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CHANGING NUTRITION KNOWLEDGE AND BEHAVIOR IN YOUNG CHILDREN: THE ROLE OF REFLECTION ON PERSONALLY-RELEVANT, TECHNOLOGY-RICH REPRESENTATIONS

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Sunghyun Park

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The thesis of Sunghyun Park was reviewed and approved* by the following:

Susan M. Land
Associate Professor of Education
In Charge of Instructional Systems
Thesis Adviser
Co-chair of Committee

Brian K. Smith
Associate Professor of Information Science & Technology and Education
Co-chair of Committee

George M. Graham
Professor of Kinesiology

Carla Zembal-Saul
Associate Professor of Science Education

*Signatures are on file in the Graduate School.

ABSTRACT

As pediatric obesity has become a significant public health concern, recent educational programs have emerged to identify and intervene with pediatric obesity. However, there has been minimal focus on considerations of working with younger children by adopting reflection upon everyday experiences as an integral step to cultivate a healthy life style. The purpose of this study was to introduce digital imaging to young children as a technique to capture, monitor, and reflect upon everyday experiences, thereby supporting children to turn everyday experiences into knowledge about practice, and thus help them improve dietary-related behaviors. A case study design was used within the context of the Bennett Family Center (BFC) Kindergarten, which is housed by the Pennsylvania State University. Five children who enrolled in the BFC participated in the 12 nutrition education sessions during three weeks. A personalized E-portfolio was designed to support children's learning about their unconscious behaviors by visualizing everyday eating experiences in an easily interpretable form, using self-captured digital images. Additionally, a food-train activity was designed to support children to visualize their current eating and to reflect upon them using the food photos that children ate.

The results of the study showed that children were able to reflect upon every day experiences and apply proper nutrition knowledge within the proposed interventions. After the reflective activities, children ate more balanced meals across five food groups and made more healthful food choices within the food group. Children reportedly talked more frequently about the foods they were eating and tried to accomplish their goals elicited from the e-portfolio activity to eat more healthily. Children's score of nutrition

knowledge about the food guide pyramid increased and about general food healthiness was maintained as high. The findings indicate that the e-portfolio aided children in discovering the discrepancy between expectations and the actual captured data and in being conscious of their eating along with the food-train activity. In this manner, the e-portfolio with self-captured images may have served as an effective learning tool for children to construct new understanding that was linked to behavior changes. The food-train activity may have amplified those effects as a transfer activity. For future research, involving parents in the reflection activity may benefit children's learning in the long term.

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CHAPTER 1

INTRODUCTION

Problem Statement

Nutrition education is significant since it educates people about how to maintain a healthy lifestyle. Education in early childhood is even more crucial, since it is more difficult to adjust one's health habits as people get older (Seaman & Kirk., 1995). The goal of nutrition education is to influence learners to change their eating and nutrition-related behaviors towards a healthy lifestyle (Sim, 1987). Traditional nutrition education uses many approaches to achieve this goal, but they are often criticized since they do not typically change learners' negative habits but simply expand their nutritional knowledge.

There have been many efforts to improve educational efficiency in nutrition education (Schnoll, 1997; Schnoll & Zimmerman, 2001; and Stewart, Houghton, Hughes, Pearson, & Reilly, 2005, Foreyt & Paschali, 2001). Among them, an approach employing reflection as an educational strategy with behavioral goals (cognitive-behavioral approach) promises improvement in dietary behavior as well as knowledge extension (Contento, Balch & Bronner, 1995). Reflection is a learning process that makes tacit knowledge and routines explicit, so they can be analyzed and promote self-awareness (Lin, Hmelo, Kinzer, & Secules, 1999). Awareness of personal risk behavior enables individuals to set personally-relevant behavioral goals and enhances motivation for behavior change (Weinstein, 1988).

However, supporting individuals, especially children, to reflect on their everyday experiences is not simple to accomplish. Although the benefits of having children make

connections between their classroom knowledge and their everyday life choices are clear, it is less clear how to best support them to do this. When learning is anchored in a meaningful, familiar context, it is much easier for learners to understand how concepts are applied and why they are important and useful. This understanding facilitates transfer to new settings (Bransford, Sherwood, Hasselbring, Kinzer, & Williams, 1990; Cognition and Technology Group at Vanderbilt (CGTV), 1993). However, other support mechanisms or "scalffolds" are needed to help learners observe, interpret, and reflect upon everyday experiences, as they are unlikely to be able to accomplish this spontaneously without assistance (Land, Smith, Beabout, Park, & Kim, 2005).

Another reason that reflection on everyday experiences in nutrition education is challenging for learners is related to the fact that a given approach might have varied effectiveness across varied age ranges. Most prior studies have focused on student populations ranging from elementary school to college, and few studies have been conducted with young children such as preschool children or toddlers (Schonoll & Zimmerman, 2001). Often, nutrition education targeted to young children focuses only on providing generalized information, rather than on scaffolding reflection on their everyday life with an individualized learning opportunity. This is mainly due to young children's limited reading and writing abilities. Capturing daily dietary-related behavior in some form such as audio, video, or photographs and using them as conversational props (Roschelle, 1992; Brinck & Gomez, 1992; cited in Smith, Frost, Albayrak, & Sudhakar, 2005) might help young children to reflect upon their everyday experiences better.

Currently, educational strategies used in most kindergarten classes are based largely on the information dissemination model (Contento et al., 1995). According to the National

Center for Education Statistics Report (NCES) (2000), it was reported that some teachers in kindergarten through second grade employed active learning strategies such as hands-on learning and role playing for nutrition education; yet, the majority of teachers were still using traditional educational approaches such as lecturing, demonstration, and media presentations. Student projects that encourage reflection are also less likely used. Similarly, technology-based tools have been widely used to provide scaffolds for reflecting upon and organizing ideas and making thinking more explicit and "visible" (Linn, 2000). Yet, computer or advanced technology has been rarely implemented (5 percent or less) in nutrition education for young children (NCES, 2000). In sum, little work has been done to help students to reflect upon experiences in their everyday world -- particularly in the field of nutrition education for young children. The purpose of the study was to introduce digital imaging to young children as a technique to capture everyday experiences and to support for children to reflect upon them.

Background to the Problem

Nutrition Education

Nutrition education is viewed as any set of learning experiences designed to facilitate the voluntary adoption of eating and other nutrition-related behaviors conducive to health and well-being (SNE, ADA, & ASFSA, 1995). The definition suggests that behavioral change is the ultimate criterion for effective nutrition education (Sim, 1987). The term "behavior" refers to proximal effects of nutrition education, such as intakes of specific foods, some composite index of food intake or food score, or actual behaviors such as eating five fruits and vegetables per day, having fruits available and visible at

home, salting foods, taking skin off chicken, having one's serum cholesterol checked, or even, in the ecological domain, reusing grocery bags (SNE, ADA, & ASFSA, 1995).

Williams (1985) suggested that childhood might be the easiest time to learn healthier lifestyle behaviors. The early adjustment of health habits can influence children to make healthier choices at a younger age. In turn, healthier behaviors at one stage in life are a positive predictor for healthier behavior at later stages (Nicklas, Baranowski, Baranowski et al., 2001). Dixon and his colleagues (Dixon, McKenzie, & Shannon, 2000) found that children who received nutrition education promoting lower dietary fat were more likely to meet the recommendations for total fat, saturated fat, and sodium than other children who did not receive the same education.

Traditional Nutrition Education

Traditional nutrition education promotes the belief that dissemination of nutrition information impacts attitude formation and induces behavioral change. The educational messages are determined by knowledge from medical and/or nutrition science (Cerqueira, 1991; Achterberg, 1988). These standardized nutrition facts and skills are typically delivered to a mass community such as school students, pregnant women, or elderly people through didactic teaching methods. The instruction is designed by nutrition educators such as dietitians or classroom teachers using technical or scientific rules. The designed activities and services are based on nutrition educators' social and cultural context (Dervin, 1981). Normally, the aim of the instruction is to address basic nutritional guidelines and general nutritional problems (e.g. deficiency and excess) identified for the population. However, such educational approaches have been criticized because of their

isolation from contexts and irrelevance to individuals (nutrient based approach, Gussow and Contento, 1984), instrumental knowledge (Contento et al., 1995), and ignorance of learners' active role in learning (Dervin, 1981). This approach does not typically focus on changing dietary behaviors or practices, but instead on increasing nutritional knowledge. The educational approach rarely considers the analyses of individual nutritional problems or the process of building people's capacity for making decisions and taking action to solve problems (Stevenson, 1988; Cerqueira and Olson, 1991). Because of these reasons, the approach has been criticized as paternalistic, prescriptive and victimizing (Achterberg, 1988; Fahlberg, Poulin, Girdano, & Dusek, 1991). Although the approach increases nutritional knowledge of learner, it remains inert and not readily transferable.

Nutrition Education Employing Educational Strategies

While traditional nutrition education can be viewed as the dissemination of information, an alternative approach has been emerging which is learner centered and employs cognitive-behavioral strategies to improve dietary behaviors in nutritional therapy. (Schnoll, 1997; Schnoll & Zimmerman, 2001; Stewart et al, 2005, Foreyt & Paschali, 2001). This emerging approach takes many forms with different names in interventions by different researchers or different educational strategies, namely, evidence-based behavioral approach (Robinson, 1999; Stewart, Houghton, Hughes, Pearson, & Reilly, 2005), family-based intervention (McKenzie, Valoski et al, 1985; Epstein, 1996; De Bourdeaudhuij, Brug, Vandelanotte, & Oost, 2002; Berry, Sheehan, R, & Heschel et al, 2004), cognitive-behavior therapy (Foreyt & Goodrick, 1993; Schnoll, 1997; Foreyt and Poston, 2001;Powers, Struempler, Guarino, & Parmer, 2005),

empowerment education (Wallerstein & Bernstein, 1988), active-participatory program (Hotz & Gibson, 2005), community-based program (Cerqueira, 1991b), and so forth. It encompasses various strategies such as problem solving, goal setting, self-monitoring, cognitive restructuring, and stimulus control for the modification for eating style, activity, and related habits (Foreyt & Poston, 1998; Foreyt & Goodrick, 1994a, 1994b; Foreyt & Goodrick, 1993; Johnson, Hinkle, Carr et al. , 1997; Perri & Fuller, 1995). Among them, self-awareness is the core of all these programs (Foreyt & Poston, 1998), as it raises awareness of behavior patterns and identifies faulty eating and activity patterns (Penningto Biomedical Research Center (PBRC), 2005). Self awareness is promoted through reflection (Lin et al., 1999). The effectiveness of nutrition education employing reflection is attributed to the fact that self-reflection on everyday experiences commands greater attention, is processed more intensively, contains less redundant information , and is appreciated more than more general intervention materials. Accordingly, people are more likely to modify their unhealthy behavior (Brug & Assema, 1999; Brug & Campbell, 2003).

Reflection

Reflection makes tacit knowledge and routines explicit so they can be analyzed and promote self-awareness (Lin et al., 1999). Reflection has been at the center of many educational endeavors and explored by many scholars of diverse traditions and perspectives. These diverse approaches to the study of reflective thinking have led to various definitions and roles of reflective thinking and the interchangeable use of the

terms reflective thinking, reflection, self-reflection, metacognitive reflection, or critical reflection in the literature (Ertmer & Newby, 1996; Grimmett, 1988; Moon, 1999).

According to Schön (1987), reflection occurs when there is a surprise and when something interrupts the flow of knowing-in-action (i.e., our unstable, tacit knowledge that drives our actions). In this case, knowing-in-action requires minimal effort, once routines are learned and becomes automatic. Reflection, as a responsive process to unexpected consequences, enables people to examine their practices focusing on implicit understandings, beliefs, and ways of performing, and identify why or how these tacit practices may no longer be adequate to deal with new situations. This reflection process can occur either after an event or at a time when it can still influence an event, and they are called reflection-on –action and reflection-in-action, respectively. Reflection-on-action takes place after the performance, and it works as we think back on our activities to understand why the surprise has happened and how knowing-in-action contributed to that surprise. This reflection process allows people to consider the situation by being evaluative and critical. The process also improves future action or performance. Reflection-in-action is concerned with thinking about what we are doing while we are doing it, in what Schön calls the ‘action-present’. It is about challenging our assumptions because knowing-in-action forms the basis of our assumptions and about thinking again in a new way. Reflection-in-action serves to reshape what we are doing with conscious consideration; its expected outcome is outside of our knowing-in-action.

Both types of reflection are regarded as a process in which practitioners reorganize and construct personal and practical knowledge that leads to new understanding of self as a professional within the context of the activity. Moon (1999)

pointed out that reflective thinking has been initiated or guided differently or used and applied for different purposes in a variety of fields of education. Schön ‘s potential influence on nutrition education is important since reflection-in-action coupled with reflection-on-action is individually introspective and in turn, the increased awareness about personal risk behaviors becomes prerequisite to motivation for behavior change (Weinstein, 1998).

Schön (1983) suggested that practitioners’ professional knowledge could be constructed by their reflective practice. If students research their everyday dietary-related behavior and reflect-in/on action, i.e. become deliberate about their choice of snacks in order to implement appropriate changes to their life style, then students might develop improved self-awareness of what actions to take or why a certain action was taken in terms of autonomous choice of healthy food. As a reflective practitioner, students might be able to ‘celebrate’ their everyday dietetic-related activities as examples of intelligent knowing-in-action (Schön, 1983). It is the ultimate goal of nutrition education to help individuals make healthy choices as daily routine

Reflection in Clinical Settings

Reflection plays a key role in clinical therapy (e.g. obesity). Obese patients can be advised of their own dietary behaviors through a reflection process. For the process, active monitoring and recording of their daily dietary-related activities are required, and dietary journal writing is one of the most widely-used and highly-regarded monitoring techniques to providing individualized feedback (Frobisher and Maxwell, 2003; Bingham, Gill, Welch et al,, 1994). Journal writing includes observations and records of

everyday health related behaviors, and it allows individuals to capture everyday dietary performance and to use them as artifacts for reflection. Patients, who discovered unexpected unhealthy behaviors while reviewing their own dietary journals with dietetic professional support, are then primed for reflection. Patients are voluntarily identifying their own problems and needs, exploring why it happened or how current knowledge and behaviors are contributing to the problems, envisioning personal well-being, planning new way to eliminate unhealthy patterns, deciding action for reaching well-being, and are motivated for behavior modification (reflection-on-action)(Cerqueira, 1991b).

Some patients change their health-related routines because they become more conscious of them while they write dietary journals. Patients know that their recorded indiscretions will be scrutinized by a therapist or peer (Foreyt, Goodrick, & Gotto, 1981). Through these processes, inappropriate behavior may be prevented and these decisions are likely to occur in action (reflection-in-action). Continuous restructuring of current dietetic-related action through reflection in/on-action may be promising in guiding future lifestyle and autonomous healthy choices.

Reflection in Nutrition Education for Young Children

Reflection as an educational strategy in nutrition education has not been studied across a wide range of populations, especially young children in kindergarten and early elementary grade levels.

Nutrition Education in School Settings (Kindergarten and Elementary School)

It has been well established that healthy eating behaviors need to be built in childhood, especially if we are to begin to stem the obesity epidemic (Jonides, Buschbacher, & Barlow, 2002). School health programs can play a critical role in promoting lifelong healthy eating habits (Centers for Disease Control and Prevention [CDCP], 1996; Gregory, 2002) because schools can reach almost all children and have more influence on children's lifestyles than any other social institution except family. While schools alone cannot be expected to address the health problems of young children, they are an ideal channel to reduce health risk behaviors and improve health status (CDCP, 1996). Schools are an appropriate intervention site to develop the knowledge, skills, and attitudes necessary for lifelong healthy eating behaviors and can make an important contribution to both short and long-term disease prevention and health promotion through nutrition education (Department of Health and Human Services, 2001).

However, the educational strategies used in most kindergarten and elementary schools are largely based on an information dissemination model, where knowledge is assumed to lead to a change in attitude, which, in turn, leads to change in behavior (Contento et al., 1995). The nutrition content is usually based on existing frameworks such as the Society for Nutrition Education concepts for food and nutrition education. The curricula cover topics such as the role of nutrients in the body, food sources of nutrients, food groups, and healthful eating in general. Mostly, nutrition instruction in schools is delivered by classroom or health teachers, and their role is very important since nutrition education depends largely on teachers' knowledge and skills. However it is very

difficult to provide qualified nutrition education given constraints in time and curriculum, and lack of training of teachers, support from school, and community.

In order to improve nutrition education aimed at young children, research suggests that nutrition education should involve the following: (a) focus on specific behavior rather than on learning general facts about nutrition; (b) employ active learning strategies for self-monitoring and self-assessment instead of relying exclusively on information dissemination and didactic teaching methods; and (c) use developmentally appropriate techniques to help children make informed food choices (Contento et al., 1995)

Cognitive Development Stage and Young Children

Cognitive development refers to the way children's thinking matures as they grow and gain experience in learning. Cognitive development, or cognitive maturity, is a major influence on what children can learn (Hertzler, 1994) including what they can learn cognitively from nutrition education. Early childhood is a period when cognitive ability develops rapidly (Branson, 2000). Reflection is not natural nor occurs spontaneously in young children. According to Brown and Palincsar (1989) and others (Hattie, Biggs, & Pudie, 1996; Schunk & Zimmerman, 1994a: Boekaerts,. 1997), the ability to think reflectively improves with age; however, the acquisition of the skill is not necessarily associated with natural development. Therefore, it should be explicitly trained (Schunk & Zimmerman, 1994b) and appropriate supports are crucial for engaging higher levels of reflection (Lin et al., 1999).

