study was designed to be administered by classroom teachers and involved an interview that took place while children played a game in a setting with which they were familiar. The assessment was intended to be one of a variety of assessments used.

Chapter 3

Methods

Development of Game used in Measuring Nutrition Knowledge

A game was developed for use in assessing nutrition knowledge of preschool age children. A set of 12 drawings with a variety of nutrition subjects that could be used in a “Lotto” type game or a “Memory” type game was designed (Appendix C). The pictures were randomly selected from nutrition topics covered in the curriculum guides described earlier. The pictures included nine foods from the fruit, vegetable, breads and cereals, and milk products food groups as well as one picture each representing hand washing, growth and a sweet snack. All of the foods except the cake and the noodles were on the list of familiar foods developed by Torisky (36) from a survey of parents of preschoolers in a similar population.

The games were designed so that the format would be familiar to preschool children. The style of the games is similar to other games available to early childhood educators (37, 38, 39). “Lotto” games in current catalogs have boards with six, nine or twelve pictures. “Memory” games have as many as 36 pictures in pairs, but teachers often choose to play with a smaller number of pairs, especially for preschool children.

One type of game, a “Memory” type game is played with a deck containing two cards with each picture (Appendix C). The "Memory" type game developed for this purpose has 24 cards, two each for 12 pictures representing food and nutrition concepts described above. The cards are shuffled and placed face down in rows on a surface. Each player, in turn, turns over one and then another card in attempting to turn over two identical cards. If the cards are not identical, the cards are returned to a face down position, and the next player attempts to make a match. Memory of the various pictures' positions aids in making matches.

During the data collection the game was used in the “Lotto” form exclusively. A “Lotto” type game which is popular with younger preschool children is played with a game board for each player and a set of shuffled face-down cards (Appendix C). The cards are drawn from the deck one at a time by players in turn. The cards are then placed on the game boards on top of the matching picture. The object of the game is to fill up the game boards. Although this game is played with many variations on the basic rules, any variation would provide an opportunity for the pictures to be seen and discussed. The teacher played with one of the game boards just as if the teacher and the child were playing the game without the interview. This allowed a card with each picture to be drawn twice so that it could be talked about twice.

Development of Interview Questions and Procedure

When the assessment was originally planned, questions were designed for each of the 12 pictures. In initial trial uses of the game and interview questions, asking the questions and recording the child's responses were so time consuming that progression of the game was slowed. The game would not have progressed at the speed of game playing with which the child is familiar in the classroom. Therefore, the questions were then limited to one food group, vegetables. The writer's choice of vegetables was related to her experience with food choices of high school students. Vegetables are the least accepted food group and the area of foods and nutrition study to which many students offer the most resistance.

The pictures from the vegetable group include a plate of green beans, a raw carrot and french fries in a fast food type container. Questions developed to accompany pictures in the games (Appendix D) were selected from concepts suggested by Herr (25) and Hertzler (23) and behavioral objectives in the vegetable related activities in *A Preschool Nutrition Education Curriculum* (25) and the *Head Start Nutrition Education Curriculum* (40). In addition to identification of the three vegetables, concepts tested include:

- The vegetable group includes green beans, carrots and potatoes as well as others.
- Vegetables come from plants.
- Vegetables are prepared and eaten in many forms.
- Preparation of vegetables may include washing, cutting, peeling and/or cooking before eating.
- Vegetables help the body grow, have energy and be healthy.
- Vegetables help the body have healthy skin & eyes.

Identical questions were asked about each of the vegetables, french fries, carrots and green beans. The questions related to classification were:

What food group do french fries (carrots or green beans) belong in?
What kind of food is french fries (carrots or green beans)?

The source question was:

Where do french fries (carrots or green beans) come from?

The preparation questions were:

Tell me about fixing this food.
How do you get this food ready so it is safe to eat?

The question related to use by the body was:

What do french fries (carrots or green beans) do for your body?

The nutrition questions were printed on a 5" x 8" index card for use with each child (Appendix D). The card could be easily held by a teacher to use as a response sheet while playing the game in a classroom setting. One side of the card contained space for the child's name, age, school, beginning and ending times and longer comments such as "My mom cooks yummy carrots."

The response sheet included several possible answers for the questions. These possible answers were based on responses children gave during the pilot test and in other classroom activities. They were included as a convenience for the teachers rather than an indication of correct responses that should be given. There was a small space for writing in an answer that did not fit the possible responses exactly.

The game was designed to be played by teacher (high school student) and child in an ordinary classroom setting, most commonly at a games and manipulatives learning center during a free-choice time period. The questions were designed to be asked in any food order since cards would appear in a random order during the game playing.

As each of the cards was turned over the child was prompted to identify the food. The teachers (high school students) were instructed to model identifying the cards they drew by saying "My card has the cake" or a similar statement so that the children might start doing the same. If the child did not identify the food, the teachers were told to ask "What is on your card?" or "What is that food?" If the child did not identify the food correctly, the teacher (high school student) was instructed to tell the child what food it was. Next, the child was asked the questions about the food. If the child became impatient with the questions and wanted to move on with the game, some of the questions were asked the next time the card appeared, since each card appeared twice in each game.

Preschool Children

The preschool children selected for testing ranged from 3 to 5 years of age. There were also five two and one-half-year old children in the class of one of the teachers who were included in the study. The sample of children is described in Table 1. The children were chosen because they were in the class where each participating high school student worked as a teacher's aide. The high school students had all been working in their prospective centers longer than six months. The children were enrolled in a the half-day preschool at the high school, or one of four full-day child care centers in the Reston/Herndon, VA community (Appendix G). As a group the children were representative of the ethnic and economic mixture of the community (Table 1). Demo-graphic information for the community is shown in Tables 2 and 3. Directors of three of the centers indicated to the writer that the centers served parents of a variety of income levels. One of the centers (designated as Class 5 in Results) is supported by a charity organization in the com-munity and provides subsidized child care to low income families. All of these centers are child care facilities which have hired students from this high school in cooperative education programs. Administrators of each of the schools gave permission for the study to be carried out in the school (Appendix H). The parents of the children were told about the project. No parents objected to the children's participation. The high school students had all been working in their prospective centers longer than six months and knew the children well.

Table 1. Description of sample (N = 44)

Group	Total	Male	Female	Age-2.5 & 3	Age 4	Age 5	African-American	Asian	Caucasian	Latino
Class 1	11	4	7	4	3	4	2	0	8	1
Class 2	10	4	6	10	0	0	0	0	9	1
Class 3	6	3	3	6	0	0	0	0	6	0
Class 4	7	3	4	5	2	0	1	0	6	0
Class 5	10	4	6	0	2	8	6	0	0	4
Total	44	18	26	25	7	12	9 20%	0 0%	29 66%	6 14%

Table 2. Household Income Distribution, Fairfax County, Virginia, 1990 (41)

Income Category	Percentage of Households
< $15,000	3.2%
$15,000 - $44,999	26.9%
$45,000 - $89,000	45.0%
$90,000	24.9%

Table 3. Racial/Ethnic Composition, Fairfax County, Virginia, 1990 (42)

Racial/Ethnic Group	Percentage of Individuals
African-American	5.8%
Asian	3.8%
Latinos	3.3%
White	86.2%
Other	1.0%

High School Students

The high school students chosen for administering this study were 11th and 12th grade students enrolled in an Occupational Child Care I and II class taught by the writer. The curriculum includes the basics of child development, developmentally appropriate practice in the care of preschool children, and operation of preschools and child care facilities. As high school students, they serve as teachers, assistant teachers and aides as well complete food preparation and clerical duties in preschool facilities housed in high schools. While some of the students are exploring career choices, many are seriously considering entering the child care field after high school or continuing their education in elementary or early childhood education or related fields at the university level. They are learning to teach nutrition and health as well as language, math, social studies, science, art and music to the preschool children.

High school students are not generally considered to be well-informed on nutrition (43, 44). However, the use of teenagers to teach younger children nutrition has been documented in the literature (45). In one successful program the teenagers' knowledge increased significantly as a result of the training and work with younger children. In the writer's experience high school students in the class have not demonstrated a high degree of nutrition knowledge, but they show willingness to prepare and present lessons on foods and nutrition for the preschool children.

The Child Care I and II students were enrolled at South Lakes High School in Reston, Virginia. A total of 18 students were enrolled in the 1996-1997 school year. The class participated in a lesson on assessment (Appendix E) which covered the basics of assessment theory. The students who were invited to participate were those students who had performed well in the preschool they operate, had successfully completed other class assignments and had career goals related to early childhood education. Four students out of the 18 were invited to participate in the study because they had been employed as teacher's aides in child care centers in the community for longer than six months. The fifth student who participated in the study working with the children in the preschool at South Lakes was enrolled in Occupational Child Care II. The students who agreed to help with the study were further trained in using the game and questions. In the training session the game and interview techniques were demonstrated by the writer, and high school students practiced with each other and the writer (Appendix F).

Training and Pilot Test

The game and interview were tested during the spring of 1996. During free choice time on a preschool day after the training, the high school students alternated as the teacher in charge at the games and manipulatives learning center. The students played the game with one child and recorded the child's responses to three questions for each of 3 food items. The writer observed the game and interview and recorded all of the questions and responses. The written record and

the cards marked with checks and comments were compared to assure that the high school students were recording the responses accurately. Variations in the writer's notes and the response cards were used to discuss and clarify misunderstanding about what should be recorded. The writer and the high school students discussed whether more questions than the original three for each food item could be asked. As a result of the discussion and need to make questions for each vegetable consistent to facilitate analysis of results, several questions were added. The test resulted in seven questions for each food dealing with concepts of identification, classification, origination, preparation, and use in the body.

High school students also had an opportunity to ask questions about techniques and recount difficulties they had. Changes were made in the pictures to help recognition. Milk changed from a paper carton to a glass of white liquid. Each student tested another child several days later. The students expressed that they felt comfortable with the procedures during their second test with a preschool child.