King and Kitchener (1994) suggested that reflective thinking has seven developmental stages. Among the stages, reflective-judgment is in the seventh stage, and it is the most advanced stage in the model. In the seventh stage, beliefs are justified probabilistically using evidence and arguments; conclusions are defended as representing the most complete, most compelling, or most plausible understanding of an issue available to date, based on the current evidence (King & Kitchener, 1994). According to a Piagetian view, young children are in lower stage of cognitive development (Piaget & Inhelder, 1969). They begin to develop the ability to classify and think causally, but their ability to reason is limited to concrete objects and specific experience. Therefore, school-age kids need to be presented with concrete ideas, since many nutrition concepts are abstract. No matter how skilled the presenter, young children can notunderstand abstract concepts until they are developmentally ready (Wisconsin Nutrition Education Program, 2001).

Contrary to these views that young children are concrete and simplistic thinkers, new views of what children know and how they learn has emerged in recent cognitive science research (e.g., Baillargeon, 1995; Gelman and Lucariello, 2002; Yoachim and meltzoff, 2003; Saxe, Tenenbaum, and Carey, 2005;). Current research suggests that children can think both concretely and abstractly and their thinking is surprisingly sophisticated. Those researchers claims that young children have “rich knowledge of natural phenomena” although much of which is implicit (Duschl, Schweingruber, and Shouse, 2007). Young children are able to engage in reasoning with these knowledge of the natural world, which can be “potential precursors of modeling, designing experiments, and reasoning about theory and evidence"(Duschl, Schweingruber, and Shouse, 2007).

However, these early reasoning abilities vary across children and even within an individual child. They are also influenced by the depth of children's conceptual knowledge, the nature of the task, and their awareness of their own thinking (metacognition). Therefore, what children are capable of at a particular age is viewed not as a simple function of age or grade but as the result of a complex interplay among maturation, experience, and instruction.

On the basis of new understanding about children's development, children can engage in and profit from relatively complex practices such as self-evaluation which is identified as a crucial element for successful nutrition education. However, it is necessary to provide an appropriate support for young children to build on or utilize their early capability to make their learning meaningful and active instead of waiting until a child is cognitively ready for abstract content. In nutrition education, any form of support to make children more easily understand abstract concepts linking food and health and to make their thinking process explicit would be helpful for young children.

Making Connection to Everyday Experiences

When learning is anchored in a meaningful context for learners, learners are more likely to understand how concepts are applied and why they are important and useful and thus, they transfer new knowledge more easily (Bransford et al., 1990; CTGV 1993). The core of successful nutrition education is identified as active reflection upon daily experiences. The reflection requires observation of individuals' daily dietetic-related activities and deliberate thinking during the observation as well. Making observations of dietetic-related behaviors and using them for reflection in the classroom sounds simple

and easy. However, previous studies showed how difficult it is for students to make accurate observation in their everyday world and explain them. Many nutrition education studies (e.g. Lloyed, Paisley,& Meta, 1993, Brug & Kok, 1997; Kearny, Bibney, Martinez et al., 1997; Lechner, Brug, Vries, Assema, & Muddie, 1998; De Bourdeaudhuij and Brug, 2000; De Bourdeaudhuij and Van Oost, 2000; De Bourdeaudhuij, Brug, Vandelanotte, & Oost, 2002) indicated that large proportions of the population have misconceptions about personal dietary-intake levels and especially about fat, factors that limit nutrition education success. People also develop different misconceptions about the fat content of foods and possible low-fat alternatives, and therefore the knowledge gained from nutrition education or clinical therapy will not be effective to decrease their fat intake. Indeed, previous studies found that, despite high levels of fat intake, respondents did not report an increase in awareness of personal fat intake after receiving standardized nutrition education. They were even more convinced that their fat intake was low already, resulting in lower perceived fat intake at post-test (De Bourdeaudhuij and Brug, 2000)

Writing Dietary Journal and Young Children

There is no perfect way of measuring habitual intake. Dietary journal writing is one of the most widely-used techniques to monitor everyday experiences (Frobisher and Maxwell, 2003; Bingham et al., 1994). It is highly regarded among other techniques and studies have found a good correlation between using dietary journal and weight loss (Perri, Nezu, Patti & McCann, 1989; Dubbert & Wilson, 1984) and maintenance (Kayman, Bruvold & Stern, 1990; Hartman, Wapner & Saxon, 1990). Some clinical studies on obesity found that patients spontaneously reduced calorie intake when daily diet records

were kept and reviewed. Patients who monitored their caloric intake and expenditure lost more weight than did those who did not use self-monitoring (Foreyt & Goodrick, 1993).

However, other studies criticized it with respect to accuracy especially in estimating the amount of foods consumed (Beaton, Burema, & Ritenbaugh, 1997; Tran, Johnson, Soultanakis, & Maththews., 2000; Frobisher and Maxwell, 2003), since it relies on individual ability and willingness to remember and record everyday experience accurately (Robson & Livingstone, 2000). For example, dietary intake reports from obese people, white women, and individuals from lower socioeconomic groups have been found to underestimate food intake (Tran et al., 2000; DeLancy, 1998; Johnson , Soultanakis, & Matthews, 1998.; Kretsch, Fong, & Green, 1999; Price, Paul, Cole, & Wadsworth, 1997; Pryer, Vrijheld, Nicholas, Kiggins, & Elliott, 1997). For young children who have relatively minimal observation skills, memory, and writing ability, it is more difficult to record dietary behavior accurately. One study on the validity and reproducibility of self-reported intake of fruit and vegetable found that 6th graders were capable of recording yesterday's intake of fruit and vegetable, but they were inaccurate in recording frequency and portion size (Anderson, Bere, Kolbjounsen, & Klepp, 2004).

According to Young and Nestle (1995), children, because of their immature cognitive skills, cannot observe and record their eating accurately even when visual aids are used. When memory/recall is brought into consideration, the effectiveness of dietary journal recording could be questionable. A recent study by Foster and his colleagues estimated the portion sizes of food items consumed by children (6 and 11 years old) during a school dinner, with aids of food photographs (Foster, Anderson, & Admson,

2001). When the estimated weights were compared with the actual weights a large spread was found in the amount of under- and over-estimation. Only 21% and 17% of the estimated portion weights of the 6 and 11 years olds, respectively, were within ±10% of the actual food weights; whereas studies with adults have found that 50% had estimated weights correct to within ±10% of the actual weights (Lucas, Niravong, Villeminot, Kaaks, & Clavel-Chapelon, 1995). Furthermore, children under 6 years old who lack recording skills may have more difficulties in recording daily experiences. Because of these reasons, writing dietary journal is rarely applied to nutrition education for young children.

Nutrition education may become more effective if an alternative self-monitoring tool which is friendly to young children is provided, so that young children can have accurate information about their daily health-related routine and use them as artifacts for reflection.

Technology Assisted Reflection (Images as artifacts for reflection)

Smith and Blankinship (2000) introduced the use of images as a primary source for reflection in educational settings. In their demonstration, they used photographs and video as an imagery tool for discovering information from data. When students use images as a *tool*, they actively construct understanding by observing and interpreting image data, while they simply receive and understand facts with photographs used as *objects* (Smith et al., 2005). For instance, in nutrition education, photos of foods can be used in an activity of grouping food photos into each food group's category (imagery as *objects*). However, self-captured food photos based on what students consumed for the day can be used for

evaluating their health-related routines and finding unconscious faulty behaviors. "When photographs and video are used as data, overly-optimistic views of health maintenance can be shared and critiqued by experts to potentially increase awareness of harmful practices" (Smith and Blankinship, 2000).

Purpose of Study

This study aimed to introduce digital imaging to young children as a technology for enhancing reflection on dietary behaviors. Using digital imaging in nutrition education for young children has several advantages. First of all, it provides an easier recording method for children who have little ability to write. Secondly, it improves accuracy of observation in terms of the foods consumed and serving sizes. And lastly, it serves to capture specific dietary-related acts in their everyday world and turn them into concrete "artifacts" for reflection. Based on successful results of related prior studies (Land et al., 2005), this study extended the approach to a younger age group (age 5) who need more assistance recording dietary behavior and reflection. The goal of the study was to integrate digital imaging as a self-monitoring tool to help young children to visualize their everyday eating behaviors, interpret, and reflect upon them. In this way, we provided more individualized nutrition instruction to young children that were more personally relevant and meaningful, thus enhancing the likelihood of behavior change towards a healthy life style.

Research Questions

The overarching research question of the study was: What are the effects of using digital imaging as a self-monitoring tool to support kindergartner's reflections on nutrition education?

Question 1: Does reflection on everyday experiences in the nutrition education influence kindergartner's daily action, as measured by increased healthy food consumption?

Question 2: Does using captured data representations help young children reflect on daily dietary-related activities as observed by increased self-awareness?

Question 3: What is the relationship between accuracy of food intake analyses and behavior changes?

The predicted effects of the use of digital imaging to support reflection on everyday experiences with nutrition were that students would show some evidence of (a) improvements in dietary behavior; (b) increased self awareness; (c) increased accuracy of basic nutritional conceptual knowledge.

Definitions of the Terms

Behavior change: refers to proximal effects of nutrition education, such as intake of specific foods, some composite index of food intake or food score, or actual behaviors such as eating more fruits and vegetables per day (SNE, ADA, & ASFSA, 1995). In this study, behavior change will be evident if children are more conscious about what they eat (ask mom or teachers if the food they are eating is healthy), ask for healthier snacks (for example, asking fruit instead of cookie and candies), eat more fruit and vegetables for the day, or want to try new food they didn't try before that are healthy).

Dietary-related behavior (food behavior): refers to the way in which individual in response to social and cultural pressures, select, consume, and utilize portions of the available food supply. For example, a kindergartener selects and decides what kinds of food and how much to eat among the provided foods for lunch.

Knowing-in-action: our unstable, tacit knowledge that drives our actions. In this study, this could be a child who eats lots of one food item because it tastes good, rather than based on knowledge of what is healthy.

Nutrition education: any set of learning experiences designed to facilitate the voluntary adoption of eating and other nutrition-related behaviors conducive to health and well being.

Reflection: refers to a responsive process to unexpected consequences. The process involves one's purposeful and conscious activity to monitor, analyze, and evaluate one's own learning in terms of achieving learning goals, sustaining motivation, making deep understanding, using appropriate learning strategies, and interacting with peers and instructors in order to construct new perspectives of learning that directly lead

to improve learning process and performance (Schön, 1983). In this study, reflection could be seen with a child who realizes he has not been drinking enough milk. He may also think about how he can drink more milk for the day and ask for milk instead of soda.

Reflection-in-action: simultaneous reflecting and doing, implying that the professional has reached a stage of competence where she or he is able to think consciously about what is taking place and modify actions virtually instantaneously. In this study, a kid may eat less chocolate while he takes pictures of his foods because he knows chocolate is not a healthy food and his chocolate photos will be scrutinized in the class.

Reflection-on-action: a reflection process after the event. It involves looking back upon action some time after it has taken place. For example, in the nutrition education session, kids may be reminded of what he ate for dinner yesterday and consider if it was healthy or not.

Self-awareness: refers to an attribute of the human which not only allows awareness of self, but also realizes the position of the self in the social milieu (Demaree & Harrison, 1997). For example, in this study, when a child reviews his photos of foods analyzes them through an e-food journal activity, he may be surprised about how many cookies he ate or how little vegetables he ate. The child may realize the he doesn’t eat as healthy as he thought.

Scaffolds: all forms of learning support to assist learning. A form of assistance provided to a learner by a more capable teacher or peer that helps the [learner] perform a task that would normally not be possible to accomplish by working independently (McLoughlin & Marshall, 2000). In this study, question prompts and e-food journals

using digital images and voice logs will be used to help children's reflective thinking process and improve their learning.

CHAPTER 2

LITERATURE REVIEW

This chapter reviews the literature on reflection from different traditions and contexts of education. Studies on utilizing technologies to support young children's reflection on everyday contexts are also reviewed.

Perspectives on Reflection

In this section, the nature or meaning of reflective thinking in education is discussed through the review of John Dewey's reflective thinking, Schön's reflective practitioner, and Kolb's experiential learning.

John Dewey's Reflective Thinking

John Dewey introduced the concept of reflective thinking to education in his book, *How We Think* (1933) and it has made a unique impact on the field. Dewey is concerned with the nature of reflection and how it occurs. Dewey distinguishes reflective thinking from uncontrolled consciousness as a consecutive deliberation. Dewey further defines reflective thinking as "active, persistent and careful consideration of any belief or supposed form of knowledge in the light of the grounds that support it and further conclusions to which it tends…it includes a conscious and voluntary effort to establish belief upon a firm basis of evidence and rationality" (p9).

According to Dewey, reflective thinking arises when the individual detects incompatible factors within the situation. Reflective thinking involves a state of doubt, hesitation, perplexity, mental difficulty, in which thinking originates, and an act of searching, hunting, inquiring, to find material that will resolve the doubt, settle and

dispose of perplexity (Dewey, 1933). On this basis, reflective thinking can be viewed as the learner's intentional and conscious problem-posing and problem-solving process. For Dewey, knowledge is constructed, in part, through reflection and involves the active, persistent and thoughtful consideration of a situation.

Dewey (1933) delineates five phases or aspects in the development of reflection: (1) suggestions, in which the mind leaps forward to a possible solution; (2) an intellectualization of the difficulty or perplexity that has been felt (directly experienced) to a problem to be solved; (3) the use of one suggestion after another as a leading idea, or hypothesis, to initiate and guide observation and other operations in the collection of factual material; (4) the mental elaboration of an idea; and (5) testing the hypothesis by overt, or imaginative action. Reflective thinking is highly interactive rather than hierarchical or procedural. The sequences in which these phases occur vary according to each situation but they are vital elements of reflection (Loughran, 1996).

Dewey (1933) argues that not everyone may be willing to reflect. For these people, "suspense of judgment and intellectual search may be disagreeable or it may be regarded as evidence of mental inferiority" (p. 16). He advocates the cultivation of three essential features of one's attitudes that influence reflection: open-mindedness, whole-heartedness, and intellectual-responsibility.

Open-mindedness implies an intellectual receptiveness. Dewey describes it as a willingness to consider alternative and novel ideas. It includes an interest to listen to more than one point of view on an issue with recognizing one's equality. Whole-heartedness is the entire individual's mental, emotional, and physical resources committed to the resolution of the problem (Norton, 1997). Dewey describes whole-

heartedness as a genuine enthusiasm that operates as an intellectual force and drives thinking. It can be viewed as a willingness to overcome personal fears demonstrating a sincere and generous attitude in order to bring about change. Intellectual responsibility requires learners to "consider the consequences of a projected step, ...and to be willing to adopt these consequences when they follow reasonably from any position already taken" (Dewey, 1933, p. 32). Responsible learners must ask for the meaning of what they learn and evaluate the ideas in the sense of consequences and implications of the proposed plan in the short-term and long-term.

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Schön's Reflective Practitioner

Donald Schön applied the concept of reflection to the understanding of professional practices in his two books, *The Reflective Practitioner* (1983) and *Educating the Reflective Practitioner* (1987). His focus is on the nature of professional action and its relationship to theory, not the nature of reflection (Moon, 1999).

For Schön, reflective practice is a critical process involving thoughtfully considering one's own experiences in applying knowledge to practice while being coached by professionals in a specific discipline. Schön describes professional ability as artistry, which he defines as "the competence by which professional handle the indeterminate zones of practice…an exercise of intelligence, a kind of knowing, though different in crucial respects from our standard model of professional knowledge. It is not inherently mysterious; it is rigorous in its own terms" (1987, p. 13). Schön contends that professional practice is more than the application of theories which is represented by the technical rationality. Schön found that when effective practitioners were faced with a

problem in their practice, they worked through it instinctively and, drawing on previous similar experiences, they tried and tested out various possible solutions until they resolved the issue. They worked through the problem using a mixture of knowing and doing. By that, professionals enhanced their learning and added to their repertoire of experiences, from which they could draw in future problem situations. Based on the observation of professionals, Schön describes how professionals think and act in the complex and ambiguous situations in their practice(reflection-in-action) and coined the term 'theory-in-use' to describe the nature of the reflective activity in which they are engaged. Reflection-in-action refers to thinking in the midst of action that reshapes what individuals do while they are doing it.

Schön (1983) argues against technical-rationality--the view of professional knowledge which has most powerfully shaped both our thinking about the professions and the institutional relations of research. Technical rationality reflects a belief that education and practice-professional activity consist of instrumental problem solving made rigorous by the application of scientific theory and technique. The rational in this view is the logical abstraction of thought and action. Schön believes that this approach, although rigorous, bore little semblance to reality and did not equip professionals with the training needed to solve real-world problems that are messy, indeterminate, and ill-formed (1983, 1992).

Schön (1983) looks to an alternative epistemology of practice in which the knowledge inherent in practice is "understood as artful doing based on reflection-in-action". He describes a reflective practitioner as "a researcher in the practice context" who attempts to create meaning of the problematic aspects of the situation through

problem setting and problem solving (p. 68). Problem setting is distinguished from problem solving as a process which interactively frames the problem, names the things to which s/he attends and frames the context in which s/he attends to them. He contends that problem setting is a necessary condition in order not to neglect and deny the practitioner's ability to identify and refine problems of practice. A reflective practitioner focuses on problem-setting to overcome the limits of problem solving.

For Schön (1987), reflection occurs when there is a surprise and when something interrupts the flow of knowing-in-action. Knowing-in-action refers to our unstable, tacit knowledge that drives our action. Knowing-in-action requires minimal effort, once routines are learned and becomes automatic, therefore it is revealed by the skillful execution of the performance. As such, we are characteristically unable to make it verbally explicit. He emphasizes the importance of actions that yield unexpected consequences. Reflection, as a responsive process to unexpected consequences, enables people to examine their practices focusing on implicit understandings, beliefs, and ways of performing, and identify why or how these tacit practices may no longer be adequate to deal with new situations. Schön states "The practitioner allows himself to experience surprise, puzzlement, or confusion in a situation he finds uncertain or unique. He reflects on the phenomenon before him, and on the prior understandings which have been implicit in his behavior" (p. 68). Two main processes of reflection are central to professional practice: reflection-in-action and reflection-on-action.

Reflection-in-action is concerned with thinking about what we are doing while we are doing it, in what Schön calls the action-present (Schön, 1983). He asserts "reflection-in-action may not be very rapid ….action-present is the zone of time in which

action can still make a difference to the situation. [It] may stretch over minutes, hours, days, or months, depending on the pace of activity and the situational boundaries that are characteristic of the practice" (p. 62). Reflection-in-action is conscious inquiry which allows the person to frame and reframe the problem, comprehend its setting, critically evaluate the underlying assumptions that led to the problem, and construct an alternative method of solving it. Schön refers to this process as a "frame experiment" and this involves examining a problem from many different perspectives. When a professional successfully handles a failure or a new kind of case, (s)he creates new knowledge related to the troublesome practice problem (1983, p. 63).Therefore, reflection-in-action is 'central to the "art" by which practitioners successfully deal with situations of uncertainty, instability, uniqueness, and value conflict' (1983, p. 50). Reflection-on-action takes place after the performance so as to produce a good description of reflection-in-action with or without verbal help. It works as we think back on our activities to understand why the surprise happened and how knowing-in-action contributed to that surprise. In so doing we develop sets of questions and ideas about our activities and practice.

Both types of reflection are regarded as processes in which practitioners reorganize and construct personal and practical knowledge that leads to new understanding of self as a professional within the context of the activity. The reflection process informs knowledge construction and contributes to the repertoire of experiences that improves practice, thus changing the situation. Schön sees individuals' ability to reflect both in and on action as one means to distinguish effective from less effective professionals (Feiman-Nemser, 1990; Schön, 1983, 1987).

According to Schön (1987), the ideal learning environment for the reflective practitioner is a virtual world of practicum, wherein one can deal with real problems. The novice practitioner is coached by the effective practitioner "in solving the problems posed in professional practice and how to negotiate the ladder of reflection" (Waks, 2001, p47). This process enables the novice practitioner to move towards independent practice by accumulating his own repertoire of experiences.

The work of Schön advocates bringing theory into practice. Unlike Dewey, he reveals that not all action leads to learning; only when action is informed by reflection and, in turn, informs reflection, is one able to learn and refine one's knowledge (Sanyal, 1997). His concept of reflective practice has been applied to many training and education programs for teachers and others in a variety of professional fields.

Experiential Learning and Reflection

Rogers (1994) identified two types of learning: cognitive and experiential. The former corresponds to rote knowledge such as learning vocabulary or multiplication tables. He regarded this type of learning as meaningless. The latter refers to applied knowledge such as learning about engines in order to repair a car. He regarded this type of learning as the most important (Kearsley, 1994).

Eraut defines experiential learning as "situations where experience is initially apprehended at the level of impressions, thus requiring a further period of reflective thinking before it is either assimilated into existing schemes of experience or induces those schemes to change in order to accommodate to it" (1994, as cited in Moon, 1998).

Eraut made a point that all learning is not experiential and stressed the nature of experiential. In his conceptualization, reflection is pivotal for experiential learning.

The experiential learning theory is traced back to the work of Dewey (1938) who believed “all genuine learning comes about through experience” (p. 25). However, Kolb’s experiential learning cycle introduced in his book, *Experiential Learning* (1984) is widely known within the field of education and professional development and training. Many researchers who come from different backgrounds(for example, Boud, et al., 1985; Gibbs, 1988; Warner Weil and McGill, 1989; Boud & Walker, 1991) widely reproduced, or expanded Kolb’s experiential learning cycle (1984), which made an immense contribution to the evolution of the field in the modern education arena.

Kolb defines learning as "the process whereby knowledge is created through the transformation of experience” (1984, p.41). Kolb’s experiential learning originates from the experiential works of Dewey (philosophical pragmatism which emphasizes the need for learning to be grounded in experience), Lewin (social psychology which stresses the importance of a people being active in learning), and Piaget (cognitive-developmental genetic epistemology describing intelligence as the result of the interaction of the person and the environment) (Kolb, 1984). Kolb describes learning as a 4-stage cycle (Figure 2), and the cycle moves through concrete experience, reflective observation, abstract conceptualization, and active experimentation.

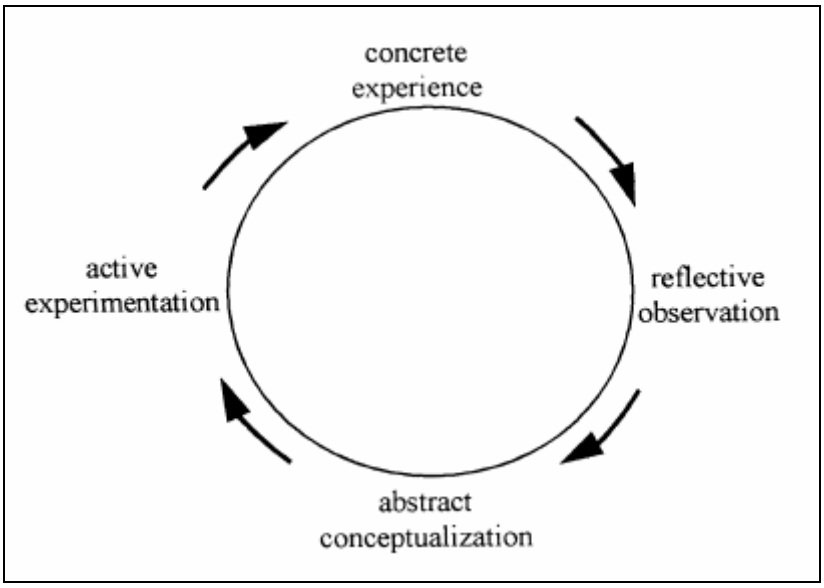

Figure 1.1. Kolb's experiential learning cycle

In the first stage, learners are engaged in concrete experiences. The next stage allows learners to use the experience as a basis for observations and reflections. From these reflective observations, learners move to the third stage, that of creating generalizations or building a theory about the experiences and reflections. The active experimentation stage allows learners to actively test the application of the newly developed theories in new and more complex situations. And the cycle continues at increasingly more sophisticated levels. Through this process, the learning cycle is transformed into a spiral of ever-increasing complexity (Kolb, 1984). While Kolb's experiential learning cycle does not, itself, expand on the concept of reflection, it attempts to locate it in a sequence of activities of learning from experience. A number of researchers from diverse perspectives focus more directly on reflection in experiential learning (Moon, 1999).

Boud, Keogh, and Walker (1984) who expanded Dewey's view of reflective thinking and Kolb's experiential learning, argue that experience alone is insufficient for learning but that reflection is key to learning from experience. "Perhaps if we can sharpen our consciousness of what reflection in learning can involve and how it can be influenced then we may be able to improve our own practice of learning and help those who learn with us" (Boud et al. 1985, p. 7-8). Consistent with Kolb's work, Boud et al. depict five assumptions about learning from experiences: (1) experience is the foundation and stimulus for learning; (2) learners actively construct their experience; (3) learning is a holistic process; (4) learning is socially and culturally constructed, and (5) learning is influenced by the socio-emotional context in which it occurs. Based on the assumptions about experiential learning, the group defines reflection as "a generic term for those intellectual and affective activities in which individuals engage to explore their experiences in order to lead to new understandings and appreciations" (p. 19). Boud and Walker (1990; Boud et al., 1985) associated the timing of reflective activities with three stages of experience-based learning: preparation for experiential events, engagement, and processing. The importance of including reflective activity is highlighted at each stage. In the preparatory phase, students examine what is required of them and the demands of their field site; during the experience, they process a variety of inputs arising from the field site; finally, they must consider and reevaluate what they have experienced. In their model, reflection is crucial for experiential learning.

In the early 1980's, Mezirow, Freire and others stressed that the heart of all learning lies in the way we process experience, in particular, our critical reflection of experience. They spoke of learning as a cycle that begins with experience continues with

reflection, and later leads to action, which itself becomes a concrete experience for reflection (Rogers, 1996).

Weil and McGill(1989) define experiential learning as "…the process whereby people individually and in association with others, engage in direct encounter and then purposefully reflect upon, validate, transform, give personal meaning to and seek to integrate their different ways of knowing. Experiential learning therefore enables the discovery of possibilities that may not be evident from direct experience alone (p. 245)". They (1989) developed a "village" metaphor to categorize experiential learning into four diverse contexts (P.3). Village 1 is concerned particularly with assessing and accrediting learning from life and work experience; Village 2 sees experiential learning as catalyzing change in the structures of post-school education; Village Three emphasizes experiential learning as a basis for consciousness raising, community action, and social change; and Village 4 focuses on personal growth and development to increase self-awareness and group effectiveness. The four villages are not mutually exclusive but interact and intersect with each other (Anderson, Boud, and Cohen, 1995).

An experiential approach assumes that the most important learning outcomes occur through the learner's own experiences of action in the real world (Kolb, 1984). Researchers from diverse backgrounds approach experiential learning differently and develop various models. However, reflection is consistently found to be central in these literatures and models. Anderson et al. (2000) note that , "the ultimate goal of experience- based learning involves the learner's own appropriation of something that is to them personally significant or meaningful (sometimes spoken of in terms of the learning being 'true to the lived experience of learners')"(p. 227).

Defining Reflection for This Study

In this chapter, diverse aspects and definitions on the concept of reflection by different professions have been explored. The concept of reflection for this study is strongly grounded in Schön's theory of the reflective practitioner focusing on reflection-in/on-action. Reflection occurs in response to an uncertain, puzzling, surprising, or problematic experience. Such an experience is processed through a series of cognitive activities –reflection-in-action and reflection-on-action that are critical and evaluative. Self-awareness and motivation are increased through the process, and as outcomes, knowledge is constructed and repertoires of experiences are stocked, which improve performance. Therefore the definition of reflection guiding this study is one's deliberate thinking and continuous process of evaluating experiences to discover self and improve performance based on, but not limited to, one's instinct and previous repertoires of experience.

Current Studies on Technology to Support Reflection on Everyday Experiences

Over the past century, technological applications are increasing exponentially in education to help information-age learners reflect on and organize evolving ideas by making learners' thinking explicit and 'visible' (Linn, 2000). Although much of the research on technology-enhanced reflection has focused on classroom contexts, some studies have been applied outside of the classroom and connected to everyday contexts (for example, Land et al, 2005;Smith and Reiser, 2005; Smith and Blankenship, 2000; Aschermann et al, 1998; Barrett, 2005). This section reviews some of these studies.

Use of Digital Video as a Reflection Tool.

Collins and his colleagues (2004) used video clips to promote students' reflection on their professional development through a process of experiential learning, self-reflection, and peer review. Digital video, course management systems (blackboard), online discussion forums, and CD-ROM compilations were used to support professional development of students within graduate professional programs. The process involved the students in authentic situations as a course assignment. Sessions were captured through digital video and the captured video clips were shared with fellow students who were called "critical friends" through Blackboard. Critical friends post their thoughts anonymously and shared critique about how to improve their fellow student's professional skills through online discussion. Individual students review their own video and post a self-reflection and notes for improvements. In this study, video capture of professional practice session is used to foster students' engagement of their own performances and to receive critiques from student colleagues. Students in this study reported that the "coupling of experiential learning, video documentation, and reflective critique was highly beneficial" (p.142). The participating students also perceived a high educational value of the digital video assignment.

Hong and Broderick's study (2003) investigated the role of instant video revisiting (IVR) on promoting reflection of both preschool teachers and children (aged 2.5 to 5). The study found that videotaping experiences and IVR regarding social conflicts in the classroom was beneficial to both teachers and children. The teachers used video clips as data. It served as a tool for teachers to discover the true intent of the children who exhibited challenging behaviors and to revisit the children's actions in order

to better understand children's thinking and interpret them with multiple perspectives. This, in turn, informed their teaching practice. For students, revisiting their experiences helped them extend their thinking, reflect on their actions, and solve their own conflicts.

Bouras and his colleagues (2000) illustrated how a "diary composer" supported reflection of young children (aged 4 to 8) on past events. The study was conducted as a part of the "Today's Stories" project, which utilizes daily activity pictures to promote learning of young children in everyday contexts, with the intent to develop social, communicative and emotional skills of children. To capture and bring everyday activities to the classroom, a wearable KidsCam was used. The diary composer is a software tool that acts as a video explorer to support reflection on past events. It allows children to review collected materials and to annotate and edit it, thus creating stories of everyday life from their own perspectives. The tool focuses on facilitating multiple perspectives of events through capturing events by one or more children and their cooperation during the annotation procedure by linking their collected material. The authors concluded that "the tool seems to succeed in acquiring collaboration of its young users, by presenting simultaneously video recordings on the same event and provoking small groups of children to comment upon them and annotate them. It, therefore, distinguishes itself among relevant existent tools."

Use of Digital Photography to Support Reflection.

Land et al (2005) examined elementary students' use of digital photography of their everyday food and exercise choices as data for reflection on health and nutrition education. The project focused on anchoring nutrition concepts in everyday eating and

exercising experiences of kids. For reflection to occur, children need something concrete and visible to which to refer (Loh et al., 1998). Children used images of their food choices as concrete evidence for reflection. Photo journals were used to support kids to analyze the healthiness of their food choices, based on the photo data. .

Smith (Smith and Blankenship, 2000) described the use of photographs and video as primary sources for reflection. When students use images as a tool, they actively construct meaning by observing and interpreting image data, while they simply receive and understand facts with photographs used as objects (Smith et al., 2005)

In a study of everyday health maintenance, Smith (2004) designed an intervention that introduced digital photography into diabetes self-management routines through visualization of physiological data and taking photographs of daily dietary activities. These images are integrated into a computer visualization that contextualizes numerical data (Albayrak and Smith, 2004). The participant is involved in discussion about their implicit ideas via visual representations of captured activities and photos.

In other studies, photography has been used to provoke response, which is called ‘photo-elicitation’ (Harper 1984). Collier (1967) first described the photo elicitation interview and suggested that photographs, when used in interviews, "sharpen the memory and give the interview an immediate character of realistic reconstruction" (Collier and Collier, 1986, p. 106) Harper (2002) advocates the use of photo elicitation because images evoke deeper elements of human experiences than words alone (Loeffler). Photo-elicitation has been applied to different contexts of social research, and Hurthworth listed the different purposes of the photo-elicitation used as follows (2003):

- determine ethnic identification (Gold 1986)

- understand behaviors (Entin 1979, Wessels 1985)
- enhance memory retrieval (Aschermann et al. 1998)
- work with young children/school students (Diamond 1996, Weiniger 1998, Foster et al. 1999, Salmon 2001)
- undertake program evaluations (Brown et al. 1980, Tucker and Dempsey 1991, Buchanan 1998)
- provide a tool for nursing, medical and gerontological research (Hagedorn 1996, Higgins & Highley 1986, Magilvy et al. 1992)
- teach tertiary students (Killion 2001, Smith and Woodward 1999)
- talk about more difficult, abstract concepts (Curry and Strauss 1994, Bender et al. 2001)

Aschermann, and her colleagues (1998) evaluated photographs as retrieval cues to aid memory of preschool children (age 3;7-6;8). In this study, children participated in a fishing game and ten days later they were questioned about the game under three conditions: questions only; questions with photos; and questions with photos and training to use photos. The study found that both photo groups remembered more accurately and in more detail than the questions-only group and concluded that photos are effective retrieval aids for young children.

Barrett (2005) suggests some other technology tools that engage learners in reflection as a part of electronic portfolios: web logs (‘blogs’), reflective journals, online discussions, self-report surveys, and digital storytelling. The National Learning Infrastructure Initiative (NLII, 2003) defines an electronic portfolio as a collection of

authentic and diverse evidence drawn from a larger archive representing what a person or organization has learned over time on which the person or organization has reflected, and designed for presentation to one or more audiences for a particular rhetorical purpose.