During the winter 1997, training was reviewed with two students who participated in the pilot, and three additional students were trained (Appendix F). Procedures were reviewed immediately before actual collection of data.

Data Collection

Data collection took place during April and May 1997. The writer observed all the testing in four of the schools. The writer listened and made notes about the children's responses if it was possible to sit close enough to the high school student and preschool age child; response cards were checked later for accuracy. The high school student in the fifth school made audio tapes of her sessions with the children and the writer listened to them to check for accuracy.

The assessment was designed to be administered during a free choice time in the children's school schedule. The high school students were sitting at tables with games and manipulatives as they normally would in their teacher roles. Preschool children either came and expressed an interest in playing or were invited to play the game. The setting varied somewhat in the various classes depending on the time of day and nature of the school. The differences are discussed below with the results. The time for the assessments ranged from five to twenty minutes, with most around ten minutes.

As the game was played the high school students asked the questions associated with the vegetable pictures as those playing cards were drawn and recorded responses on the response card provided (Appendix D). All responses were recorded on the response cards. If children did not identify the vegetable, they were asked what the food was. If the child could not name the vegetable, but recognized the food when it was told to him/her, questioning proceeded. The high school students were instructed to read the nutrition questions from the response card as written,

but, despite reminders from the writer most of them worded questions in phrases that were more comfortable for them. The writer found it necessary to prompt the high school students occasionally not to ask more questions or totally different questions than those written on the response cards. While in a research setting it was important to ask the questions consistently, the students were doing what a teacher might do to find out if the child could demonstrate knowledge of a subject if asked in a different way. The high school students were allowed to make comments on other subjects and any child initiated conversation was allowed. If the child's response matched one of the answers on the response card, the high school student checked that answer. Otherwise the high school student wrote the answer on the response card along with any interesting or unusual comments. If more than one child was playing, the nutrition questions were asked of only the child being tested and the high school student made conversation unrelated to the test questions with the other child. The game player who was not the subject could also be asked questions related to the other nine pictures which were not vegetables.

The high school students retested one or two children one to two weeks after the initial test to check for reliability of the assessment. In the preschool at the high school a different high school student retested the children because two high school students performed the assessment with that group.

Data Analysis

Responses were tabulated for each of the five classes. Correct answer scores were not appropriate in this study. The open-ended questions produced a wide range of answers based on the children's prior knowledge and experiences.

Since the assessment was designed to be used by a classroom teacher, the results were summarized separately for each class. Individual student's response cards were saved with other materials from the study, but might otherwise be added to a child's portfolio.

A few responses whose meaning could not be understood by the writer were not included in the summaries. Responses with similar ideas were grouped in the summary. For example, "good bodies," "grow," big and strong," "feel good" and "take care of body" were all grouped together as "health and growth." When a meaningful response was given to a question of a different category, the response was counted under the question it answered.

The responses were also summarized for the total sample and analyzed by children's age so that comparisons could be made with prior research on children's nutrition knowledge.

Chapter 4

Results

The responses of each child in a class are recorded in tables in Appendix I. The high school students are shown performing the assessments in Appendix J. A summary for the class is shown on the bottom row of each table. Below the table the percentage of total responses is given. The summary of results for each class is also shown following the description of the assessment administration for each class on the following pages.

None of the children in any class responded "vegetable" to the question "What food group do … belong in?" Those who answered "vegetable" did so when asked "What kind of food is …?"

Most of the responses about food preparation were in answer to "Tell me about fixing …" When high school students did not ask a question as it was written on the card, it was most likely the "How do you get this food ready so it is safe to eat?" They often changed it to a question like "How does Mommy cook ...?

Results Class 1

In Class 1, the high school laboratory preschool, the assessments were completed as designed. A low pupil-teacher ratio allowed for teachers to easily have short one-on-one time periods with the children. Each assessment was carried out by one of two high school students who were both regular teachers in the preschool. One of them, JW was also the teacher of Class 3.

The assessments were done on several days over a three week period. Eleven children completed the assessment. The four others enrolled in the class were asked several times but never wanted to play the game. In keeping with the design of an assessment that fits into the child's normal activities and is part of "learning center" time when children choose their activities, they were not required to participate.

Nutrition knowledge was generally low as judged by responses to most of the questions asked as shown in Table 4. With only one exception, the children identified all the vegetables. Only two children were able to classify the foods as vegetables from the use of the alternative form of the question. (These two were the oldest children in the class.)

The children demonstrated very little knowledge about the sources of the foods other than McDonalds for the french fries. Not surprisingly, seven of the eleven children (64%) answered McDonalds. For the carrots and green beans 36% of responses were related to growing vegetables and one child's answer to the source of carrots was "store."

The children also told very little about preparation. Only 27% of responses to the pair of preparation questions demonstrated any knowledge of how the food was fixed.

In answer to the question about use by the body, 61% of the responses indicated a general idea of benefit to the body, but none of the responses were more specific than "makes you strong" or "takes care of the body."

With this class the writer and the high school students were considering the assessment to be a pre-test for a vegetable unit. With the writer's encouragement the high school students had provided many food preparation experiences, and three weekly themes were related to foods (grocery store, fruits and bread), but there has not been any focus on vegetables. The high school students knew after the assessment that the children were able to identify the vegetables, could generally not classify them as part of the vegetable group, and had some general ideas about health and growth benefits but did not know of specific benefits to the body from vegetables. Experiences with preparation of vegetables would help children identify the sources and ways to prepare vegetable dishes.

Table 4. Summary of Results for Class 1 (N:11)

Carrot questions	
Identify	11/11 correct
Classify (What kind of food are carrots?)	2/11 vegetable, 2/11 rabbit food
Source (Where do carrots come from?	2/11 store, 3/11 grow, 1/11 farm, 1/11 bunnies
Preparation (Tell me about fixing this food. How do you get this food ready so it is safe to eat?)	2/11 eat, 3/11 wash, peel, and/or cut, 2/11 cook
Use by the body (What do carrots do for your body?)	8/11 health or growth
French fries questions	
Identify	11/11 correct
Classify (What kind of food are french fries?)	2/11 vegetable, 1/11 yellow
Source (Where do french fries come from?)	7/11 McDonalds, 1/11 people make them
Preparation (Tell me about fixing this food. How do you get this food ready so it is safe to eat?)	2/11 cook
Use by the body (What do french fries do for your body?)	5/11 health or growth, 1/11 swallow
Green bean questions	
Identify	10/11 correct
Classify (What kind of food are green beans?)	2/11 vegetable, 2/11 green
Source (Where do green beans come from?)	4/11 grow
Preparation (Tell me about fixing this food. How do you get this food ready so it is safe to eat?)	2/11 cooking before eating, 2/11 cook
Use by the body (What do green beans do for your body?)	7/11 health or growth

Children responded in 64% of question categories.

Results Class 2

Completing the assessments with Class 2 was more difficult than Class 1. The children were all young three-year-old or two-year-old children who would have their third birthday within three months. The teacher in this class had difficulty balancing one-on-one time with other duties. This center has a lower teacher:pupil ratio and smaller classroom space than the other centers. Unlike the children in other classes, the children did not seem to be accustomed to playing games such as the lotto game used in the assessment.

Several of the assessments were done the morning of a day when the high school was not in session, because the writer was available and the student worked at the center all day. The others were completed in the afternoon after nap time which is the high school student's normal working time. The children in this class wanted to play the game quickly and move on to something else, but gave as many responses to the questions as other groups except Class 5.

The children did not demonstrate a high degree of nutrition knowledge as shown by the responses in Table 5. None of the children classified the foods as vegetables, but all the foods were identified correctly except for one child who didn't give the name for carrots but seemed familiar with them.

Few responses were given about sources or preparation of the vegetables except McDonalds as the source of french fries. However 65% of the responses to the questions about use in the body indicated some general idea of benefit for health and/or growth. Knowledge of the general ideas would give a teacher a starting point for planning future lessons on specific benefits of vegetables.

Table 5. Summary of Results for Class 2 (N:9)

Carrot questions	
Identify	8/8 correct
Classify (What kind of food are carrots?)	0 responses
Source (Where do carrots come from?)	1/8 store, 4/8 bunnies, 2/8 tummy
Preparation (Tell me about fixing this food. How do you get this food ready so it is safe to eat?)	3/8 wash, 2/8 break or cut, 1/8 cook, 1/8 peel,
Use by the body (What do carrots do for your body?)	4/8 health & growth
French fries questions	
Identify	9/9 correct
Classify (What kind of food are french fries?)	1/9 yellow
Source (Where do french fries come from?)	1/9 grow in garden, 7/9 McDonalds
Preparation (Tell me about fixing this food. How do you get this food ready so it is safe to eat?)	1/9 wash, 1/9 wash & cook, 1/9 cut, 1/9 stir
Use by the body (What do french fries do for your body?)	8/9 health & growth
Green bean questions	
Identify	9/9 correct
Classify (What kind of food are green beans?)	0 responses
Source (Where do green beans come from?)	1/9 store, 1/9 momma, 1/9 dinner
Preparation (Tell me about fixing this food. How do you get this food ready so it is safe to eat?)	1/9 wash, 2/9 cut, 1/9 in a pan
Use by the body (What do green beans do for your body?)	4/9 health & growth, 1/9 tummy

The children responded in 73% of question categories.

Results - Class 3

Class 3 included young three-year-olds who did not have the ability to wait their turn to play the game. As shown in the illustration below, the teacher had several children near her all the time. The assessments were initially done during the afternoon (after nap) shift when the high school student usually works. The first three children's assessments overlapped. The teacher did a masterful job of juggling the response cards and asking all the questions individually to each child. The writer suggested she not continue that day and arranged to bring the high school student back for a short time one morning during the free choice time at the center. Again the children flocked to JW but did wait their turns to play the game. The different setting did not, however, yield more responses to the questions. This was not a talkative group.