Barrett (2005) addresses its definition as the container, allowing students/teachers to collect and organize portfolio artifacts in many media types (audio, video, graphics, text), and using hypertext links to organize the material, connecting evidence to appropriate outcomes, goals or standards. Barrett asserts that reflection is an essential component of an electronic portfolio differentiating it from a multimedia presentation, a fancy electronic resume, a web page, or a digital scrapbook. Only through reflection, the collections are transformed to artifacts for the learning. She applied this method to kindergarteners and demonstrated children's portfolios using digital images (scanned digital images) that are organized with Power Point. For the children's reflections, "sticky notes" were attached to the artifacts by typing into Acrobat stamps, and links to sounds and Quick Time movie of her reading were used.

It has been controversial whether young children should use computers and technology for learning purposes or wait until they get older. Kelly and Schorger (2001) suggest that computers can aid in the development of children's language. When young children use computer centers in a preschool setting, they engage in as much talk and collaboration as they do at other activity centers. Other researchers stressed that the developmentally appropriate use of computers could benefit young children in their cognitive and social-emotional growth, and problem solving. (e.g. Char 1990, Clements, Nastasi and Swaminathan 1993, Haugland and Wright 1997, as cited in Gibbs and Roberts, 2003).

The studies described in this section clearly show the potential of technology use to facilitate learning in the everyday contexts for early childhood education when it is incorporated in a pedagogical framework and provides well-designed scaffolds for reflection.

CHAPTER 3

RESEARCH METHOD

Participants

The study was conducted with kindergarten students of Bennett Family Day Care Center. The institute is housed by the Penn State University and it has an enrollment of 12 children this year. The participants of this study were recruited from the children who are enrolled in the institution and who completed the informed consent form. All twelve children in the classroom received the same nutrition education intervention, but the data were collected only from six participants who gave informed consent. The approximate age of the children who participated in the study was 5.

In compliance with the university's regulations, the purpose of the study, a brief description of the procedure, and the rights while participating in the study were explained to all six children under the witness of their teacher in order to obtain children's assent. Only five children out of six participants completed the study; one child dropped because of serious illness during the study period.

Research Design

A multi-participant case study was selected to investigate the proposed research question. Yin (2002) suggests that case study is more appropriate over other research methods when 1) the type of research question is "how" and "why", 2) extent of control over behavioral events is limited, and 3) general circumstances of the phenomenon to be studied are not manipulated. Eating behavior is socially influenced. The researcher

examined children's eating behaviors without controlling the children's eating behaviors or manipulating the environments to investigate the proposed research question and reveal other possible explanations. For the purpose of the study, five individuals were investigated within the larger case of children's dietary behavior changes with the support of reflection on everyday experiences. These individuals were selected on the basis of children's and their parents' interests in the study and the belief of the researcher that their representativeness would lead to the understanding of the effects of reflection upon everyday experiences on children's behavior changes. All relevant information about each participant was collected and analyzed as a group to find the similarity and patterns. The current case study can be characterized as a holistic design since the study examined only the effects of the nutrition education developed for this study on dietary behavior.

The Instructional Context and Procedures

A total of twelve sessions for 3 consecutive weeks were provided to the children. Each session lasted one to two hours according to the activity. One month and five months after the study, interviews with a teacher and a child and her mom were conducted respectively. Table 3.1 shows a summary of the study procedure, collected data from each activity, and data source by Yin's category.

Session one consisted of an introduction to the study and practice taking photos. Each child received a digital camera and a voice recorder at lunch time and practiced taking photos of the foods on his/her plate.

Table 3.1.
Summary of the study procedures, collected data from each activity, and data source by Yin's category.
* B: Breakfast, L: Lunch, S: Snack, D: Dinner

Date	Meal/ Time	Activity	Collected data	Data Source
Week one (2006)				
11/27 Mon.	L*	• Introduction and practice of taking pictures of own foods • Children's assent form	• N/A	
11/29 Wed.	BF, L, S, D*	• 1st Picture day • Answer the questions regarding healthiness about their eating	• Food images • Verbalizations • Field notes	• Documents • Documents • Observation
11/30 Thur.	BF, L, S, D*	• 2nd Picture day • Answer the questions regarding healthiness about their eating	• Food images • Verbalizations • Field note	• Documents • Documents • Observation
Week two (2006)				
12/1 Fri.	10:00-11:00 11:10-12:00	• Pre-game: Food pyramid game & healthy snack games • Pre-interview with kids • Parents survey	• Game scores • Game scores • Field notes • Interview • Pre-test score • Survey data	• Documents • Documents • Observation • Interview • Documents • Archival records
12/4/ Mon.	10:30-11:30	• Lesson 1: Five food groups Pre-interview with kids	• Field note	• Observation
12/6/ Wed.	10:30-11:30	• Lesson 2: Balanced diet	• Field note	• Observation
12/8/ Fri.	10:30-12:00	• E-portfolio activity: food picture analyses - food group categorization -bucket activity -responses on question prompts	• E-portfolio aritifacts • E-portfolio activity scores • Verbalization • Field note	• Documents • Documents • Documents • Observation

Table 3.1. (continued) Summary of the study procedures, collected data from each activity, and data source by Yin's category.

Date	Meal/ Time	Activity	Collected data	Data Source
Week three (2006)				
12/11 Mon.	10:30-12:30	• Mid-interview •-Setting goal and plans	•Interview •Artifacts	•Interview •Documents
12/12 Tue.	After each meal	•1st day food- train activity •Responses on question prompts	•Artifacts •Scores •Verbalizations •Field notes	•Documents •Observation •Observation
12/13 Wed.	After each meal	•2nd day food- train activity •Responses on question prompts •Interview with parents	•Artifacts •Scores •Verbalizations •Field note •Interview	•Documents •Observation •Observation •Interview
12/14 Thur.	After each meal	•3rd day food- train activity •Responses on question prompts	•Artifacts •Scores •Verbalizations •Field note	•Documents •Observation •Observation
12/15 Fri.	10:30-12:30	•Collect 3-day food-train •Post interview with kids •Interview with a teacher	•Food-train artifacts •Interviews •Post-bucket score	•Documents •Interviews •Documents
One and five months after (2007)				
1/16 Tue.	2:00-2:30	•Interview with a teacher	•Interview	•Interviews
5/8 Tue.	8:00-9:00	•Interview with a child •Interview with a parent	• Interviews	•Interviews

In Session 2 and Session 3, children were asked to take photos of all the foods that they ate for two consecutive days. The research team helped kids take pictures of their breakfast, lunch, and snack and to record voice logs about the items and the amounts

of the foods they ate. Then, kids were asked to answer the question; “do you think you ate healthy? Why do you think so?”

Session 4 consisted of two pre-study games (Food Pyramid Game and Healthy Snack Game, Appendix C) to assess children’s previous nutrition knowledge about categorizing food into the five food pyramid groups and distinguishing healthy from unhealthy foods. In the pre-food pyramid game, children were divided into two teams, and each child received fourteen different food pictures across the food groups including unhealthy snacks such as cake, chocolate, and pop tarts. Children were then asked to put the food pictures in the right food group of the food pyramid poster template. Children were instructed to place the unhealthy food pictures on the top of the pyramid. As a team, the number of correctly-grouped food pictures was counted and a discussion session followed.

In the healthy snack game, one green and one yellow bucket was introduced. The green bucket signified the place to categorize healthy snacks that children are allowed to eat as much as they want to, but the yellow bucket signified the place to categorize unhealthy snacks that children need to slow down and prepare to stop eating. For the game, each child received 7 healthy and unhealthy snack pictures and were instructed to put the pictures into the right color bucket. After the activity, children discussed healthy and unhealthy snacks. Both pre-food pyramid and bucket activity were observed and video taped and individual performances were calculated as an accuracy score. Then, the pre-interview with kids and the parents’ survey followed. The questions for the initial interview of kids and the survey given to the parents are presented in APPENDIX D. At the end of the session, digital cameras and voice recorders were collected for the e-

portfolio activity preparation. The researcher prepared the e-portfolio for each child using the child's food pictures with MS. Publisher.

Session 5 consisted of nutrition instruction on the five food groups and practices of categorizing a variety of foods into the right food groups. Session 6 provided nutrition instruction on eating a balanced meal and differentiating healthy food from unhealthy foods. During two nutrition lessons, children were introduced to the food groups (grains, vegetables, fruits, milk and cheese, and meats), the food pyramid and a balanced diet, and to the relationship of exercise to health. The detailed lesson outlines are described in Appendix B. To ensure that the proposed nutrition education concepts are valid and developmentally appropriate for this age group, and met by nutrition education guidelines suggested from the USDA, the nutrition concepts in the lesson are adapted from existing materials and guidelines for the age group listed below:

- My Pyramid Food Guidance System Education Framework
- Team Nutrition. USDA
- The Pennsylvania FSNE Preschool Track (PA Nutrition Education Network)
- Nutrition Education: A Teaching Curriculum for First Grade (Tershakovec & AMSA)
- Play and Learn with Arthur (PBS Kids)
- Health and Nutrition (Florida Department of Education)
- Nutrition Adventures tool kit based on a nutrition Olympics tool kit by Health Education Council (www. Healtheducouncil.org) (Dole 5 A Day).

The E-portfolio activity took place in session 7. To analyze captured everyday experiences, each child received a lap top computer in which his or her e-portfolio template was stored as a MS. Publisher file prior to the session. A research team of 7 individuals sat with each child with a lap-top computer and instructed a child to drag and drop their self-captured food picture icons on the right food group of the food guide pyramid as well as to decide its healthiness by placing it at the top (unhealthy), middle, or bottom (healthy) of the pyramid. Then, students were asked to complete a bucket activity using icons of the food they ate in which kids moved the food items they ate to the right color of the bucket (healthy foods: green bucket; unhealthy foods: yellow bucket). Figure 3.1 shows an example e-portfolio template for a child (categorizing foods into food groups), and an example bucket activity template for the same child which involved dragging and dropping healthy and unhealthy foods into the correct color bucket.

Figure 3.1. Example of the e-portfolio template (categorization of food groups and bucket activity)

Session 8 conducted mid-point interviews with the children. During the interview, children analyzed their eating for the day which was captured and represented in the personalized e-portfolio. The interview prompted children to evaluate their own eating

for the day in terms of its healthiness and to elicit goals based on their analyses. The mid-point interview questionnaires are presented in APPENDIX D.

Then for next 3 days (session 9, 10, and 11), children recorded their eating with voice logs and conducted a food-train activity right after each meal, trying to improve their food choices based on the goals set in the previous session. Before the study, kids made their own train with one engine, 5 color box cars, and one black caboose. Each box car represented a food group as orange (grain), red (fruits), green (vegetables), blue (milk), purple (meat and beans), and black caboose (unhealthy foods). Each box car was divided as three sections (top-middle-bottom) for the three-day eating record. Figure 3.2 shows a picture of the food-train activity.

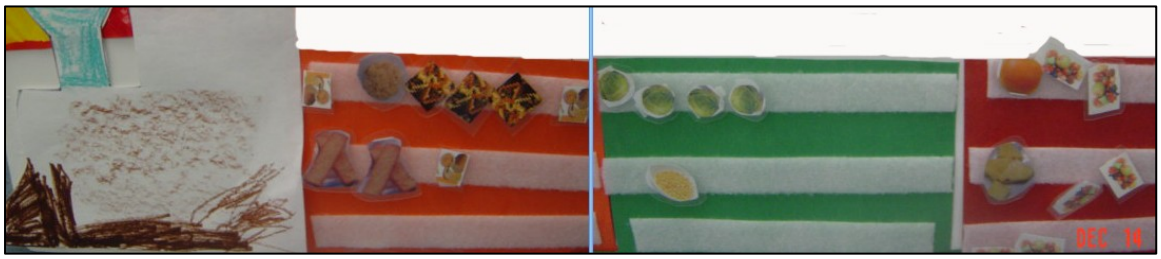

Figure 3.2. Example of a child's food-train with engine, orange (grain), green (vegetables), and red (fruits) box cars.

To encourage kids to eat healthy, kids were prompted to eat from all five groups and fill their box cars with food fuel to move their train. The train activity asked kids to identify food groups of the food they ate for the meal and to put food photo icons into the right color box car of the train. If they ate any food items that were unhealthy, the photos were placed in the caboose (unhealthy food items). It was assumed that if one of the box cars was not full or if they filled too many items in the caboose, their train would not be able to start the engine. After kids grouped the food photos to the right food group, specific self-assessment questions were asked about their eating of each meal as well as

their efforts to improve their eating. Different from the e-portfolio activity, the food photos used in the train activity were prepared by researcher based on the school menu. For the photos of the foods eaten at home, general food photos representing each food group were used. (e.g., mixed fruit picture for any fruit consumption at home. If a kid ate canned fruit, it would be placed in the caboose; mixed meat & bean pictures for any meat & bean group consumption at home. If a kid ate sausage, it would be placed in the caboose.) At the end of each day at school, children were received smiley stickers or 'Nittany Lion' (the symbol of PSU) stickers as a reward to try eating healthy for the day. During the train activity, interviews with parents were conducted at parents' convenience.

In the last session, kids' food-trains were collected by the researcher and the post-interview with children was conducted about kids' thoughts on how healthy they ate, how their food choices were different from regular meals, in addition to their thoughts on the project. The post interview questionnaire is presented in APPENDIX D.

To investigate long-term effects, an unstructured interview with the teacher one month after the study and an interview with a child and her mother five months after the study were conducted.

Apparatus

Digital cameras (Fischer-Price Kid Tough Digital Camera) and voice recorder (Olympus digital voice recorder w-10) were used for taking pictures of foods that children had eaten for the day and for recording voice logs. Figures 3.3 and 3.4 show images of the digital camera and voice reorder used in this study. The food pictures taken by the children and food logs translated from voice records were organized into

electronic-portfolio templates and were used for children's reflection on their eating habits. SmartBoard and MS. Publisher software were used for the e-portfolio activity and recording children's actions and verbalizations while working on the portfolio activity.

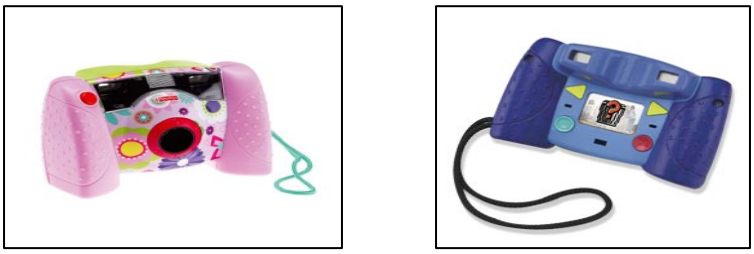

Figure 3.3. Picture of the fisher-price kid tough digital camera

Figure 3.4. Picture of the Olympus digital voice recorder w-10

For a pre-food pyramid game, a total of eighty four sticky food pictures(fourteen pictures per a child) across the five food groups and two big food pyramid templates were used to assess children's previous knowledge about food groups. Forty eight food pictures of healthy and unhealthy snacks (seven pictures per a child) with two color buckets (green and yellow) were used for the pre-healthy snack game (bucket activity) to assess children's knowledge about food healthiness. Rubber food models and food guide pyramid posters for kids released from USDA in 2005 were used during two nutrition

lessons. Lastly, individual food-trains with color coded box cars were made by each child before the study began

Justification for the Nutrition Instruction

The aim of the study was to support young children to be engaged in reflective practice and ultimately to use reflection as part of their routine behavior in order to make wise food choices. The instruction was designed to reach the deliberate action stage on the basis of Schön's definitions of reflection and learning, which is spontaneously restructuring behaviors through reflection-on/in –action. The following table 3.2 illustrates the instructional steps and strategies based on Schön's reflection stage.

1. Capturing daily experiences for the reflection: Children identify and capture their everyday dietary-related actions using a digital camera in order to deconstruct tacit knowing-in-action such as underlying misconceptions, beliefs, or values, and unconscious unhealthy dietary-related routines. Children become conscious of their routine and consider which aspects of their experiences are worth capturing or try to modify their daily routines while taking pictures. However, as Driscoll and Teh (1929) point out "what passes for reflection is often is not reflection (p. 96)". Reflecting effectively is a skilled activity requiring an ability to analyze practice actions and beliefs and to make judgments about their effectiveness (Ashley, Gibson, Daly, Baker, & Newton, 2006). Because children are in the tacit knowing-in-action stage, their observations are imprecise (Land et al., 2005), and knowledge structures are limited (Gick, 1986). Therefore, reflection-in-action in this step is not likely to get new understanding and appreciation and reach the

Table 3.2.
The steps of instruction and strategies based on schon's reflection stage.

Reflection stage	Steps of Instruction	Strategies and tools used in the steps
Tacit knowing-in- action	1. Capturing daily experiences for reflection	Digital camera and voice recorder -easy and accurate recording tools -visualization
	2. Nutrition Lessons	Cumulating necessary knowledge for reflection
Reflection-on-action	3. Transform images into data	E-portfolio -visualization of the routines of eating -question prompts to support reflection -bridge the gap between what is believed and actual eating -setting personally relevant goal driving behavior change
Reflection-on-action	4. Restructuring daily routines –setting goals	E-portfolio -behaviorally focused and personally relevant goal to help change behaviors of young children
Reflection-on-action Reflection-in-action	5. Change behaviors	3-day-food-train: -visualization of current eating and reflection-in-action -question prompts to foster reflection-on-action
Deliberate action Intelligent-knowing-in-action	6. Ongoing efforts and reflection as daily routines	Long term effects

deliberate action stage (Schön, 1983). In this stage, although the nutrition education strategy increases students' knowledge, it remains inert and not likely to be transferred to daily experiences.

2. Nutrition lessons provide the necessary information to facilitate children's reflections and behavior changes.
3. Transform images as data: Children transform the captured images into data and explore their daily dietary-related experiences. The images are displayed in a way

that allows for analysis and reflection in an e-portfolio template. Through active analysis, interpretation, and evaluation of data, learners discover unexpected outcomes and seek reasons for the surprise. This process is facilitated by discussion with the researcher (research team) and question prompts. This method was selected because a number of different models of learning through reflection have suggested that group discussion assists with the development of reflective activity (Platzer, Blake & Ashford, 2000; Ashford, Blake & knott, 1998; Platzer, Snelling, & Blake, 1997) and young children are in a lower stage of cognitive development and possess limited writing ability (WENP, 2001). The process leads children to increase self-awareness and a new understanding of the situation. In turn, learners are motivated for the following step of planning new future action and applying it to the daily routine.

4. Restructuring daily routines: Children plan new behaviors with setting a goal, and the goal should be behaviorally focused, realistic, and based on the evaluation of individual daily experiences. A behaviorally-focused goal, specifically targeted at preschool children, has been recognized as an essential element of successful nutrition education. According to the extensive reviews of studies by Contento et al., 18 of 23 studies with interventions that focused on specific behaviors resulted in behavioral change while only 8 of 17 general nutrition education studies showed clear evidence of behavioral change. Setting a realistic goal based on the evaluation of individuals' daily experience is essential to nutrition education's success, since it makes the nutrition knowledge personally relevant, familiar to individuals, and easy to practice. Children are more conscious about their daily

eating behaviors. They are spontaneously restructuring their behaviors through reflection-on -action and reflection-in-action to achieve personal goals, as supported by the food train activity.

5. Change behaviors: Children are encouraged to improve their diets and accomplish their goals. When they meet the class goal, all participants will be rewarded with small incentives. Children record their voice logs and conduct food-train activity. Children deliberately consider if the food they are eating is healthy or not and try to modify their daily routine during the food-train activity. The food-train activity is designed to help children visualize their current eating and to analyze, interpret, and evaluate their eating. Children are prompted to think about whether their daily routine been influenced, or changed.
6. Ongoing efforts: Children continue practicing to modify their daily routines with deliberation, which is called conscious (or intelligent) knowing-in-action.

Data Sources

Data for this study consisted of the following: 1) Collection of documentations (Yin, 2002); 2) observations with field notes and recording devices (voice recorder, camcoder, and smartboard software); and 3) informal communications and interviews with children, parents, and teachers.

- Documentations: Children's artifacts of two-day dietary records, pre-game scores, e-portfolio activity, and the 3-day food activity were collected to investigate children's changes in dietary behavior and nutrition concepts.

- Direct observations: All the activities were observed by the researcher with field notes or video taped to cover the events in real time. Children's verbalizations during the e-portfolio activity were recorded by the Smart Board software and children's verbalization during two-day food intakes, and 3 day train activity were recorded with voice recorder or field notes.
- Informal communication, interview, and survey: To gain focused information as well as perceived causal inferences, three semi-structured interviews (pre-, mid-, post-) with each child were conducted. The survey responses from parents were collected at the beginning of the study to investigate the background information of children related to dietary behaviors. Interviews with parents and a teacher were conducted at the end of the study in an open ended manner to obtain parents and teacher's observations of increased self-awareness or behavior changes of their children. An unstructured interview with a teacher one month after the study and an unstructured interview with a child and her mother five months after the study were conducted to explore longer-term effects.

Data Analyses

In this study, pattern-matching was used to analyze the effects of the proposed nutrition intervention on children's behavior changes. Campbell (1975) described "pattern-matching" as a useful technique for linking data to propositions, and Trochim (1989) considered pattern-matching as one of the most desirable strategies for analysis of a case study. In order to compare empirical patterns with predicted ones, first, the research team transcribed all the verbalization of children recorded during the study,

videotaped activities, and the interviews. The scores pre-rated during the activities by the research team members (e.g. two pre-game activities; food pyramid game and healthy snack game were scored by two research team members during the activity; each child's food categorization during the e-portfolio activity was rated by each research team member who sat with the child during the activity; each child's food categorization for each meal during the food-train activity was rated by the research team member assigned to the child for each meal during the activity) were reviewed and reevaluated by the researcher to increase reliability. The researcher analyzed the transcripts, field notes, and artifacts of children. All data sources were re-read between five and ten times in order to develop a clear picture of children's learning (Lincoln & Guba, 1985). Then the data were organized and clustered by each research question to conceptualize the empirical data and find the patterns or characteristics (Merriam, 1988). To increase internal validity, multiple sources of data were used in comparison and a chain of evidence was established for each research question. According to Yin (1994), using multiple sources of data triangulates evidence, and it increases the reliability of the data and the process of gathering it. Yin (1984) also suggests that to have an external observer (Tellis, 1997) increases the reliability of the study. In this study, multiple data sources of within-participant and cross-participant were analyzed to match the propositions through various coding schemes and techniques which are described more fully in Chapter 4, the presentation of results. Previous research guided the interpretation of evidences.

CHAPTER 4

RESULTS

The purpose of the study was to explore how kids' reflection on their daily eating could affect their healthy-related behavior change. Among the six participants, one child was ill and not able to complete the study; therefore a total of five children completed the following research activities: The 2-day picture+voice logs, 3 interviews (pre-mid-post interviews), pre-pyramid/bucket activity, e-portfolio activity, and 3-day "train" activities with 3-day voice food logs. Three out of five parents completed the pre- e-survey (Dec 1st). Four parents were interviewed at the end of the study (Dec 13th); one parent chose an e-survey instead of interview. The following findings are reported and correspond to each of the three research questions.

Q.1. Does Reflection on Everyday Experiences in the Nutrition Education Influence Kindergartner's Daily Action, as Measured by Increased Healthy Food Consumption?

The researcher expected that kids would improve their eating as a result of the nutrition education intervention and that reflection on their daily eating (e-portfolio activity) would serve as a motivator for their behavior change, with nutrition knowledge directing these changes towards healthier choices. To address this question, analyses of the kids' eating behavior changes were investigated, following the e-portfolio activity (reflection on daily eating).

Eating Behavior Changes

The primary data sources for addressing this question came from the analyses of the 2-day pre-study food logs (picture with voice logs) and 3-day post-food logs during the "train" activity (voice logs with food icons), kids' responses to the questions about healthiness of their eating, and semi-structured interviews with parents and teachers.

Changes in the Five Food Group Intakes: Artifact Analyses

The amounts of the five food-groups consumed before and after the e-portfolio activity were evaluated according to the daily recommendation (DR) for 4~ 8 year-old children released by USDA (2005). The researcher expected that kids would eat more balanced meals while trying to reach their goals elicited from the e-portfolio activity. Table 4.1 shows the average amount of food consumed from the five food groups before and after the e-portfolio activity for each child. Then, the % rate of the average amounts of each food group consumption to the daily recommendation was calculated as % of mean. Please note that pseudonyms for each child are used throughout the presentation of results. Table 4.2 provides group average consumption amounts of the five food groups and the % rate of them to the daily recommendations before and after the e-portfolio activity.

Table 4.1
Individual average food consumption amounts of the five food groups before vs. after reflection activity

* DR: Daily Recommendation for 4~8 years old children by USDA

				Before the reflection		After the reflection	
	Food groups	**DR***	**% of DR**	**Mean**	**% of Mean**	**Mean**	**% of Mean**
Abby							
	Grain (ounce)	4~5	80-100	5.0	100.0	4.5	90.0
	Vegetables (cups)	1.5	100	1.4	91.7	1.6	105.6
	Fruits (cups)	1~1.5	67-100	1.4	91.7	2.1	138.9
	Milk (cups)	2	100	1.6	81.3	1.8	91.7
	Meat&Beans (ounce)	3~4	75-100	3.5	87.5	3.3	83.3
Beth							
	Grain (ounce)	4~5	80-100	5.5	110.0	5.5	11.0
	Vegetables (cups)	1.5	100	0.8	50.0	1.4	91.7
	Fruits (cups)	1~1.5	67-100	1.3	83.3	1.3	83.3
	Milk (cups)	2	100	2.0	100.0	1.3	62.5
	Meat&Beans (ounce)	3~4	75-100	2.6	65.6	4.0	100.0
Chris							
	Grain (ounce)	4~5	80-100	5.3	105.0	5.3	106.7
	Vegetables (cups)	1.5	100	1.3	83.3	1.2	77.8
	Fruits (cups)	1~1.5	67-100	0.9	58.3	1.3	87.8
	Milk (cups)	2	100	2.5	125.0	2.0	100.0
	Meat&Beans (ounce)	3~4	75-100	1.0	25.0	3.4	85.4
Dan							
	Grain (ounce)	4~5	80-100	8.5	170.0	6.1	121.7
	Vegetables (cups)	1.5	100	0.8	51.7	1.0	66.7
	Fruits (cups)	1~1.5	67-100	2.8	183.3	2.2	144.4
	Milk (cups)	2	100	2.8	137.5	2.3	116.7
	Meat&Beans (ounce)	3~4	75-100	3.5	87.5	4.3	108.3
Ed							
	Grain (ounce)	4~5	80-100	5.8	115.0	5.0	100.0
	Vegetables (cups)	1.5	100	0.9	58.3	1.2	77.8
	Fruits (cups)	1~1.5	67-100	1.8	116.7	1.8	122.2
	Milk (cups)	2	100	1.8	87.5	2.2	108.3
	Meat&Beans (ounce)	3~4	75-100	2.5	62.5	3.5	87.5

Table 4.2
Group average food consumption amounts of the five food groups before vs. after reflection activity.

* DR: Daily Recommendation for 4~8 years old children by USDA

Food groups	DR*	% of DR	Before the reflection		After the reflection		Rate of Changes (%)
			Mean	% of Mean	Mean	% of Mean	
Total (Abby, Beth, Chris, Dan, Ed)							
Grain (ounce)	4~5	80-100	6.0	120.0	5.3	105.4	11.7
Vegetables (cups)	1.5	100	1.0	67.0	1.3	85.3	25.8
Fruits (cups)	1~1.5	67-100	1.6	106.7	1.8	117.6	10.3
Milk (cups)	2	100	2.1	106.3	2.0	98.2	7.6
Meat&Beans (ounce)	3~4	75-100	2.6	65.6	3.7	92.4	40.8

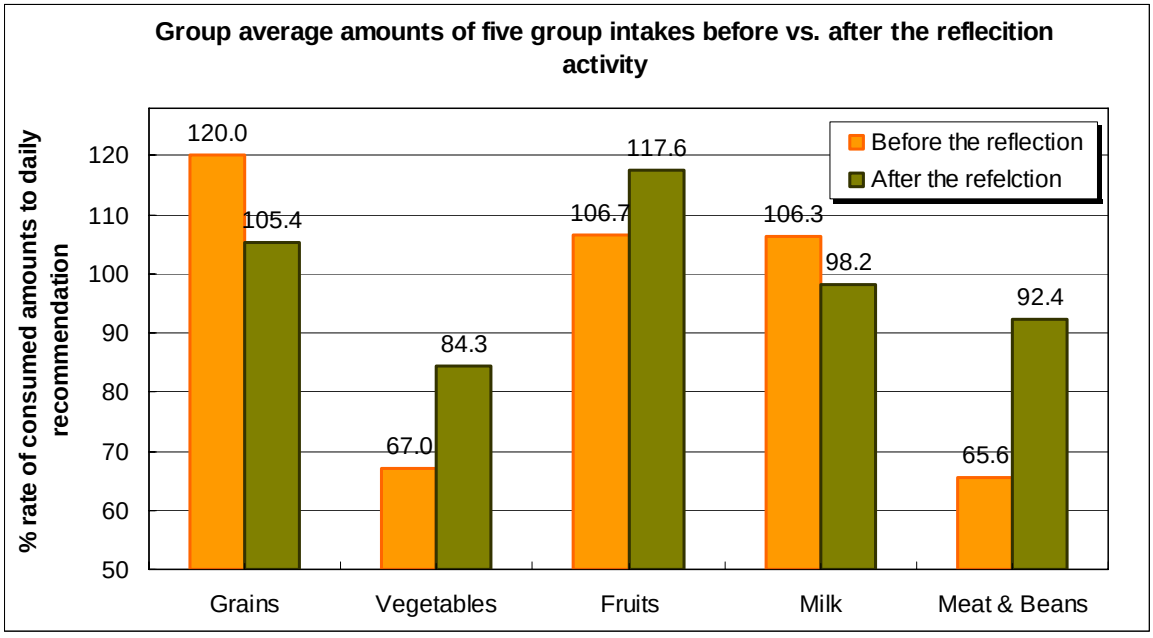

Figure 4.1. Group average food consumption amounts of the five food groups before vs. after reflection activity.

Changes in amount of food group consumption. Table 4.2 shows that the average amounts consumed from grain, vegetables, and meat & beans groups changed positively, as they got closer to the daily recommendation. Meanwhile, the amounts of milk and fruit group consumption did not improve in terms of the daily recommendation from USDA. Even though the average amount of milk consumption grew closer to the daily recommendation (% Mean, from 106.3% to 98.2%), it decreased slightly below the amount that is needed daily. The amount of fruit consumption was slightly higher than the daily recommendation before the reflection activity (% Mean, 106.7 %), and it increased even more after the reflection activity (% Mean, 117.6 %). Overall, the biggest change in the amount of consumption was found from the meat & beans and vegetable groups (40.8% increase, 25.8 % increase respectively).

Average grain group consumption decreased from 6 ounce (120.0%) to 5.3 ounce (105.4%) from before to after the reflection activity. This is a desired change because, before the reflection activity, the amount of grain group consumption was higher than the DR range, and half of the grain-group intake for most kids came from unhealthy refined grain snacks such as muffins, brownies, and crackers; But, after the reflection activity, the amount of grain-group consumption is closer to the DR range (4~5 ounce/ day), and the grain group intakes are mostly from rice, bread (both whole wheat and white), and cereal.

Overall, the mean vegetable consumption increased from 1 cup (67.0%) to 1.3 cup (85.3%), which is closer to daily recommendation (1.5cup). During the study, the vegetable group was observed as the group that kids tried the most to improve. For example, kids mentioned vegetable food items more frequently as the foods that they

tried more in order to improve eating for the meal than the other groups. Before the reflection activity, only one child (Abby) ate sufficient vegetables (1.5cup) for one day, while rest of the kids didn't eat sufficient vegetables for any of the two days of observation. After the reflection activity, however, the vegetable consumption of most kids improved to meet the daily requirement for at least one or two days.

Average fruit group consumption increased slightly from 1.6 cup (106.7%) to 1.7 cups (117.6%). During the conversation with the researcher, most of the time, kids responded that they loved fruit on the menu for the day. Fruit consumption of most kids met the daily recommendation even before the reflection activity; however, Abby and Chris were encouraged to eat more fresh fruits. For Abby, before the reflection activity, her fruit consumption amounts were within an adequate range (1~1.5cup/day), however, all of Abby's fruit intake came from canned fruits or from fruits mixed with syrups, while she did not try any fresh fruits for the day. For Chris, his fruit consumption was below the DR range as 0.9 (58.3%). After the reflection activity, Abby's fruit consumption was not only within RDI range but also came from all fresh fruits such as apples, bananas, and pears. Chris's fruit intake increased to 1.3cup (83.8 %) and became within the DR range.

Average milk group consumption decreased from 2.1 cup (106.3%) to 1.96 cup (98.2%). Most kids drank a sufficient amount of milk before the reflection activity except Abby. Abby is allergic to dairy foods and drinks soy milk instead. Abby didn't drink much milk at school, and her mom mentioned that she always forgot to buy milk for Abby. Abby's average milk consumption was 1.6cups per day which is below the daily recommendation (2 cups). While Abby was encouraged to drink more milk after the reflection activity, the rest of the group was not. Abby's milk consumption increased to

1.8 cups (91.7%) after the reflection activity; however, milk consumption of Beth, Chris, and Dan during the three days after the reflection activity decreased, especially, the second-day milk consumption was much lower than the other two days. This can be explained partially by the impact of an in-school event on that day, the Festival of Light. During the event, a variety of foods were brought from each family as a potluck buffet, and kids tended to eat less balanced foods and to drink more punch or soda than milk. In addition, apple cider was served as an extra drink for snack that day, and kids drank more apple cider than milk that day. While Abby kept working on her goal of drinking more milk, the other kids drank more apple cider or juice than milk for the day.