The children in this class demonstrated very little knowledge of nutrition concepts in any category besides identification. The results are summarized in Table 6. Only 16% of the classification, source, preparation and use by the body questions were answered.

Illustration 1. Teacher JW with members of Class 3

Table 6. Summary of Results for Class 3 (N:6)

Carrot questions	
Identify	4/6 correct
Classify (What kind of food are carrots?)	1/6 broccoli
Source (Where do carrots come from?)	0 responses
Preparation (Tell me about fixing this food. How do you get this food ready so it is safe to eat?)	1/6 set the table, 1/6 cook
Use by the body (What do carrots do for your body?)	1/6 healthy
French fries questions	
Identify	5/5 correct
Classify (What kind of food are french fries?)	0 responses
Source (Where do french fries come from?)	1/5 McDonalds
Preparation (Tell me about fixing this food. How do you get this food ready so it is safe to eat?)	0 responses
Use by the body (What do french fries do for your body?)	1/5 feel good
Green bean questions	
Identify	4/6 correct
Classify (What kind of food are green beans?)	0 responses
Source (Where do green beans come from?)	1/6 plant
Preparation (Tell me about fixing this food. How do you get this food ready so it is safe to eat?)	1/6 crunch, crunch, crunch
Use by the body (What do green beans do for your body?)	3/6 health or growth, 1/6 digestion

Children responded in 29% of question categories

Results Class 4

The children with whom DG played the nutrition game were three-year-olds in her class or three- and four-year olds with whom she worked before they moved up to the next class. She rotated occasionally in the older children's class, so she continued to have contact with these children. The assessments were completed in the afternoon during her normal working hours.

The results as shown in Table 7 are similar to Class 1 and Class 2. The children identified all the vegetables correctly and 24% of the classification responses were related to food groups. However, these children gave very few responses about sources or preparation of the vegetables, except for responding McDonalds as the source of french fries.

When asked what the vegetable did for the body, all the children except one responded with some statement of benefit for the body for each vegetable. Some of the responses were related to growing or the common "big and strong" idea; others answered that the food was something to eat or it went in the tummy. As mentioned earlier, these ideas of benefit can give a teacher a starting point for teaching more specific benefits.

Table 7. Summary of Results for Class 4 (N:7)

Carrot questions	
Identify	7/7 correct
Classify (What kind of food are carrots?)	2/7 vegetable, 2/7 rabbits
Source (Where do carrots come from?)	2/7 bunnies, 1/7 country, 1/7 refrigerator
Preparation (Tell me about fixing this food. How do you get this food ready so it is safe to eat?)	1/7 wash
Use by the body (What do carrots do for your body?)	2/7 eat, 2/7 health or growth, 1/7 tummy
French fries questions	
Identify	7/7 correct
Classify (What kind of food are french fries?)	1/7 vegetable
Source (Where do french fries come from?)	4/7 McDonalds
Preparation (Tell me about fixing this food. How do you get this food ready so it is safe to eat?)	1/7 eat it at lunch time
Use by the body (What do french fries do for your body?)	2/7 eat, 3/7 health or growth, 1/7 tummy
Green bean questions	
Identify	7/7 correct
Classify (What kind of food are green beans?)	2/7 vegetable
Source (Where do green beans come from?)	1/7 store
Preparation (Tell me about fixing this food. How do you get this food ready so it is safe to eat?)	0 responses
Use by the body (What do green beans do for your body?)	1/7 eat, 4/7 health or growth

Children responded in 67% of question categories.

Results Class 5

The assessments in Class 5 were administered slightly differently than the other classes. ST did not want to be watched as she was playing the game initially, but the center allowed her to make audiotapes of the children. With her work responsibilities she was able to play the game with one or two children once or twice a week. She brought the response cards and tapes to the writer after completing each one. The writer listened to the tapes to verify that the questions were asked and the children's responses were the same as recorded. Because she did not understand the importance of doing the assessment in the classroom, she followed her supervisor's suggestion and took the children one by one into an adjacent room to play the game. The writer was not aware of this until she was finished with many of the assessments. Some were done in the classroom after that, and the writer did observe her completing several assessments after she was more comfortable doing it. The director in this center was most supportive of this study. The teacher with whom ST worked was less enthusiastic because of the time that ST was out of the classroom doing the assessments in the adjacent classroom. This illustrates the need for classroom teachers to have assessment techniques which fit into normal classroom activities.

The observation of ST playing the game with the children showed her calm, unhurried manner and obvious close relationship with the children. She had worked with her group of children longer on a daily basis than had the other high school students in their respective classes. The writer believes this close relationship resulted in the high (77%) rate of response to the questions compared with the other classes. Based on casual observations, the writer feels the teacher in the class has encouraged much verbal expression. The writer believes that ST's results are most like what a full-time teacher trained in early childhood methods, including assessment, could achieve.

The results are summarized in Table 8. Except for one child who did not know green beans, all the other children identified the vegetables correctly. However, only 26% of the classification responses were "vegetable." One child knew that french fries come from potatoes. Otherwise the responses were similar to other classes. There were a few children whose responses showed that they were familiar with the concept of vegetables growing on plants.

This class had the highest response rate for the preparation questions. Sixty-three percent answered with a combination of preparation terms such as cut, wash, stove, cook and boil. Either at home or at school these children seem to have had more preparation experiences with vegetables than the other classes.

Children in all the classes made references to rabbits when answering the questions about carrots. In this class eight of the nine children answered that the type of food for carrot was rabbit food. Being aware of connections such as carrots and rabbits that children make can help teachers in helping children learn nutrition concepts.

Table 8. Summary of Results for Class 5 (N:10)

Carrot questions	
Identify	10/10 correct
Classify (What kind of food are carrots?)	2/10 vegetable, 9/10 rabbit
Source (Where do carrots come from?)	4/10 rabbit or forest, 1/10 store, 1/10 grow
Preparation (Tell me about fixing this food. How do you get this food ready so it is safe to eat?)	1/10 cut, 5/10 wash and/or cook
Use by the body (What do carrots do for your body?)	6/10 health or growth
French fries questions	
Identify	10/10 correct
Classify (What kind of food are french fries?)	1/10 white & yellow, 2/10 vegetable
Source (Where do french fries come from?)	6/10 McDonalds, 1/10 potato, 1/10 food
Preparation (Tell me about fixing this food. How do you get this food ready so it is safe to eat?)	4/10 cook, 1/10 serve
Use by the body (What do french fries do for your body?)	6/10 health or growth
Green bean questions	
Identify	8/10 correct
Classify (What kind of food are green beans?)	3/10 vegetable
Source (Where do green beans come from?)	2/10 grow, 1/10 from lunch
Preparation (Tell me about fixing this food. How do you get this food ready so it is safe to eat?)	6/10 wash and/or cook
Use by the body (What do green beans do for your body?)	6/10 health or growth

Children responded in 77% of question categories.

Reliability Test

In each of the centers except one where the teacher became ill, one or two children were tested a second time. As shown in Table 9, in the second testing of the children 74% of the responses were the same.

There was only one pair of responses that were different (corn and carrots as identification answers). There was one pair of responses that were slightly different (wash, peel, cut top off carrot and wash, cut dirt off) and two pairs of responses where the child gave more information one time than another. In response to the questions about preparation a child discussed putting in the mouth and putting on a plate both times and added a comment about the pot once. The other different set of responses were in answer to source of french fries (McDonalds only and McDonalds along with grow in garden). The other pairs of answers which were not the same were a response and a lack of response, rather than different answers. In using an open-ended type of questioning where more than one answer might be correct, children would be expected to choose to answer differently on different occasions. Because of the similarity of responses, the writer judged the assessment to be a reliable measure of the children's knowledge.

An interesting observation was the answer "flowers" by AN in response to the question, "Where do green beans come from?" "Flowers" was the answer both times the question was asked. For this child the testing and retesting were two weeks apart. Giving the response twice suggested the child had a definite idea about the source of green beans, possibly an understanding that the vegetable grows on the plant where the flower was. In classroom use, a teacher could inquire further to find out what the child was thinking about and build on that idea or help the child discover the real source of green beans.

Table 9 Results of Reliability test

Initials of child & school	Carrot					French fries					Green beans				
	Identify	Classify	Source	Preparation	Use by body	Identify	Classify	Source	Preparation	Use by body	Identify	Classify	Source	Preparation	Use by body
SL RCC 1st	✓					✓							plant		
Sl RCC 2nd	✓	bunnies				✓					✓			cook	
AN at McN 1st	✓		bunnies, grow in the mud	wash	big & strong	✓		dinners McD	go to McD, wash	big & strong	✓		the flowers	put in mouths, put on plate	big & strong
AN at McN 2nd	×[a]					✓		dinner McD		big & strong	✓		flowers	pot, put in mouth, put on plate	big & strong
RE at McN 1st	✓		rabbits	break them		✓		grow in garden, McD		big & strong	✓				
RE at McN 2nd	✓					✓	Happy Meal	McD			✓				

Table 9 Results of Reliability Table, *continued*

Initials of child & school	Carrot,					French fries					Green beans				
	Identify	Classify	Source	Preparation	Use by body	Identify	Classify	Source	Preparation	Use by body	Identify	Classify	Source	Preparation	Use by body
TD at SL 1st	✓	rabbit tummy		wash, peel, cut top off	makes you strong	✓	McD			big & strong	✓				Makes you strong
TD at SL 2nd	✓			wash, cut dirt off	makes eyes good	✓				big & strong	✓	says he has never eaten green beans			
RD at SL 1st	✓		ground	cook	big and strong	✓		McD		grow	✓				grow
RD at SL 2nd	✓	Bugs Bunny	the ground	cook	grow	✓		McD, Burger King	cook	grow	✓	carrots green	the ground	cook	grow

Table 9 Results of Reliability Table, *continued*

Initials of child & school	Carrot,					French fries					Green beans				
	Identify	Classify	Source	Preparation	Use by body	Identify	Classify	Source	Preparation	Use by body	Identify	Classify	Source	Preparation	Use by body
LE at LLC 1st	✓	bunny, orange & green	from bunny	no one can fix it; eat it all & drink milk, cut it	makes you fine	✓	McD, white & yelow	McD	don't fix, eat it all-put in trash	feel better	✓	green, green & black		wash, eat all of it	make me die
LE at LLC 2nd	✓	bunny	dirt & water	Don't, not broken, sit in chair and put it on table	feel good	✓	McD, yellow	McD	Don't fix		✓	for us, green	Don't fix, not broken		

[a] corn

Abbreviations: ✓-correctly identified, ✕-incorrectly identified, McD-McDonalds or other fast food, ref-refrigerator, veg-vegetable

Chapter 5

Discussion

Comparison with other research

The literature does not contain examples of classroom teacher administered nutrition or health knowledge assessments which meet the criteria described above on which this study was based. Therefore the administering of the assessment could not be compared with other researchers' findings.