Average meat and bean group consumption increased from 2.6 ounces (65.6%) to 3.7 ounces (92.4%) which is within DR range (3~4 ounce/day). Before the reflection activity, the amount of meat and bean consumptions of Beth, Chris, and Ed didn't meet the DR range, and they each set a goal to eat more meat and bean group foods. After the reflection activity, it was observed that some kids tried to eat more meat and bean groups at lunch. For example, Chris reported that he tried more meat balls than usual to accomplish his goals. However, more changes (increased intakes of meat and bean group) were observed at dinner at home. It is possible that parents tried to serve more meat and beans at home, in an effort to help their children accomplish their goals. For example, at Chris's home, regular milk was replaced by soy milk after the reflection study. Soy milk is not necessarily providing more amounts of protein than regular milk, but it is well known that soy milk is a good source of protein. In addition, chicken or meat was served for two dinners at Chris's home after the reflection activity, while pasta dishes were served for two dinners before the reflection activity. Beth's mom mentioned that she was

aware that Beth needed more meat and beans, and she tried to cook more meat and beans at home. These findings could point to a possible school-home connection for improving the kids' nutrition that was facilitated by the reflection activity. As a result, the kids ate more balanced meals in term of adequate amounts from all five groups after the reflection activity.

Changes in making quality choices within food groups. During the analyses process, it was observed that kids made healthier choices within some food groups after the reflection activity. Since different kinds of muffins or crackers were served to kids every lunch or snack time at school, kids normally had no control over a healthier choice of snack at school, unless they controlled the amounts eaten of these foods. During the two days before the reflection activity, crackers were served as a snack while muffins, cardemon bread, and peach cobbler were served as a snack for three days after the reflection activity. So, it was not feasible to compare the amounts eaten of these snacks before (crackers) and after the reflection activity (muffin, cardemon bread, peach cobbler), except in Abby's case. Because Abby is allergic to milk, she was served the same graham crackers before and after the reflection activity instead of cardemon bread. Abby ate 5 crackers before the reflection activity but ate only 2 crackers after the reflection activity "*because cracker is unhealthy*". She reportedly limited the amount of crackers she ate to three at the in-school event, the Festival of Light as well.

At home, kids may have had slightly better control of the food choices than at school by asking parents to buy a certain food item for snack during grocery shopping (e.g. Abby's mom went to food store with Abby and asked her if she wanted to buy ice

cream) or deciding when to eat a snack (e.g. Kids reportedly did not choose to eat sweet-desserts at home after the reflection activity). The analyses of food snacks eaten at home showed evidence of improvement in kids' choosing better quality of foods. Five unhealthy dessert items (brownie, oatmeal cookie, ice bar, ice cream, and lollipop) were found across children during the two days before the reflection activity; while only two unhealthy dessert items (3 crackers and brownie) were reported during three days after the reflection activity. Kids ate both the crackers and the brownie after the reflection activity at the Festival of Light event. Considering the special nature of the in-school event, the "Festival of Light", there is nonetheless some evidence that kids made healthier choices of foods like snacks after the reflection activity. The post interview data support this finding. In the post interview, kids reportedly gave up ice cream (2), lollipops, cookies, or marshmallows as a snack at home because they were identified as unhealthy foods. In addition, two kids reportedly ate mushroom and vegetable pizza (Chris) and supreme pizza (Abby) to eat more vegetables at dinner after the reflection activity. Chris, particularly, reported that he tried a mushroom in the vegetable pizza for the first time in order to eat healthier. Although pizza itself is not necessarily a healthy food because it is high in fat, a vegetable pizza is better choice than a higher fat pepperoni pizza that was reportedly eaten at a dinner before the reflection activity (Dan).

Additionally, other positive quality changes in the food served at home were reported, particularly in the meat and bean group, despite the fact that these foods were not directly chosen by the kids. For instances, spam, sausage, and chicken wings were reportedly consumed at dinner at home before the reflection activity, but no unhealthy meat and bean group food items were found except pizza after the reflection activity.

Instead, natural meats were often served at dinner (e.g., chicken was reported frequently, steak and sloppy Joe).

Overall, the kids not only made some progress towards eating more balanced meals (eating adequate amounts from all five groups) but also chose better quality foods within the group (eating fresh fruits; giving up unhealthy snacks such as ice cream, lollipops; moderating unhealthy food consumption such as crackers, muffin, etc).

Eating changes in terms of individual goals. The changes of food group intakes shown here matched individual goals that were drawn from the reflection activity. Table 4.3 provides the degree of the child's diet improvement in relation to their goals. The changes in kids' eating during the three days after the reflection activity were scored on a scale that ranged 0 to 4 for the degree of accomplishment of meeting daily recommendation of assigned food groups as a goal. To illustrate, if the food group intake which was assigned as a goal met the daily recommendation, it was scored as 4; if the food group intake assigned as a goal increased more than 50% of the amounts needed to accomplish the goal but didn't meet the daily recommendation, it was scored as 3; if the food group intake assigned as a goal increased less than 50% of the amounts needed to accomplish the goal, it was scored as 2; if there was no change in the amount of food group consumption assigned as a goal, it was scored as 1; if the changes made were in the negative direction from meeting the daily recommendation, it was scored as 0. Then the score was converted to a % rate of the amount of changes in eating the food group to accomplish their goals. The rubric is presented in APPENDIX E.

Table 4.3.
The scores of kids' goal accomplishments

		Goal accomplishment	
Child	**Food group set as a goal**	**Score**	**Total % score**
Abby			
	Vegetable	4	91.7 %
	Fruits	4	
	Milk	3	
Beth			
	Vegetables	3	87.5 %
	Meat & Beans	4	
Chris			
	Fruits	4	100 %
	Meat & Beans	4	
Dan			
	Grain	3	62.6 %
	Vegetables	2	
Ed			
	Vegetables	3	87.5 %
	Meat & Beans	4	
Total Average % score			86.4 %

The average total % score of the kids was 86.4%. As shown here, most of the kids ate at least 50% of the amounts they needed to accomplish their goals in two or three food groups that were set as goals except Dan's vegetable consumption. This indicates that all the kids tried to improve their eating in terms of their goals. On the other hand, the amounts from the other food groups consumed that were not set as goals vary by child after the reflection. Abby maintained both grain and meat & bean intakes within DR range; Beth maintained grain group intakes as adequate amounts but milk group consumption decreased significantly below the daily recommendation; Chris maintained his grain group consumption to adequate amounts, but his vegetable and milk group consumptions decreased, although his milk group consumption still met the daily

recommendation; Dan's fruits and milk group consumptions decreased slightly, but both of the groups were still over the daily recommendation. In addition, his meat & bean group consumption increased over the DR range; Ed's grain and fruit group consumptions changed positively and met the DR range.

Overall kids' eating changed positively towards the daily recommendations in that they made major improvement (eating more/less than 50% of amounts needed for the goal) in the food groups identified as goals. Although some other changes were made in the food groups not set as goals, only two cases (e.g., Beth: milk group and Chris: vegetable) changed in an unhealthy direction and only Beth's milk consumption changed from adequate amount of intake to below the daily recommendation after the reflection activity.

Behavior Changes at Home

To address perceptions of kids' healthy-related behavior changes at home, interviews with parents were analyzed in the following two areas: (a) the perceived frequency of kids' talking about healthy eating and (b) the perceived eating changes at home after the study.

Interviews with parents showed that all five kids talked more frequently about healthy eating at home. For example, Abby proudly said (while pointing at the food) "*do you know which group this is?...I learned it at school*"; Dan made references to whether the foods on his plate were above the black line or below the black line (referring to the relative quality of the food choice within the food group as represented on the food pyramid used in the reflective activity). Ed's parents indicated that, while on a trip at the

end of the study, Ed kept asking about whether his eating was healthy or not in the car. Parents of four of the children (Abby, Chris, Dan, and Ed) reported that their child changed his or her eating at home positively during the study. Chris and Ed even reportedly changed their eating behaviors during the picture-taking activity at the beginning of the study (e.g. Ed avoided a lollipop because he thought that the researchers would find out about that through the pictures).

Parents also reported that behavior changes at home matched their child's goals for improving their eating. For example, Chris reportedly ate more fruits at home as part of his goal for more healthy eating. Abby, Dan, and Ed reportedly ate more than a bite of vegetables during the study, yet their parents reported that they did not eat vegetables much at home before the study, despite their parents' encouragement. Table 4.4 presents each child's goal and reported behavior changes at home. The followings comments indicate how specific children tried to eat healthy or accomplish their goals at home:

> [Ed's case: interview with mom]
>
> *Ed ate veggies without fights during the study. Yesterday morning, he took out broccoli from the refrigerator by himself and ate it. It must have been very cold… Ed likes only a few veggies, green beans, broccoli, carrots, and sometimes corn. But, he tried new veggies, avocado …he tried 4 brussels sprouts today. I tried to encourage him to eat them (Brussels sprouts) before but it never worked. So, it was very surprising.*

> [Dan's case: interview with mom]
>
> *Dan wanted to eat celery, which he was never really interested it before, so, I had to go out and buy some in the evening.*

> [Abby's case: interview with mom]

She brought home a ginger bread man house that she made at school. On top of it, there were marshmallows. She loves marshmallows and started to eat them. When she asked me to try a marshmallow too, and I said "I don't like it because it is too sweet." Abby stopped eating and talked to herself "right, it is not a healthy [choice]" … a few minute later, she suddenly threw all the marshmallows into the trash can as if she really hated them. It was really surprising since it looked more like hatred, and she has never done that before.

Table 4.4
Goal and behavior changes at home reported by parents

Name	**Goal: Eat …**	**Behavior Changes at Home Reported by Parents**
Abby	fresh fruits, one more milk, little bit more vegetables.	*Ate more than a bite of veggies, lots of veggie-fruits salad.* *Likes fruits and usually eats okay but tried more even in the morning.*
Beth	more meat and beans more veggies	*Don't know.*
Chris	More fruits one more natural meat or beans	*Decided to eat more fruits*
Dan	1-2 more veggies less grain group	*Eating more than one bite of veggies* *Asked to eat celery*
Ed	1-2 more veggies Little bit more meat and beans	*Eats more veggies without fights* *Tried avocado*

Behavior Changes at School: Teacher's' Observation

The teachers' observation of kids' behavior changes correspond to the findings from analyses of artifacts and parents interviews in that kids talked a lot about healthy and unhealthy foods and tried to eat healthy at school:

"The teachers were trying to initiate the discussion about healthy foods at the table but kids have never done that before. Now kids initiate the conversation

about what is on their plates, what is healthy, what groups they fall into all the time, not only at the lunch table but all day! This is really taking it to the next level."

[At the lunch table, there is veggie platter with ranch dressing.]

Beth:	I *have to eat just a little (ranch dressing).*
Dan:	*Salad is healthy*.
Ed:	*I want to eat more veggies.*
Abby:	*I want to eat more fruits and veggies.*.
Researcher:	*Do you want to eat more veggies and fruits to accomplish your goal?*
Everybody:	*yeah!*
Ed:	*I ate Brussels sprouts yesterday!*
Abby:	*I ate apple.*
Researcher:	*Why did you eat those?*
Abby:	*I ate it today because it's my goal.*

[At the snack table, there was apple cider, milk, and cardemon bread.]

Chris:	*Pepsi is not healthy.*
Researcher:	*That's right. Do you drink pepsi?*
Chris:	*Sometimes …it is not healthy, but my brother gave it to me to drink sometimes.*
Researcher:	*Does your brother ask you to drink it when you don't want to?*
Chris:	*Yes.*
Researcher:	*Why don't you want to drink pepsi?*
Chris:	*Because it is not healthy. And I don't like it.*
Dan:	*Is cardemon bread healthy?*
Researcher	*What do you think?*
Everybody:	*No, not healthy!*
Researcher:	*Why not?*
Beth:	*Because there is lots of sugar in it*.

As shown here, kids are engaged frequently in voluntary conversations about their goals, what they tried, and healthy/unhealthy foods as they tried to accomplish their goal.

The Effects of Reflection on Daily Eating on Changes of Behavior

To explore the relationships between the e-portfolio (reflection) activity and kids' behavior changes, the following data sources were analyzed: (a) kids' voice logs that were captured while discussing healthiness of their eating ; (b) structured interviews with kids before, during, and after the study; and (c) semi-structured interviews with teachers and parents.

Conceptions of Healthy Foods

To address this question, kids' responses to the following questions were investigated at the beginning and at the end of the study: "what are healthy foods? and "what does healthy food do for your body?"

The data shows that kids' conceptions of healthy foods evolved from superficial understanding of *something good* to a concrete concept of identifying healthy foods such as vegetables, milk, or yogurt, and understanding its needs in our body. As an illustration, Table 4.5 shows a conversation of Beth and Ed with the interviewer during the pre- and post-interview.

Table 4.5
Examples of kids' conceptions about healthy foods before and after the study.

* I: Interviewer, B: Beth, E: Ed

Before the study	After the study
I*: *What do you think healthy food means?* B*: *Mmm, I don't know.* I*: *Do you think healthy foods are good for you or bad for you?* B*: *Good for me.*	I*: *What is healthy food?* B*: *Vegetables* I*: *What do healthy foods do for your body?* B*: *Make you strong and not get sick.*
I*: *What do you think healthy food means?* E*: *mmm…* I*: *Somebody said "eat healthy foods" what does it mean?* E*: *You get calcium?* I*: *What is good about calcium?* E*: *mmm…I am not sure.*	I*: *What is healthy food?* E*: *Broccoli, carrots, Brussels sprouts* I*: *What do healthy foods do for your body?* E*: *Makes you strong, grow and healthy. Gives you vitamins.*

The conversation between Beth and the interviewer before the study shows that she perceived 'healthy food' as something good but was not able to relate it to the specific foods. Even though Ed made the connection between 'eat healthy to 'get calcium', he was not able to relate it to the particular food items or to explain any further about why calcium is good for body. In contrast, after the study, all five kids elaborated with food examples to the question, "*what are healthy foods*?" without hesitation. Furthermore, kids showed evidence of subtle understanding about the relationships between eating healthy and their growth and health (e.g., helps you grow and be strong).

Why do Kids Eat What They Eat?

The responses before the reflection activity to the question "*why did you eat what you ate?*" (3 times per kids, total 15 times) are characterized as 3 main categories: (i) availability (e.g. because it was on the table; because mom cooked it), (ii) preferences of foods (e.g. because I like it; because I want it), (iii) I don't know. It matched the responses to the pre-interview question about why kids eat certain unhealthy snacks and not others: (i) I ate it because we have it at home; I didn't eat it because we don't have it at school (availability), (ii) because I like it; because it is tasty (preferences of foods). However, for the responses to the question "*did you try anything new? Do you have anything you didn't eat from the menu? What was it and why?"* after the reflection activity, the following four categories emerged: I tried these foods (i) because it is my goal, (ii) because it is healthy; I didn't eat these foods (i) because it is not healthy/ not good for your body, (ii) because it has high fat/ sugar, (iii) because I am too full. During the study, it was observed that after the reflection activity, kids reportedly ate foods because they were healthy or tried a new food they didn't like before to accomplish their goal (corn, brussels sprouts, avocado, beans, and yogurt) but gave up some foods they liked before because it is not healthy (e.g. ice cream, lollipop, marshmallow, and cookies).

E-portfolio Activities and Behavior Changes: Observations of Teachers and Parents

The goal of the e-portfolio activity was to promote reflection on daily experiences and help kids become aware of their actual daily eating and thus, to drive their behavior change by providing opportunities for concrete goal setting. Teachers reported that they

believed that having the kids visually "see" their eating (pyramid activity) and setting goals based on limitations made a great impact on their behavior change:

> *"…instead of [continually] saying it as 'you are not eating it, you are not eating it", let them to actually take the pictures of foods they are eating and put it in the pyramid and then be able to see, "oh, I am not eating it", that made I think the biggest impact on the kids' behavior change."*

> *"They really do a good job on their goals because they all talk about it. I heard them all talking about it to their parents that night when they were picked up, their goals, the things they need to work on, things like that. So, that was great that it transferred them to home, not just here at school"*

In addition, four parents also reported on the perceived effectiveness of the reflection strategies on their kids' changes in eating. The following observations were reported by parents and show some evidence of effectiveness: (a) the child tried to eat more healthy foods during the study (Abby, Chris, and Ed); (b) the child is more aware of what he is eating (Chris, Dan); and (c) the child is aware of nutrition now (Abby, Dan). Only one parent responded "*I don't know. I am very busy and didn't pay much attention to it (study)*".

In sum, the findings show some evidence that kids became aware of their own eating and tried to improve upon it during the study. Reflection on daily eating through the e-portfolio activity may have aided the realization of kids' actual eating and encouraged practical goal setting. Awareness of their eating and the connections among nutrition concepts and their eating may have facilitated changes to the children's eating behaviors.

Q.2. Does Using Captured Data Representations Help Young Children Reflect on Daily Dietary-Related Experiences as Observed by Increased Self-Awareness?

Two main activities were used to foster reflection on action: (a) self-captured food photos as data in the e-portfolio activity; that is, kids built a personal food pyramid using self-captured photos that they used for analyses; and (b) the "train" activity. The train activity occurred after the e-portfolio activity and involved categorizing the food photos they ate during each meal to the right food group (color coded box cars) of the train for three days. The size and the number of the food picture icons used in the e-portfolio activity and the number of food picture icons used in the train activity represented the serving sizes of the foods that kids actually ate. The goal of these activities was to accurately represent kids eating visually in terms of both quantity and quality of food choices, and therefore help kids reflect upon their daily eating and discover unconscious faulty behaviors of their routines of eating. To address this question, the following data sources were analyzed: (a) kids' artifacts of the e-portfolio activity; (b) three structured interviews with kids before the study, during, and after the study; and (c) verbalizations of the kids during the train activity. The data were analyzed in terms of two main categories: (a) supporting accurate dietary recording and visualization of past eating behaviors; and (b) supporting awareness of discrepancies between conceptions of daily eating and actual eating.

Supporting Accurate Dietary Recording and Visualization of Past Eating Behaviors

While young children's dietary journaling and reflections on their eating are far less complete than those of adults because of their cognitive developmental stage and lack of recording skills (Young and Nestle, 1995; Foster, Anderson, & Adamson, 2001),

some studies show that using imagery as a retrieval aid (Aschermann, Dannenberg, and Schulz, 1998) and a technique to foster reflection on action (Hong and Broderick, 2003) were suitable for pre-school children. The researcher expected that using the personal food photos would provide accurate records of what kids ate in terms of both food items and serving size, and presenting it within the personalized pyramid (e-portfolio activity) and train (train activity) would provide visual information about their eating behaviors, and thus aid kids to analyze their eating.

The E-portfolio activity prompted the children to review a replica of the food pyramid developed with self-captured photos and to answer the following questions: (a) identifying mal-consumption of a food group: "Did you eat from all five groups?", "Is there any group that you need to eat more of?", (b) identifying over-consumption of the food group: "Is there any group you ate too much of?", (c) identifying unhealthy foods: "Did you eat anything that is not healthy?". The overall goal of these questions was to help kids interpret the image data and to encourage reflection on them. To investigate these questions, the accuracy of kids' identification of the food groups that they needed to eat more and less of were scored as % rate of correctness based on daily recommendations of each group for 4~8 years old by USDA. For example, if kids needed to eat more fruits and vegetables to meet the daily recommendation, it was scored as 100% correct when a child correctly identified the need to eat more fruit and vegetables; it was scored as 50% correct when a child correctly identified only one of the two groups as insufficient; and it was scored as 0% correct when a child did not correctly identify any of the two groups.

The identification of unhealthy foods was calculated based on the same scoring rubric as question (a) and (b) above. Table 4.6 shows the % correctness of kids' responses to each question.

Table 4.6.
Correctness scores of kids for each reflection question.

	Accuracy of identification of food groups that…			Total Mean Score
	Needs more (%)	Needs less (%)	Not healthy (%)	
Abby	66.7 %	100 %	100 %	88.9 %
Beth	100 %	100 %	25 %	75.0 %
Chris	100 %	100 %	100 %	100.0 %
Dan	50 %	100 %	100 %	83.3 %
Ed	50 %	100 %	100 %	83.3 %
Total Mean Score (%)	73.3 %	100 %	85.0 %	86.1%

As shown here, most of the kids identified the food groups for which they ate too much (100 %) and unhealthy food items (85 %) more accurately than the food groups for which they need to eat more (73.3 %). Only Beth and Chris identified all the groups for which they needed to eat more; Abby, Dan, and Ed missed one group that they needed to eat more of, but all of them could identify the food groups they missed with extra guidance of the interviewer (e.g., "*how about vegetables? Did you have enough vegetable here?*"). Overall, kids interpreted their dietary data presented in the pyramid easily and their total mean score was 86.1%.

During the interviewing process, it was observed that the food pyramid picture with personalized food photos helped kids identify their needs (the food groups and items for which they need to eat more or less). As an illustration, kids were likely to point to the food group on the pyramid first to answer each question and then came up with the name

of the food group when asked. For example, for the question of identifying unhealthy foods, three kids pointed to the top of the pyramid of their e-portfolio (kids were taught to place less healthy foods for each food group near the top of the pyramid); one kid started counting the foods on the top of his pyramid, and another said ice cream which was placed at the top of her pyramid. These observations suggest that supporting kids' visualization of their actual eating may aid their analyses of their eating. Figure 4.2 shows a screen capture of a personal food pyramid developed by one of the children.

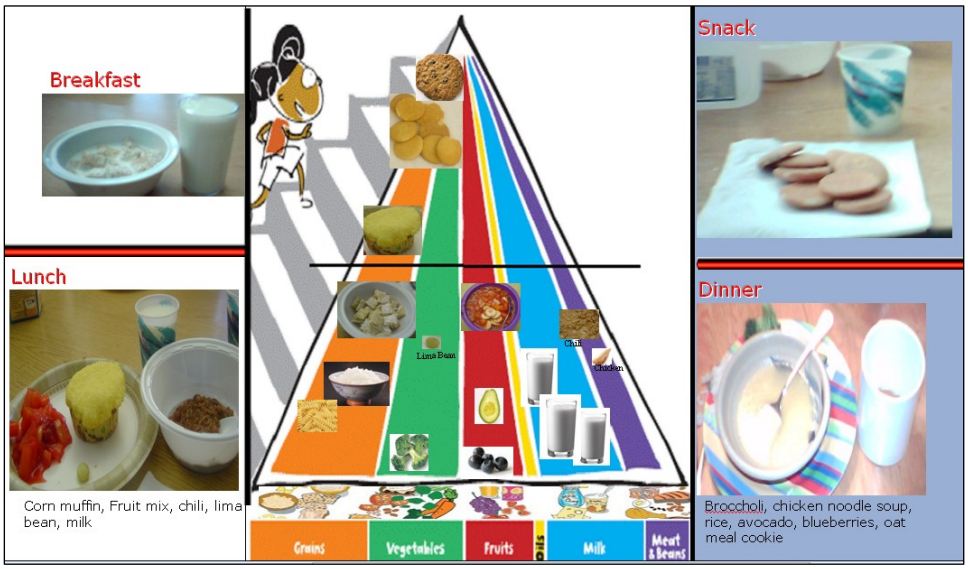

Figure 4.2. Screen capture of personal food pyramid developed in the e-portfolio activity.

Similar results were found during the food- train activity. After each meal, kids were asked to put food photos from their meal on the box cars color coded for each food group. Most of the time, kids were able to identify which group was still missing for the day and to state the goal for the next meal in order to eat healthier.

In addition, it was observed that although it was difficult to directly ask the children to set a goal to eat healthy in the e-portfolio activity, kids were able to identify which group they needed to eat more or less of to improve their eating for the day while looking at personally developed food pyramid developed in the e-portfolio activity as well as three day eating records in their trains. During the post interview, kids were able to find the differences between their food pyramids from e-portfolio activities and 3day train records, such as which one was healthier and explained why in light of their five-food group intakes with little guidance. Once, they identified their needs (goals), all of them made a commitment and tried hard to accomplish their goal most of the time. (e.g. *I ate Brussels sprouts because I said I would eat more vegetables today*; (meat and bean group was missing) *I will try it at home at dinner*.) and all the kids agreed that having a picture (printed personal food pyramid picture) was helpful for answering the questions.

As has been noted, using photos of the foods that kids actually ate and presenting it as a personalized pyramid or food-train provided relatively accurate information visually about the food groups and the amounts of the foods that kids ate. Hence, kids were supported to interpret the information about their own eating from the imagery data

Supporting Awareness of Discrepancies between Conceptions of Daily Eating and Actual Eating

The data from the e-portfolio activity and interview with kids suggest that most of the kids became aware of the fact that their actual eating was different from what they thought, and the e-portfolio played a role in it. Although kids' new awareness about their

routine of eating was not clearly expressed verbally as ‘surprise’, kids identified what they discovered/learned about their eating with some guidance:

Interviewer: *When you look at your pyramid were you surprised by something?*
Beth: *(silence)*
Interviewer: *Did you know that you ate that much of the grain group?*
Beth: *no*
Interviewer: *Did you know that you need to eat more vegetables?*
Beth: *yeah*
Interviewer: *You did know that? Did you know that you need to eat more meat?*
Beth: *no*
Interviewer: *So, you did learn that a little bit?*
Beth: *Yeah*
…

Four kids reported that the e-portfolio activity elicited some ‘surprise’ about their eating; while one child reported that there was no new information for him. Most of the kids’ surprise was about seeing that they didn’t eat as healthy as they thought in terms of eating from all 5 food groups. For instances, two kids reported that they were surprised that they didn’t eat enough meat and bean. One child reported that he was surprised not only about the quantity of the food groups he consumed but also about the quality of his eating (e.g. “*I ate too much (grain) …I ate only 4 vegetables today…too many unhealthy foods*…”; Another child said “*fruit surprised me, I likes fruits (*but I don’t have enough*)*”.

However, more directed prompts were provided to help the children connect their awareness about their actual eating behaviors to a practical goal, as shown in the following interaction:

[Chris and interviewer discussing setting a goal to improve his meal]

Interviewer: *Do you think you can eat better?*
Chris: *Yes*

Interviewer: *What would you do to improve your meal?*
Chris: *mmm…*
Interviewer: *Need to eat more of what?*
Chris: *Fruits*
Interviewer: *Anything else?*
Chris: *Meat and beans*
Interviewer: *How would you eat more meat and beans?*
Chris: *At lunch eat more meat and beans*

Kids didn't know what the word "goal" meant at the beginning of the conversation. Kids may have experienced having a goal which they wanted to accomplish (Lee, Locke, and Lantham, 1989), but may have not had a 'nutrition goal' before. In this study, children's 'surprises' about their past eating led them to recognize a need for change. Children learned how to improve their meals during interactions with the interviewers (the teacher and the researcher) and formulated their goals with the guidance of the teacher, and it was followed with commitment to the goal. Then, children remembered their own goals and tried to attain them for the rest of the study. In the case of nutrition, goal attainment is synonymous with behavior change or eating healthy. According to the data from the food-train activity, kids improved their behavior by trying to eat more of the groups that surprised them and set as goals. It provides some evidence that the e-portfolio activity along with individualized goal setting did serve a role in helping kids discover unhealthy behaviors of their actual eating and helping them to change their eating behavior in the future.

Interestingly, all the kids (3) that needed to eat more vegetables reported that they knew they didn't eat enough vegetables, and it was not a surprise for them. Given that all three parents of these kids mentioned that their kids did not eat many vegetables and they tried to encourage them to eat more, the kids may have heard the message at home that

they need to eat more vegetables. However, it was not sufficient motivation for the kids to change their behaviors.

During the study, it was observed that kids showed self-awareness about their eating and continued reflecting while they were eating or even while cooking:

> *…it has changed a lot of the way they think about their foods. When we were cooking some bread the other day, kids say "woo…you are putting oil in it" something like that, so they are definitely thinking about what is really going into it. And you know, when we sprinkled the sugar on top of it, all of them said "oh it makes it not healthy now"…they are discussing it not only with teachers, they also discussing it among themselves all day.* (teacher interview)

> *...it is very funny that Dan came back from a trip, he was gone to his cousins for Christmas, he told me "I made healthy choices, everybody was having S'mores and I decided not to have one because it wasn't healthy". S'mores is like a graham cracker with chocolate and with marshmallow melted altogether. Because it was not a healthy choice, he couldn't have one.* (teacher interview after 1 month of the study)

In addition, three parents reported that their kids were more conscious about their eating and tried to eat healthy at home as well; while one parent said "I don't know if she was conscious of her eating while she was eating" and one said "I don't know or no, maybe".

In sum, the data indicate that kids reflected on their eating and discovered eating behaviors that they were unaware of until they were captured in their e-portfolio.

Q3. What is the Relationship between Accuracy of Food Intake Analyses and Behavior Changes?

Several activities and games were used to elicit kids' developing knowledge of nutrition. In the pre-food pyramid game conducted at the beginning of the study, each child received fourteen different food pictures from all food groups (grain, vegetables,

fruits, milk, oil, meat and beans) including unhealthy snacks such as cake, chocolate, pop tarts, and so on. Children were then asked to put the food pictures in the right group of the empty pyramid and to decide if the food should be placed near the top or bottom of the pyramid as well (e.g. unhealthy food goes to the top of the pyramid). The correctness of grouping and identification of unhealthy snack for the given 14 food pictures were calculated as a % correct score. Figure 4.3 shows the photographs of two team's pre-game food pyramid filled with pictures that the children attached to each food group.

Figure 4.3. Pictures of pre-game food pyramid of two groups.

Afterwards, children received seven different food pictures including complex mixed food pictures such as taco, hamburger meal, or pizza. The pre-healthy snack (bucket) game asked children to put healthy foods into the green bucket and less healthy foods that need to be slow down into the yellow bucket. The correctness of distinguishing healthy from less healthy foods was calculated as % score. The E-portfolio activity asked children to categorize their one-day eating (self-captured food photos) to the right food group as well as to identify its healthiness (top, middle, bottom of the pyramid). It was followed by the bucket activity using the same day's food photos. The food-train activity asked children to categorize their three-day food items to the right food group and to

identify unhealthy foods among them. It was followed by the bucket activity using the food photos for one of the three days analyzed.

To explore the connection between nutrition knowledge and children's behavioral changes, the researcher first analyzed the data from the kids' artifacts from the food pyramid and bucket activities that were conducted three times throughout the study (at the beginning of the study (pre-game), during the study (E-portfolios), and at the end of the study (train activity) in terms of accuracy of categorizing foods into food groups and of distinguishing healthy foods from less healthy foods. Then, the post interview data were reviewed to investigate evidence of applied nutrition knowledge to behavior change. The researcher expected that the accuracy of children's performance during the grouping and bucket activity would increase as they increased their knowledge of nutrition. It was also expected that reflecting on their own food choices in light of what they were learning about nutrition would facilitate them to make healthier choices in their every day eating.

Accuracy of Categorizing Food Groups in terms of Nutrition Knowledge

The data of three grouping activities from pre-game, e-portfolio, and 3-day train activity were evaluated according to a scoring rubric to assess the accuracy of assigned food categories. The number of foods correctly assigned to the groups was counted and the correct rate was calculated as a % score for all three activities. Figure 4.4 provide a summary of the accuracy scores for each child in three activities (pre-game, e-portfolio, and food-train activity) and Figure 4.5 shows kids' accuracy scores before (pre-game score) and after the instruction (average score of e-portfolio and 3-day-train activity)

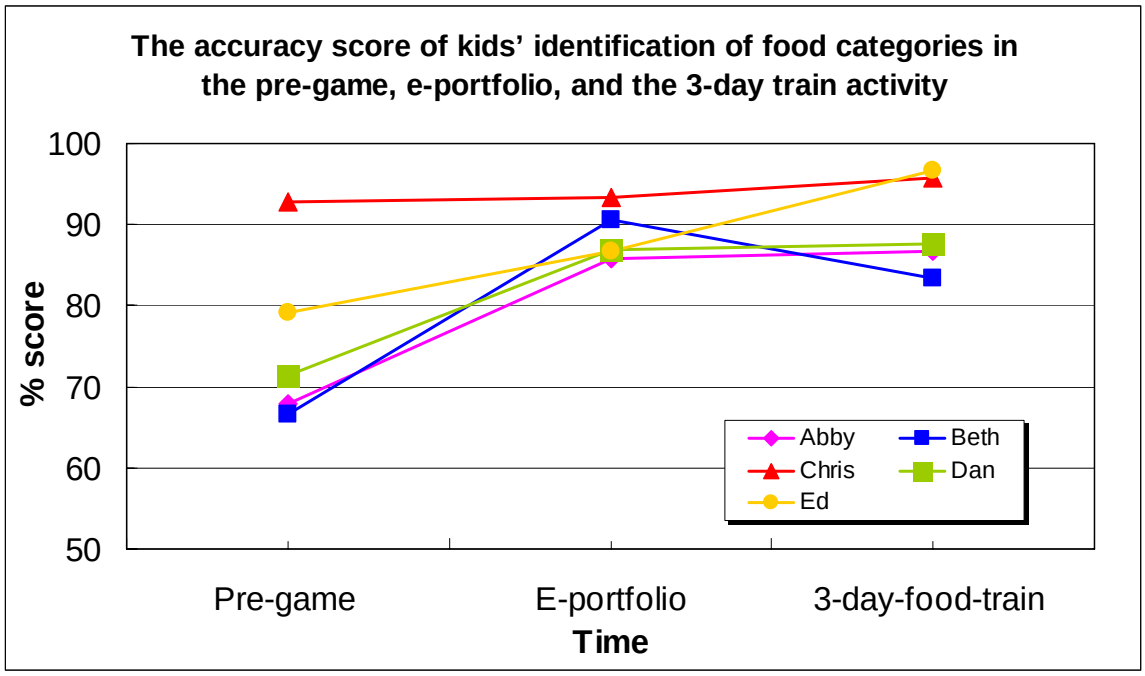

Figure 4.4. The accuracy of kids' identification of food categories in the pre-game, e-portfolio, and the 3-day train activity.