The responses of all the children in the study grouped by age are summarized in Table 10. The summary results can be compared with several other studies which used multiple choice tests or was conducted in methods that are not practical for classroom teachers. Since the assessment in this study was not given to any of the children as a follow up to a teaching unit, the findings could be compared to other studies which did not include an intervention or the control groups in those which did.

Identification questions

In this study 95% of the three-year-olds' correctly identified the vegetables. Hertzler et al. (46) found that three-year-olds were proficient in naming foods familiar to them. The one child in this study who answered incorrectly to green beans gave the name of another green vegetable, which is similar to Hertzler's findings that three-year-old children often confused names of same color foods. Children in the control (no intervention) group of Gorelick's (10) study averaged a score of six out of twelve in vegetable identification. Phillips (15) reported that of three- to five-year-olds in a day care center 86% identified green beans and 48% identified carrots.

Classification question

In Anliker's (27) study of three-year-olds who were not in preschool programs, 46% correctly picked vegetables from choices of pictures. In this study four percent of three-year-olds said that carrots were vegetables and nine percent said that green beans were vegetables, but they were not given any words as choices of categories, making the vegetable response a less likely outcome. Children also classified by color and when the food was eaten. Children in the control (no intervention) group of Gorelick's (10) study averaged six out of eight in sorting vegetables into bins. The open-ended questions in this study would be expected to produce a lower response rate on vegetable classification.

Source question

In Anliker's (27) study, 50% of the children picked french fries from three food pictures as a

Table 10. Summary of responses of all children by age

Age groups	Carrot					French fries					Green beans				
	Identify	Classify	Source	Preparation	Use by body	Identify	Classify	Source	Preparation	Use by body	Identify	Classify	Source	Preparation	Use by body
2.5-3	21/23✓ 91%	1/23 veg (4%) 2/23 bunny (8%)	3/23 store (13%) 2/23 grow (9%) 1/23 ref (4%)	12/23 prep (52%)	6/23 health or growth (26%)	22/23✓ 100 %	1/23 lunch (4%) 2/23 yellow (8%)	10/23 McD (43%)	3/23 prep (13%)	11/23 health or growth (48%) 3/23 digestion (13%)	21/24✓ 91% 1/24 ✕	2/24 veg (9%) 1/ 24 healthy (4%)	1/24 bunny (4%) 2/24 grow (9%) 2/24 store (9%)	5/24 prep (22%)	4/24 digestion (17%) 9/24 health or growth ((39%)
4	7/7 ✓ 100 %	1/7 bunny (14%) 1/7 veg (14%)	2/7 bunny (29%) 2/7 grow (29%)	4/7 prep (57%)	5/7 health or growth 71%	7/7 ✓ 100 %	2/7 veg (29%)	6/7 McD (86%)	1/7 cook (14%)	4/7 health or growth (57%)	6/ 7✓ (86 %)	2/7 veg (29%)	2/7 grow (29%) 1/7 store (14%)		6/7 health or growth (86%)
5	12/ 12 ✓ 100 %	4/12 veg (44%) 9/12 bunny (75%)	1/12 store (8%) 3/12 grow (25%)	8/12 prep (67%)	1/12 pretty eyes (8%) 1/12 digestion (8%) 9/12 health or growth (75%)	12/ 12✓ (100 %)	3/12 veg (25%)	1/12 potato (8%) 1/12 people make (8%) 6/12 McD (50%)	4/12 prep (33%)	8/12 health or growth (67%)	11/ 12✓ (92 %)	5/12 veg (42%)	3/12 grow (25%)	7/12 prep (58%)	8/12 health or growth (67%)

Abbreviations: ✓-correctly identified, ✕-incorrectly identified, McD-McDonalds or other fast food, ref-refrigerator, veg-vegetable, prep-a grouping of all preparation terms such as cutting, washing, cooking, etc.

food made from potatoes. Again, this is difficult to compare to answering "Where do french fries come from?" without answer choices, especially when McDonalds is a more likely response. Also, 80% of the children in Anliker's study picked a tomato from among egg, tomato and milk in answer to "Which grows in a garden?" The procedure in this study provided more comprehensive responses.

Preparation questions

In answer to the carrot preparation questions, 52% of three-year-olds showed some knowledge of washing, peeling, cutting and/or cooking, and 22% indicated some familiarity with preparation of green beans. Ankiker's (27) research showed that 99% three-year-olds from middle class families were involved in food preparation tasks at home, but only 12% of mothers of these families worked full-time outside the home.

Use by the body question

In this study the three-year-olds responded with health or growth concepts in 26% of carrot responses and 39% of green bean responses to the question "What does . . . do for your body?" In Anliker's (27) study of three-year-olds 63% of children picked carrots and 48% picked broccoli when asked to pick among several foods for those that would help a doll grow big and strong. The children in Gorelick's (10) study received average scores of 2.5 out of four on choosing foods to make a doll grow big and strong. The results of Gorelick's study of three- to five-year-old children was difficult to compare to this study because the results were reported as scores in categories. In this study 55% of all children responded that green beans aided health or growth. Some of the children (11% of the total, mostly three-year-olds) in this study who did not mention benefits of eating the vegetables answered the "What does this food do for your body?" question with comments about swallowing, chewing or the food going in the tummy or stomach. Contento (19) found that when asked about what happens to food in the body, children whose tests showed they were at the pre-operational level believed food goes in the stomach and/or other parts of the body and remains unchanged. These children demonstrated a belief that fruits, vegetable and milk were good for them. Coulson's (9) interviews and analyses of drawings by children, three to five, show similar beliefs that food goes in the stomach and sometimes to other parts of the body.

Value of Classroom Teacher Administered Assessment

Results of other studies described in Review of Literature (3, 11, 12) were impossible to compare with these results, because children's responses were converted to scores which could not be related to individual questions. In this study, scores were not assigned, because the information useful to a teacher in planning and revising curriculum is not a total score, but what the children's individual responses were. Using this type of assessment the teacher discovers where knowledge is lacking or where there is misinformation such as rabbits being the source of

carrots. With this information the teacher is able to plan experiences for children as a class and also as individuals.

The assessment used in this study could be used in other ways as well. Only questions about the vegetable group were asked of the children. The pictures on the game board used in this study could lead to conversation about fruits, dairy products, grain foods, growth, food safety and unhealthy snack foods. A similar game board with different pictures could provide opportunity to discuss many other nutrition topics or show pictures of foods more familiar to a particular group of children. With the availability of color copying and laminating, production of a game of this type is not a difficult task.

For use as a research tool in this study a 5" x 8" card with the questions and possible answers was developed. A teacher using this method in a classroom would need only a small index card or a small tablet of paper to write down children's significant answers which corresponds with the suggestion for teachers described in Chapter 2 that teachers have such writing tools readily available for frequent note taking as a part of continuing assessment of individual children's development.

As a research tool, the questions needed to be asked in a consistent manner. As a classroom assessment tool it would be appropriate for a teacher to ask questions in phrases that the teacher knows the child understands. For example a child that answers "tummy" in response to "Where do green beans come from?" is probably confusing *go to* and *come from* rather than giving an inaccurate answer. A teacher could ask the question differently to find out what the child really knows. The teacher can also ask the questions using words familiar to the child based on the language, culture or prior experiences of the individual child.

Chapter 6

Summary

The writer developed a game and interview questions to use as an assessment of preschool children's knowledge of nutrition concepts. The assessment was designed to meet NAEYC guidelines for good assessment, especially those which stated that assessment should be integrated with curriculum, should be teacher administered, should provide useful information so that children would benefit from adjustments in curriculum and individualized instruction, should fit into normal classroom activities and not place children in artificial situations and should be one of a variety of assessments utilized. In addition to meeting these criteria, the assessment was found to be reliable when repeated at a later date. In the second testing 74% of responses were almost exactly the same and different responses were primarily a response and no response rather than two different answers. The assessment used as it was in this study as a pre-test or unrelated to a unit of study produced findings similar to other studies of nutrition knowledge, but with much more insight into children's thoughts.

The assessment in this study was designed to be administered by classroom teachers and provide information useful to teachers for curriculum development. Results from all five classes involved in the study were similar and showed that generally the children could identify the vegetables shown, but provided diverse information about them in regard to classification, source, preparation and use by the body. The children's answers showed many connections of carrots with rabbits, and the children gave many general responses about the foods helping them to be healthy or to grow. The game used in this assessment can also be used with other questions that a teacher can ask in ways that will encourage individual children to respond, and the interview technique could be used with other games or books.

The assessment involved an interview that takes place while children play a game in a setting with which they are familiar, meeting the NAEYC guideline that assessment "relies primarily on procedures that reflect the ongoing life of the classroom and typical activities of the children." The assessment can be used successfully with children age 3 and older and, based on the writer's casual observations, in those classrooms where games such as these are commonly played. Difficulties encountered with the youngest children which included short attention spans, not waiting for a turn, and high demands on teachers' time, suggest that the assessment may not be easily used in some classes of very young three-year-old children. A teacher with control over the day's activities and schedule may be able to find a more appropriate time for the assessment than a part-time teacher's aide.

Finally, this assessment was intended to be one of a variety of assessments used. This criteria for good assessment points out the need for further research in use of other assessment tools to determine what children have learned about nutrition.

Chapter 7

Implications

Implications for Classroom Practice

Nutrition education at a young age is critically important. Gorelick (10) found that classroom nutrition education programs could be effectively implemented with children ages three to five. The *Head Start Nutrition Education Curriculum* (40) suggests activities that help children learn that vegetables grow on plants, that vegetables help keep skin and eyes healthy and that carrots belong in the vegetable food group. The *Preschool Nutrition Education Curriculum* (26) lists as goals introducing children to the concept of carrots as vegetables, making children aware of the process of plant growth from a seed, and that the vegetable family has many members. The children in the classes included in this study generally have not acquired these pieces of nutrition knowledge. Although the breadth of content knowledge measured in this study was limited, the study showed that few children had gained those concepts tested. Classroom food experiences might include food-related books and stories, songs and fingerplays, field trips to a farm, grocery store or vegetable stand, dramatic play settings such as restaurant, grocery store or farm, observing and describing fruits and vegetables such as carrots with tops, and frequent food preparation activities. The implication for teachers of preschoolers is that more experiences related to vegetables need to be added to the curriculum and a variety of assessments such as the one used in this study be used to determine if teacher's goals for children's learning are being met.

Implications for Further Research

First, the game and interview used in this study need to be tested as a follow-up to a unit of study and along with other assessment tools. Second, other assessment tools which show what children have learned about food, nutrition and health need to be developed. Possibilities include but are certainly not limited to

observations or interviews during dramatic play or block play,
different types of games which offer an opportunity to gain insight into children's thinking,
recording of anecdotes children share during circle time or other conversation opportunities,
analysis of artwork and stories children write,
interviews while children are making food from play dough, and
observation of food choices at snack or lunch time.

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Appendix A

GUIDELINES FOR APPROPRIATE ASSESSMENT FOR PLANNING INSTRUCTION AND COMMUNICATING WITH PARENTS

1. Curriculum and assessment are integrated throughout the program; assessment is congruent with and relevant to the goals, objectives, and content of the program.

2. Assessment results in benefits to the child, such as needed adjustments in the curriculum or more individualized instruction and improvements in the program.

3. Children's development and learning in all domains--physical, social, emotional, and cognitive--and their dispositions and feelings are informally and routinely assessed by teachers' observing children's activities and interactions, listening to them as they talk, and using their constructive errors to understand their learning.

4. Assessment provides teachers with useful information to successfully fulfill their responsibility; to support children's learning and development, to plan for individuals and groups, and to communicate with parents.

5. Assessment involves regular and periodic observation of the child in a wide variety of circumstances that are representative of the child's behavior in the program over time.

6. Assessment relies primarily on procedures that reflect the ongoing life of the classroom and typical activities of the children. Assessment avoids approaches that place children in artificial situations, impede the usual learning and developmental experiences in the classroom, or divert children from their natural learning processes.

7. Assessment relies on demonstrated performance during real, not contrived, activities, for example, real reading and writing activities rather than only skills testing (Teale 1988; Engel 1990).

8. Assessment utilizes an array of tools and a variety of processes, including, but not limited to, collections of representative work by children (artwork, stories they write, recordings of their reading), records of systematic observation by teachers, records of conversations and interviews with children and teachers' summaries of children's progress as individuals and as groups (Chittenden & Courtney 1989; Goodman, Goodman & Hood 1989).

9. Assessment recognizes individual diversity of learning and allows for differences in styles and

rates of learning. Assessment takes into consideration children's ability in English, their stage of language acquisition, and whether they have been given the time and opportunity to develop proficiency in their native language as well as in English.

10. Assessment supports children's development and learning; it does *not* threaten children's psychological safety or feelings of self-esteem.

11. Assessment supports parents' relationships with their children and does not undermine parents' confidence in their children's or their own ability, nor does it devalue the language and culture of the family.

12. Assessment demonstrates children's overall strengths and progress, what children *can* do, not just their wrong answers and what they cannot do or do not know.

13. Assessment is an essential component of the teacher's role. Since teacher can make maximal use of assessment results, the teacher is the *primary* assessor.

14. Assessment is a collaborative process involving children and teachers, teachers and parents, school and community. Information from parents about each child's experiences at home is used in planning instruction and evaluating children's learning. Information obtained from assessment is shared with parents in language they can understand.

15. Assessment encourages children to participate in self-evaluation.

16. Assessment addresses what children can do independently and what they can demonstrate with assistance, because the latter shows the direction of their growth.

17. Information about each child's growth, development, and learning is systematically collected and recorded at regular intervals. Information such as samples of children's work, descriptions of their performance, and anecdotal records is used for planning instruction and communicating with parents.

18. A regular process exists for periodic information sharing between teachers and parents about children's growth and development and performance. The method of reporting to parents does not rely on letter or numerical grades but rather provides more meaningful, descriptive information in narrative form.

Appendix B

CARROTS

Lesson 2

Goals:

1) To introduce the children to the concept of carrots as vegetables.
2) To make the children aware of the process of plant growth from a seed.

Behavioral Objectives:

The children will

1) correctly identify carrots as belonging to the vegetable group;
2) correctly identify vegetables from a group of mixed food types;
3) describe the process of growing carrots.

To Get Ready:

You will need

1) a bunch of carrots, preferably with tops attached;
2) *The Carrot Seed*, by Ruth Krauss;
3) a package of carrot seeds;
4) peanut butter;
5) a record or tape of appropriate music to act out the growth of a seed;
6) the song *I Like My Vegetables*, by Willie Lee Watkins (included).

Activities:

- Have the children gather in a circle and discuss carrots. Try to find out how much the children know about them. Where do they grow? Which part do we eat? Why are carrots good for us to eat? If you think it is appropriate you can mention that carrots are good sources of vitamin A_1 which is needed for eyesight.

- Have some carrots available to pass around (preferably carrots with the tops intact). Clean the carrots and cut into bite-sized pieces for the children to taste.

Source: *Preschool Nutrition Education Curriculum* (26)

BROCCOLI

Lesson 3

Goals:

1) To introduce the children to the concept of broccoli as a vegetable.
2) To review the fact that the vegetable family has many members.

Behavioral Objectives:

The children will

1) correctly identify broccoli as belonging to the vegetable group;
2) name two vegetables;
3) remember one kind of vegetable that was previously used in a lesson plan.

To Get Ready:

You will need

1) pictures of vegetables (seed catalogs and magazines are good sources of these);
2) paste, paper, crayons;
3) *The Broccoli Story*, by Willie Lee Watkins (included in lesson);
4) visual aids for *The Broccoli Story* such as a bowl, head of broccoli, cucumber, bell pepper, green peas, beans, puppets, etc.;
5) "feelings" game (see **Games and Activities** section);
6) *How A Seed Grows*, by Helen Jordan;
7) raw broccoli pieces (dip optional).

Activities:

-Using the vegetable labels, seed packages and pictures from magazines or seed catalogs, make a giant vegetable collage and hang the collage in the room for everyone to see. Also, encourage the children to draw vegetables.

-Read *The Broccoli Story*. Use the visual aids as appropriate. Ask how many of the children have had broccoli lately. How was it served? Was it cooked or raw? How many have had it in their salad? Does broccoli remind you of a bush or a tree?

Source: *Preschool Nutrition Education Curriculum* (26)

Appendix C

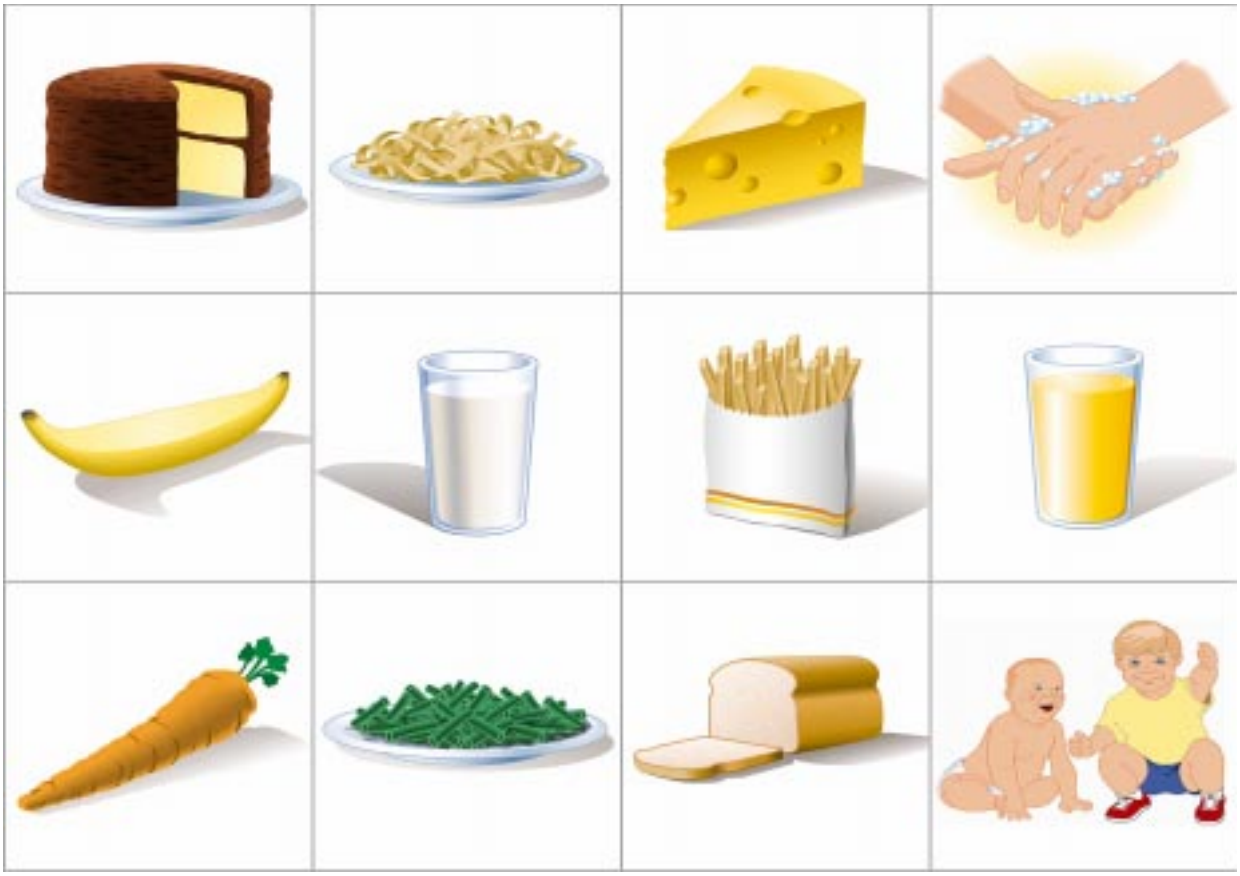


Illustration 2. Pictures used in games

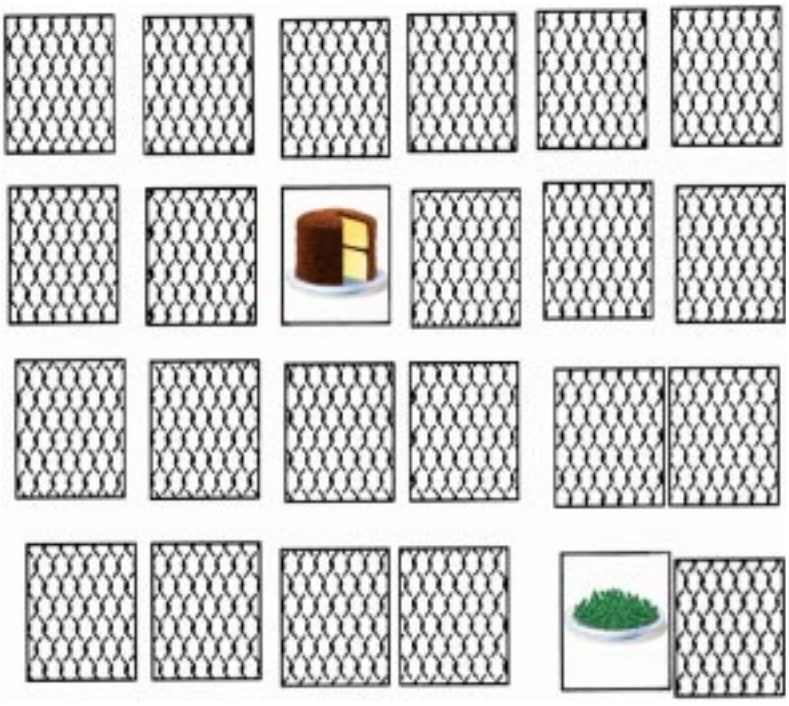


Illustration 3. “Memory” type game

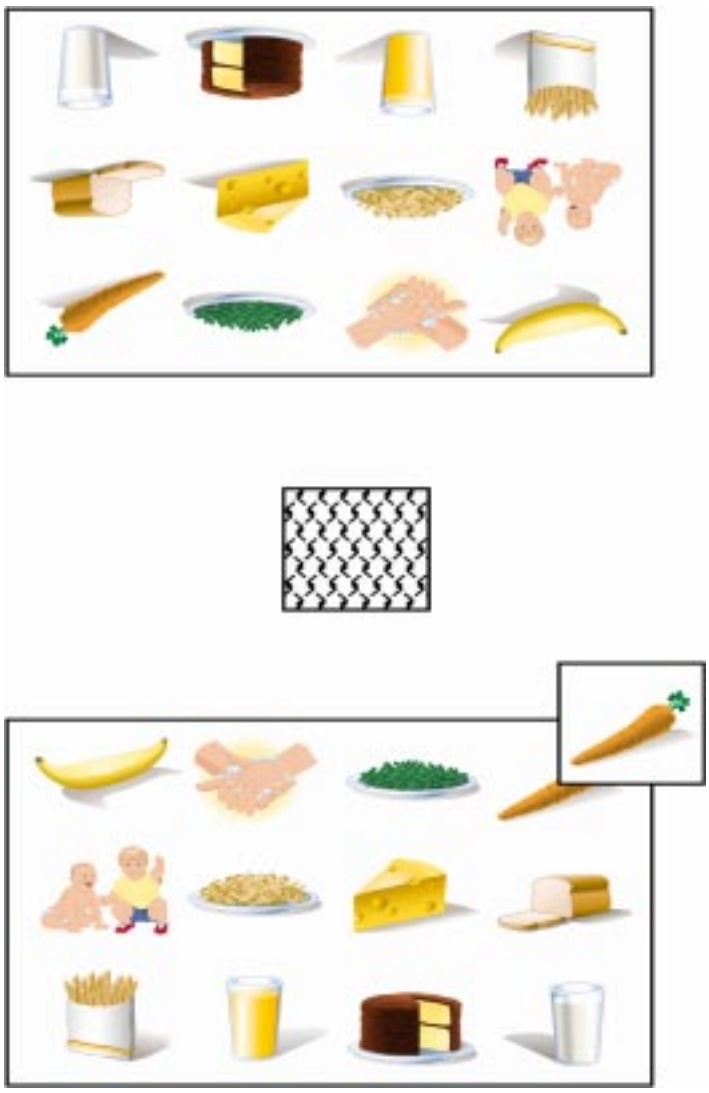


Illustration 4. “Lotto” type game

Appendix D

Response Card Side 1

Identify?	French fries?
What food group do french fries belong in?	Vegetable?
What kind of food is french fries?	Vegetable?
Where do french fries come from?	Potato? Plant? Grow in garden? McDonalds?
Tell me about fixing this food. How do you get it ready so it is safe to eat?	Wash? Peel? Cook? Fat? Grow? Big & strong? Health?
Identify?	Green beans? string beans?
What food group do green beans belong in?	Vegetable?
What kind of food is green beans?	Vegetable?
Where do green beans come from?	Plant? Grow in garden? Grocery store?
Tell me about fixing this food. How do you get it ready so it is safe to eat?	Wash? Peel? Cook?
What do green beans do for your body?	Grow? Big & strong?

Response Card Side 2

Child's 1st name_____

Age _____

School_____

Time begun _____
Time ended _____

Other interesting comments:

Identify	Carrot
What food group do carrots belong in?	Vegetable?
What kind of food is a carrot?	Vegetable?
Where do carrots come from?	Plant? Grow in garden? Grocery store?
Tell me about fixing this food. How do you get it ready so it is safe to eat?	Wash? Peel? Cook?
What do carrots do for your the body?	Grow? Big & strong?

Appendix E

Assessment Lesson for Child Care class

1. Definition of assessment
2. Reasons for assessment
3. Discussion of students' personal experiences with assessments--projects, multiple choice tests, essay tests, practical experiences, standardized tests, SAT
4. Traditional standardized tests for preschoolers
Hand out Denver Developmental Screening for example
5. Changes in assessment in recent years
6. Observation techniques
7. Record keeping techniques
8. Portfolio example

Appendix F

Training for students volunteering for project:

Explanation of purpose of the study
Become familiar with copies of the games.
Practice asking questions of each other.
Practice writing responses.
Practice making conversation with child playing game who is not the subject at that time.

Specific instructions:
●Initiate game playing with a child unless child asks you to play game first.
●Note child's name, name of school, and time begun on response card.
●Use Lotto version unless you see that it will not hold the child's attention long enough.
●Begin playing game. As cards are drawn, let the conversation flow as if you were not doing the nutrition assessment. However, remember that this is an assessment and not a teaching lesson; therefore resist the urge to tell the child about each card.
Also remember also that there are specific pieces of information that you want to get from the child; therefore don't ask questions other than the ones on the card so that the child does not tire of answering before you get to the ones for which you are recording answers.
●Encourage the child to identify the items on all game pieces with questions such as "What did you pick?" and "What is on your card?" and by modeling comments like "I picked the cheese card."
If the child does not identify the cards for which you are recording information, ask "What is that food?" Place a check by "Identify?" if the child identifies the food correctly. If he/she says anything else, record it.
●Ask the questions on the response card exactly as they are written when carrots, green beans and french fries are drawn. If the child appears not to understand, ask the question in the alternate manner (for the food group and preparation questions only) without any other comments.
●As each question is answered, mark the response on the card. If the answer is correct as written on the response card, place a check by the suggested response. Any other response should be written on the card as the child said it. If the child does not answer, write NA beside the question to indicate "no answer."
●When a child answers, do not correct them for incorrect or praise them for correct answers; just record it and move on. Remember you are giving a test.
●Make sure that the game is played as it would if you were not doing the assessment. If the child is more interested in moving on in the game before all the questions are answered, move on and ask the others the next time that picture card is drawn by either player.

- It is more convenient to play with one child at a time. However, if you need to play with more than one child at a time, ask the questions about vegetables of only the child whose answers are being recorded on the response card.
- When the game is finished, note the time on the response card. Also note any other interesting information the child shared about nutrition related topics. If the child asks to play again, do so but without recording any question answers.

Appendix G

The schools which preschoolers attended were:

South Lakes Preschool, 11400 South Lakes Dr., Reston, VA 22091
The preschool is run by student trainees and operates from October to May, 2 1/2 hours each day on alternate school days.
(designated as Class 1 in Results)

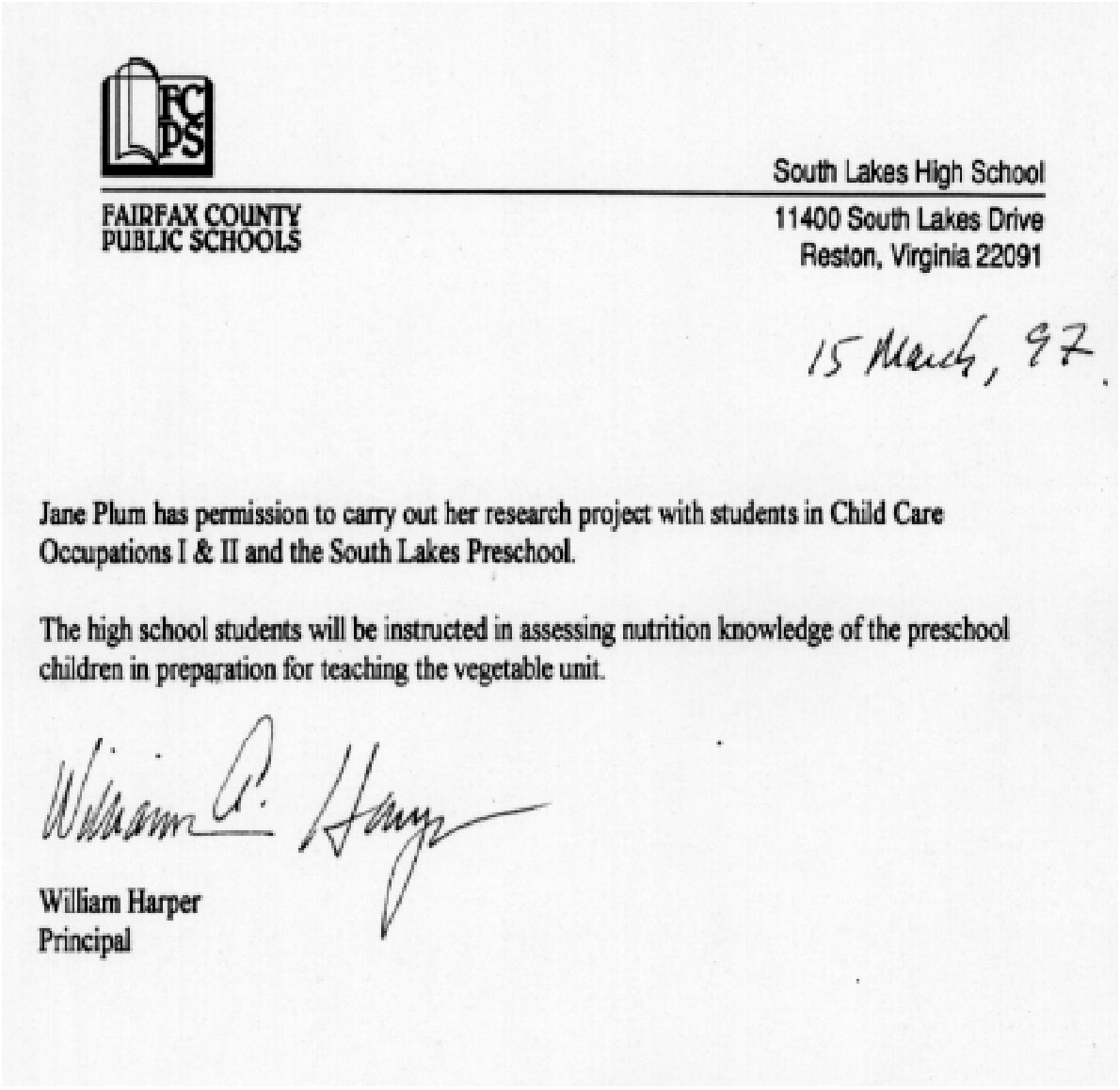
McNair Farms Children's Center, 2487 McNair Farms Drive, Herndon, VA 20171.
McNair Farms is a full-day center serving children ages infant to school age in a suburban, primarily middle to upper income community.
(designated as Class 2 in Results)

Reston Children's Center, 11825 Olde Crafts Drive, Reston, VA 20191.
RCC is a full-day center serving children ages infant to school age in a suburban, primarily middle to upper income community.
(designated as Class 3 in Results)

Robert E. Simon Children's Center, 1800 Cameron Glen Drive, Reston, VA 20190
Simon Center is a full-day center serving children ages infant to school age in a suburban, primarily middle to upper income community.
(designated as Class 4 in Results)

Laurel Learning Center, 11484 Washington Plaza W., Reston, VA 20190
LLC is operated by Reston Interfaith, a community charity organization, and offers subsidized child care to low income families for ages 3 to school age.
(designated as Class 5 in Results)

Appendix H



FAIRFAX COUNTY
PUBLIC SCHOOLS

South Lakes High School
11400 South Lakes Drive
Reston, Virginia 22091

15 March, 97.

Jane Plum has permission to carry out her research project with students in Child Care Occupations I & II and the South Lakes Preschool.

The high school students will be instructed in assessing nutrition knowledge of the preschool children in preparation for teaching the vegetable unit.

William Harper
Principal

McNair Farms Children's Center

Herndon, VA 20171
(703) 713-0093

April 29, 1997

Jane Plum has permission to direct Teresa Cook in playing a nutrition game with the children at the center and recording the children's responses. In her paper, the children will be identified by their initials only.

Sincerely,

Michelle Suling

Michelle Suling
Director

RESTON CHILDREN'S CENTER

April 1997

Jane Plum has permission to direct J W in playing a nutrition game with children at the center and recording the children's responses. In her paper, the children will be identified by initials only.

Linda Selb

Linda Selb
Director Preschool Program

11825 Olde Crafts Drive • Reston, Virginia 22091 • (703) 476-8150

Robert E. Simon Jr.
CHILDREN'S CENTER, INC.

April 1997

Jane Plum has permission to direct D G in playing a nutrition game with children at the center and recording the children's responses. In her paper, the children will be identified by initials only.

Carla Greketis-Dunn
Director

1800 Cameron Glen Drive • Suite 1000 • Reston, Virginia 20190 • (703) 834-5880

Reston Interfaith, Inc.

LAUREL LEARNING CENTER
11484 WASHINGTON PLAZA WEST, SUITE 200, RESTON, VIRGINIA 20190

Constance L. Pettinger
Executive Director

April 29, 1997

Jane Plum has permission to direct S T in playing a nutrition game with children at the center and recording the children's responses. In her paper, the children will be identified by initials only. Audio tapes of S and the children will be erased as soon as they are played to check accuracy of S 's notes.

Anne-Marie Twohie
Director

Appendix I

Table 11. Complete Results for Class 1, South Lakes Preschool, Teachers-NW & JW

Initials, Age of child	Carrot					French fries					Green beans				
	Identify	Classify	Source	Preparation	Use by body	Identify	Classify	Source	Preparation	Use by body	Identify	Classify	Source	Preparation	Use by body
TD 5	✓	rabbit tummy		wash, peel, cut top off	makes you strong	✓	McD			big & strong	✓				makes you strong
CR 4	✓					✓		Burger King			✓		bean stalk		grow
MM 3	✓		bunnies	in a pan	take care of body	✓					✓[a]	veg	bunnies	sugar and rice	
RD 4	✓		ground	cook	big and strong	✓		McD		grow	✓				grow
AL 5	✓	veg	grow in garden from seeds		big and strong, healthy	✓	veg			big & strong, healthy	✓	veg			big & strong, healthy
KD 5	✓	Bunny eats it		peel	healthy	✓	sauce on them	people make them	mash them		✓				

Table 11. Complete Results for Class 1, South Lakes Preschool, Teachers-NW & JW, *continued*															
Initials & age	Carrot					French fries					Green beans				
	Identify	Classify	Source	Preparation	Use by body	Identify	Classify	Source	Preparation	Use by body	Identify	Classify	Source	Preparation	Use by body
SB 3	✓		store			✓					✓				
SA 5	✓	veg	garden	cut the leaves off	healthy	✓	veg	McD	cook	healthy	✓	veg	garden	cook	healthy
PS 3	✓		store	you eat them	big & strong	✓	yellow		cook	you swallow it	✗[b]	green	garden	you eat it	you chew it
TS 4	✓		farm	just eat them	grow	✓	salt on them	McD	suck off the hard part	grow	✓	have beans in them, green	veg garden	you blow them	grow
MO 3	✓					✓		eat lunch , then go to McD		salt on them, then have to brush teeth	✓			if too hot, mom puts them in freezer	big & strong

Summary	11/11 ✓	2/11 veg; 2/11 rabbit food	2/11 store; 3/11 grow; 1/11 farm; 1/11 bunnies	2/11 eat; 3/11 wash, peel, and/or cut; 2/11 cook	8/11 health or growth	11/11 ✓	2/11 veg 1/11 yellow	7/11 McD 1/11 people make them	2/11 cook	5/11 health or growth 1/11 swallow	10/11 ✓	2/11 veg; 2/11 green	4/11 grow	2/11 cooking before eating; 2/11 cook	7/11 health or growth

[a]string beans, [b]peas

Abbreviations: ✓-correctly identified, ✕-incorrectly identified, McD-McDonalds or other fast food, ref-refrigerator, veg-vegetable

Children responded in 64% of question categories.

Table 12. Complete Results for Class 2, Group 2 at McNair Farms, Teacher-TC

Initials & Age of Child	Carrot					French fries					Green beans				
	Identify	Classify	Source	Preparation	Use by body	Identify	Classify	Source	Preparation	Use by body	Identify	Classify	Source	Preparation	Use by body
DE 2.5	✓		tummy	wash	nice to eat	✓		tummy	wash	big & strong	✓*	green beans	store	wash, cook	
ME 2.5	✓		store	wash, we eat it	grow, big & strong	✓		Old McD	wash, cook		stopped playing				
EM 3	✓	carrot	rabbits, grow in garden		eat it	✓	McD	tummy		big & strong	✓		dinner	cut them	big & strong
BE 3	✓			cut	grow, big & strong	✓		McD	cut them	big & strong	✓	eat them		cut them	big & strong
NA 3	stopped playing					✓		McD	stir it	grow big & strong	✓		your mouth	eat them	healthy
RE 2.5	✓		rabbits	break them		✓		grow in garden, McD		big & strong	✓				
NI 2.5	Stopped playing										✓				

Table 12. Complete Results for Class 2, McNair, Teacher-TC, *continued*

Initials & age	Carrot					French fries					Green beans				
	Identify	Classify	Source	Preparation	Use by body	Identify	Classify	Source	Preparation	Use by body	Identify	Classify	Source	Preparation	Use by body
LO 3	✓		bunny	peel them	shake around	✓	yellow	McD		big & strong	✓		momma	in a pan	
JE 3	✓		tummy, plate	cook	big & strong	✓		Old McD	with hands	big & strong	✓		with hands		go in tummy
AN 2.5	✓		bunnies, grow in the mud	wash	big & strong	✓		Dinners McD	go to McD, wash	big & strong	✓		the flowers	put in our mouths, put on plate	big & strong
Summary	8/8 ✓		1/8 store 4/8 bunnies, 2/8 tummy	3/8 wash 2/8 break or cut 1/8 cook 1/8 peel	4/8 health & growth	9/9 ✓	1/9 yellow	1/9 grow in garden 7/9 McD	1/9 wash, 1/9 wash & cook, 1/9 cut 1/9 stir	8/9 health & growth	9/9 ✓		1/9 store, 1/9 momma, 1/9 dinner	1/9 wash 2/9 cut 1/9 in a pan	4/9 health & growth 1/9 tummy

[a]beans

Abbreviations: ✓-correctly identified, ✕-incorrectly identified, McD-McDonalds or other fast food, ref-refrigerator, veg-vegetable

Children responded in 73% of question categories.

Table 13. Complete Results of Class 3, Squirrels at Reston Children's Center, Teacher-JW

Initials, age of child	Carrot					French fries					Green beans				
	Identify	Classify	Source	Preparation	Use by body	Identify	Classify	Source	Preparation	Use by body	Identify	Classify	Source	Preparation	Use by body
B 3	✓	Broc-coli		set the table	healthy	stopped playing					✓			crunch, crunch, crunch	healthy
J 3	✓			cook		✓					✓				big & strong
P 3						✓				feel good					
J 3						✓					✓				grow, big & strong
S 3	✓					✓		McD			✓		plant		
K 3	✓					✓									goes down your stomach
Summary	4/6 ✓			1/6 table 1/6 cook	1/6 health or growth	5/5 ✓		1/5 McD		1/5 health	4/6 ✓		1/6 plant		3/6 health or growth 1/6 digestion

Abbreviations: ✓-correctly identified, ✕-incorrectly identified, McD-McDonalds or other fast food, ref-refrigerator, veg-vegetable
Children responded in 29% of question categories.

Table 14. Complete Results for Class 4, Junior II's and III's at Simon Center, Teacher-DG

Initials, age of child	Carrot					French fries					Green beans				
	Identify	Classify	Source	Preparation	Use by body	Identify	Classify	Source	Preparation	Use by body	Identify	Classify	Source	Preparation	Use by body
BR 3	✓	baby rabbits	carrots	eat it	his food	✓	lunch time		eat it, lunch time	lunch	✓				your food
DA 4	✓		bunny rabbits		grow	✓		McD		grow	✓				grow
ER 4	✓	veg		wash	big & strong	✓	veg	McD			✓	veg	grocery store		big & strong
SA 3	✓	rabbit, veg			big & strong	✓		McD		big & strong	✓				big & strong
TA 3	✓		bunny		tummy	✓		McD		tummy	✓	good bodies	tummy		tummy
AL 3	✓	kitchen	country		grow	✓				grow	✓	veg	lettuce		grow
IA 3	✓		ref		eat	✓	kitchen	mouth		eat	✓	green	mouth		eat

Table 14. Complete Results for Class 4, Junior II's and III's at Simon Center, Teacher-DG, *continued*															
	Carrot					French fries					Green beans				
	Identify	Classify	Source	Preparation	Use by body	Identify	Classify	Source	Preparation	Use by body	Identify	Classify	Source	Preparation	Use by body
Summary	7/7 ✓	2/7 veg, 2/7 rabbits	2/7 bunnies, 1/7 country, 1/7 ref	1/7 wash	2/7 eat, 2/7 health or growth , 1/7 tummy	7/7 ✓	1/7 veg	4/7 McD		2/7 eat 3/7 health or growth 1/7 tummy	7/7 ✓	2/7 veg	1/7 store		1/7 eat, 4/7 health or growth

Abbreviations: ✓-correctly identified, ✕-incorrectly identified, McD-McDonalds or other fast food, ref-refrigerator, veg-vegetable

Children responded in 67% of question categories.

Table 15. Complete Results for Class 5, Room 2 at Laurel Learning Center, Teacher-ST

Initials, age of child	Carrot					French fries					Green beans				
	Identify	Classify	Source	Preparation	Use by body	Identify	Classify	Source	Preparation	Use by body	Identify	Classify	Source	Preparation	Use by body
LE 5	✓	bunny, orange & green	from bunny	no one can fix it; eat it all & drink milk, cut it	makes you fine	✓	McD, white & yelow	McD	don't fix, eat it all-put in trash	feel better	✓	green, green & black		wash, eat all of it	make me die
IA 5	✓	rabbit, veg		wash, cook	make eyes pretty	✓		potato		big & strong	✓	can, veg		wash, cook	big & strong
EO 5	✓	bunny			big & strong	✓	McD				✓				big & strong
CL 4	✓					✓		McD							
TR 5	✓	cage, veg	store	just make it, put in micro-wave	come down your throat to body	✓		McD			✓	veg		micro-wave	give electri-city

Table 15. Complete Results for Class 5, Laurel Learning Center, Teacher-ST, *continued*

Initials & age	Carrot					French fries					Green beans				
	Identify	Classify	Source	Preparation	Use by body	Identify	Classify	Source	Preparation	Use by body	Identify	Classify	Source	Preparation	Use by body
AN 4	✓	banana, bunny	bunny	bread, cheese	grow	✓	veg, chicken nugget	cook it	put in pot, cake	have muscles	✓	peas	fruit	veg	big & strong
NI 5	✓	store, rabbit	bunny rabbit	put in pot on stove, it boils	strong	✓	pots, stoves, oven, veg	McD	put in bag and shake then put in box, cook	feel good, strong	✓	bag, veg	ground, stove	stove, boil and shake, cook, salt & sugar	strong
AJ 5	✓	bunny	forest & woods	salt, put green stuff at bottom		✓	McD		put sauce on it, paper bag, stove and turn on	grow big & strong	✓	make good & strong		put peas & sauce, put on plate	grow
AK 5	✓	dirt, bunny	dirt, seeds from store, put in dirt and grow	wash, cook it with rice	grow	✓		cook, McD	put oil on it, wash your hands, give it out	grow, big & strong	✓	seeds green & good	seeds	clean it, wash it, cook it with chicken or rice	grow
AR 5	✓	bunny	bunny			✓	ketchup	food					from lunch		

Table 15. Complete Results for Class 5, Laurel Learning Center, Teacher-ST, *continued*															
Initials & age	Carrot					French fries					Green beans				
	Identify	Classify	Source	Preparation	Use by body	Identify	Classify	Source	Preparation	Use by body	Identify	Classify	Source	Preparation	Use by body
Summary	10/10 ✓	2/10 veg, 9/10 rabbit	4/10 rabbit or forest, 1/10 store, 1/10 grow	1/10 cut, 5/10 wash and/or cook	6/10 health or growth	10/10 ✓	1/10 white & yellow, 2/10 veg	6/10 McD, 1/10 potato, 1/10 food	4/10 cook 1/10 serve	6/10 health or growth	8/10 ✓	3/10 veg	2/10 grow, 1/10 from lunch	6/10 wash and/or cook	6/10 health or growth

Abbreviations: ✓-correctly identified, ✕-incorrectly identified, McD-McDonalds or other fast food, ref-refrigerator, veg-vegetable

Children responded in 77% of question categories.

Appendix J

Illustration 5. High school student JW with members of Class 1

Illustration 6. High school student NW with members of Class 1

Illustration 7. High school student TC with members of Class 2

Illustration 8. High school student DG with members of Class 4

Illustration 9. High school student ST with member of Class 5

Vita

Jane Meacham Plum

Personal information
•Born, Richmond, Virginia, May 14, 1951.
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Education
•B.S. in Management, Housing, and Family Development, Virginia Tech, 1973.

Professional Experience
•Teacher, Restaurant Trades and Home Economics, Fairfax County Public Schools 1973-1976.
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•Program Specialist, part-time, Adult Education, Fairfax County Public Schools, 1984-1990.
•Teacher, Work and Family Studies including Early Childhood Education, Fairfax County Public Schools, 1990-present.
•Department Chair, Professional Technical Studies, South Lakes High School, 1993-1997.

Memberships
Falls Church Church of Christ
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Fairfax County Family and Consumer Science Education Association
National Association for the Education of Young Children & local affiliates
American Vocational Association & local affiliates
League of Women Voters

Interests
Politics, computers, hiking, youth soccer, VA history