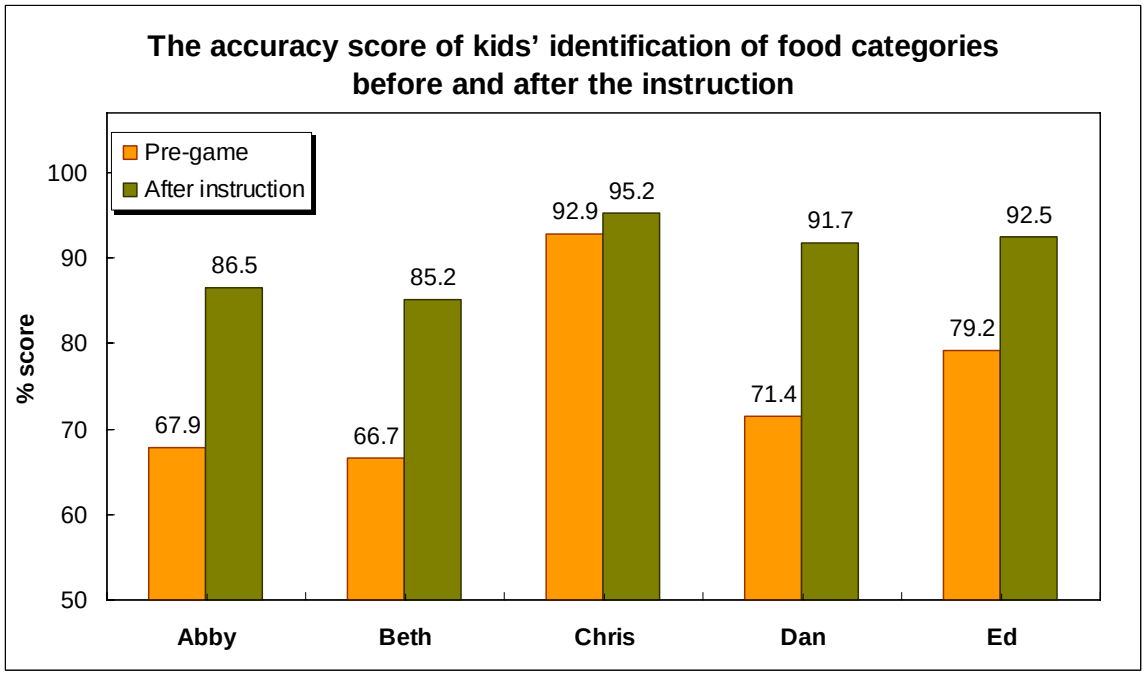

Figure 4.5. The accuracy of kids' identification of food categories before and after the instruction.

*Pre-game=Food categorization accuracy scores before instruction;
After instruction = Food categorization accuracy score from E-portfolio + train activity

The total mean for the three food-grouping activity scores for the five kids is 87.1%. The data show that most kids' grouping activity scores improved over time, most notably between the pre-game and the e-portfolio activity. The total scores for each activity are 75.6% for the pre-game; 88.7% for the e-portfolio; 91.0% for the train activity. The pre-game activity used general food photos prepared by the researcher while both the e-portfolio and train activity used food photos that kids actually ate. Despite the different types of photo data, kids categorized most of the food items they ate to the food groups correctly (Mean of pre-game, 75.6% vs. Mean of e-portfolio and train activity, 90.1%). Kids performed slightly better identifying food categories of the foods they ate in the food-train activity (90.6%) than the e-portfolio activity (88.7%).

The following three factors may have contributed to the kids' improved performances for the train activity over the e-portfolio activity: (a) knowledge and/or practice effect, resulting from kids learning and talking about food groups and practicing what they learned every day; (b) Menu differences: the meals that were analyzed in the e-portfolio may have included more difficult food items for kids to identify (e.g., salsa, sour cream, pepperoni, etc); (c) calculation methods: the train activity score was calculated from the mean of three days; and (d) Increased interactions among kids at the table: during the train activity, it was observed that kids frequently discussed with each other about the foods at the table, which group the food in their plate fell into, or if the food item was healthy or not. Therefore kids may have already learned about the food groups from each other during the meal before the train activity.

During the scoring process, it was observed that more errors occurred in identifying food groups with vegetables. Table 4.7 shows examples of food items that kids identified incorrectly in three different grouping activities.

Table 4.7.
Examples of kids' errors in categorizing food groups in the pre-game, E-portfolio, and train activity.

	Pre-game		E-portfolio		3 day Train activities	
Food Groups	**Food Items**	**Error**	**Food Items**	**Error**	**Food Items**	**Error**
Grain			Rice	(M)	Roll	(M)
					Rice	(DK)
					Granola	(M)
Vegetable	Baked potato	(C)	Kimchi	(F)	Corn	(G)
	French fries	(M)	Salsa	(DK)	Corn	(DK)
	Tomato	(F)	Salsa	(O)	Carrot	(M)
	Tomato juice	(F)	Salsa	(G)		
	Cauliflower	(G)				
Fruit	Apricot	(G)	Avocado	(DK)	Pineapple	(G)
	Raisin	(C)	Jam (jelly)	(O)	Apple	(V)
	Raisin	(G)				
	Banana	(C)				
	Apple sauce	(C)				
Milk	Cheese	(G)			Yogurt	(G)
Meat and Beans	Mixed nuts	(G)	Pepperoni	(G)	Sloppy Joe	(G)
	Kidney beans	(G)	Sausage	(G)		
	Shrimp	(G)				
		(G)				
Top/ Caboose	Butter	(M)	Sour cream	(DK)	Peach	(F)
	Cracker	(MB)	Vanilla	(MB)	cobbler	(F)
			wafer		Apple cider	(DK)
					Apple cider	

* ( ) indicates where kids categorized the food item during the activity.
(G: Grain; V: Vegetable; F: Fruit; M: Milk; O: Oil, MB: Meat and Beans; C: Caboose of the train or top of the pyramid; DK: don't know)

As shown here, kids made more errors with the foods that they were not familiar with or did not eat often (e.g., apricot, avocado, cauliflower, mixed nuts, and shrimp), processed foods (e.g., apple sauce, butter, cracker, apple cider, granola, sour cream, raisin, and jelly), complex vegetables (e.g., potato, tomato, corn), and complicated mixed foods (salsa, sloppy Joe, peach cobbler). Specifically, more kids had difficulties to categorize 'salsa sauce' as vegetable group and seventy one percent of the incorrectly categorized food items were misplaced in the either grain group (G) or top (C). While participating in the pre-game, it was observed that kids tended to categorize the food they were not sure about in the grain group or in the top of the pyramid sometimes. (e.g. Ed commented, "I *don't know what it is*" and put it on the top of the pyramid; Dan placed the food pictures that he was not sure where they belonged to in the grain group)

The Accuracy of Distinguishing Healthy Foods from Less Healthy Foods (Bucket Activity)

The data from the three bucket activities from the pre-game, e-portfolio, and post interview were evaluated according to a scoring rubric to assess the accuracy of differentiating healthy from unhealthy foods. The number of food items correctly assigned to the color coded bucket as green light (good to eat a lot) and yellow light (slow down and prepare to stop) was counted, and it was converted to % score for all three activities. Due to one child (Dan) being unable to complete the bucket activity during the e-portfolio activity, only 4 kids' data were analyzed for the e-portfolio activity. During the pre-game, each child received seven different food items and were asked to identify its healthiness. The pre-game used relatively simple (mixed) food photos

prepared ahead of the study (e.g. cucumber, oat meal, fruit mix, etc); The E-portfolio used self-captured food photos that kids ate, including both simple and complicated mixed food photos (e.g., lima bean, banana, salsa, taco, pizza etc), and the post interview used selective 16 food photos that kids ate the day before covering both simple and complex foods (e.g. hot dog, cereal with marshmallow, salad dressing, corn, rice & beans, etc).

The data indicated that kids had some knowledge about healthy and unhealthy foods before the study. Kids mostly performed better with simple food, although some were good with both simple and complex foods. Figure 4.6 shows example of a child's e-bucket activity in e-portfolio and Figure 4.7 provides a summary of the bucket activity scores of each child across the three activities. Figure 4.8 shows kids' bucket activity scores before (pre-game bucket activity score) and after the instruction (average bucket activity score of e-portfolio and post interview).

Figure 4.6. Example of e-bucket activity in e-portfolio.

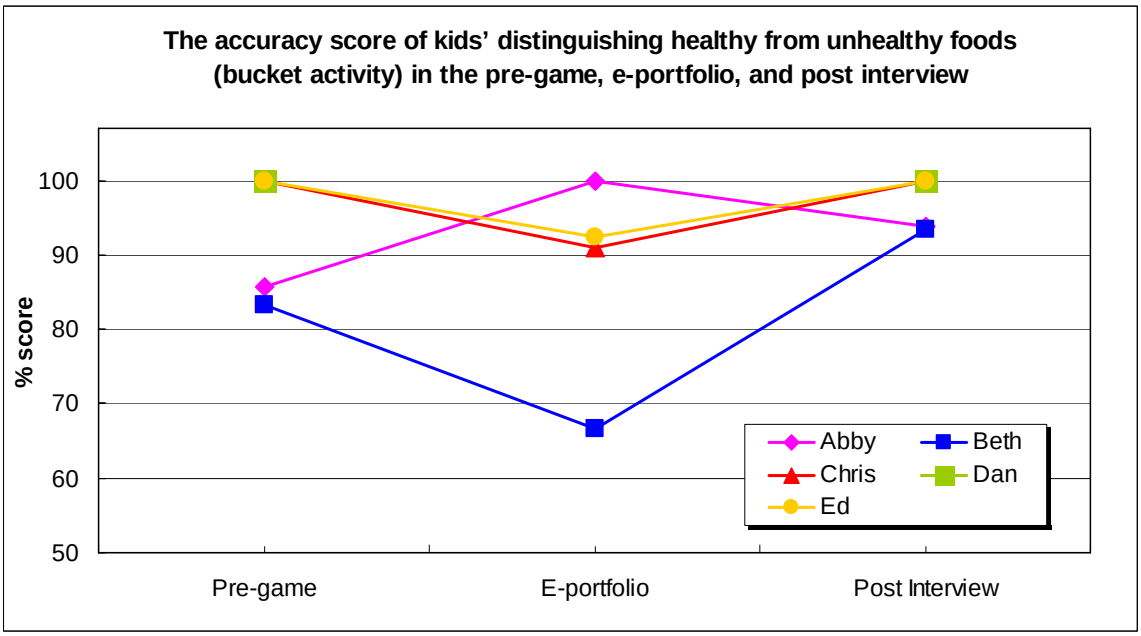

Figure 4.7 Accuracy scores of distinguishing healthy from unhealthy foods (bucket activity) in the Pre-game, E-portfolio, and post interview.

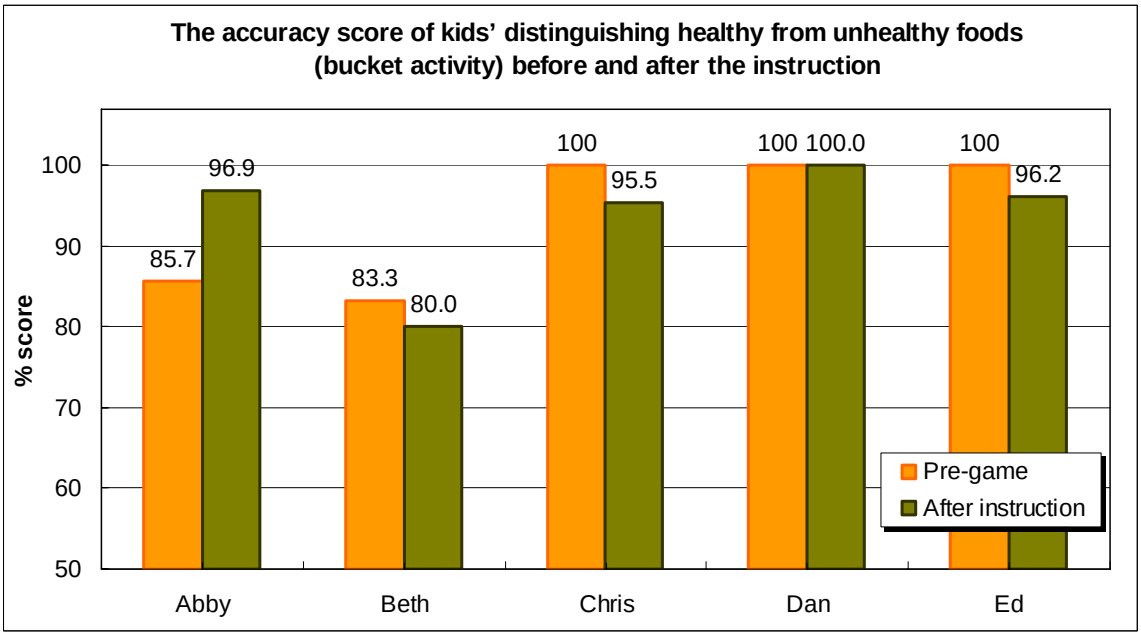

Figure 4.8. Accuracy scores for distinguishing healthy from unhealthy foods (becket activity) before and after the instruction.

*Pre-game= bucket activity scores before the instruction;
After instruction = bucket activity scores from E-portfolio + post interview

In the pre-game, most of the kids identified healthy foods and unhealthy foods correctly (93.8%) and only two errors occurred in identifying healthiness. (e.g., hamburger & French fries; chocolate milk). In addition, it was observed that they were knowledgeable about some of nutrition concepts for their age, as the following excerpt shows:

[Discussions about foods in the each bucket after the pre-game]

Researcher:	*Are French fries healthy?*
All kids:	*No, (Some said) yes*
Researcher:	*Yes, it is not healthy. French fries are made of potato. Potato is healthy but when it is fried, it gives you too much of what?*
Abby:	*Sugar*
Ed:	*Sugar, transfat.*
Researcher:	*What is transfat? why is that bad?*
All:	*mmm…*
Researcher:	*Why is this hot dog not healthy?*
Dan:	*Because it has transfat in it?*
Abby:	*Sugar in it?*
Ed	*Fat*
Researcher:	*Is a pop tart healthy?*
Chris:	*Yes (the others said no)*
Researcher:	*Chris, why do you think the pop tart is healthy?*
Chris:	*Because there is no transfat.*

As shown here, some kids had heard about transfat, sugar, and fat before the study and knew they were bad. However, it was not observed that they applied it to the right food items. Typically, when they were asked to explain why the food item was not healthy, most kids came up with the same answer of “sugar”, “fat” or “transfat” regardless of the kind of foods. Similar case was observed with vitamins. Dan explained that “I ate healthy because of vitamins” for all five meals including unhealthy snacks for the day in the beginning of the study food logs. He could not explain any further information about vitamins or the connection to the food items he ate.

In the e-portfolio activity, most kids' errors in identifying healthiness of food items occurred with apple, chicken taco, salsa, cracker, and unsweetened cereal. But more than half of these errors (66.7 %) occurred with one child, and hence it doesn't accurately represent all the kids' errors. In the post interview, most of the kids did well in identifying the healthiness of the foods they ate (93.8%), and the errors occurred with only yogurt and hot dog.

During the scoring process, it was also observed that kids became more aware of hard-to-see ingredients that are unhealthy such as sugar and fat.

> *Yogurt is not healthy because it has lots of sugar.*
> *There is a yogurt that has no sugar in it.* (Chris in the post interview)
>
> *Coco ball is not healthy…..because of lots of sugar.* (Abby in the train activity)
>
> *Meat ball is not healthy…because there's fat in it.* (Ed in the train activity)
> *Onion ring is not healthy because of crumble.* (Ed in the post interview)

As shown here, kids show evidence of considering added sugar and fat as well as the main ingredient of the food before making decisions about whether the food is healthy or not. Although kids came into the study knowing of unhealthy foods, that knowledge was rather superficial (e.g., Abby: "*Cocoball (will make me) fat*"). After the e-portfolio activity, the children were able to explain their interpretation more precisely (e.g., Dan: "*I ate lucky charms, it is unhealthy because of the marshmallow... marshmallow means sugar and sugar is bad for you*"). In some cases, incomplete conceptions kids had at the beginning of the study were modified as they realized the presence of fat or sugar that were added to the food. For example, Beth regarded ice cream as a healthy food "*because there is milk in it*" at the beginning of the study. In contrast, she categorized it as unhealthy at the end of the study because "*there is lots of sugar and fat in it*"; Ed

categorized pizza as healthy in the pre-interview. However, he moved it to the yellow bucket (unhealthy foods) because of fat, although "*pizza is sort of healthy because of cheese*" during the post interview.

Overall, as observed in the e-portfolio and food-train activity, kids' nutrition knowledge increased over time in both the accuracy of identification of food category (grouping) and healthiness (bucket) when compared to pre-game scores. The data also indicate that kids developed a particular nutrition construct of evaluating food healthiness. However, individual's increased accuracy in food grouping and evaluation of healthiness was variable. Although all the kids performed better in the bucket activity at the beginning of the study than the grouping activity (Total mean of grouping in the pre-game, 75.6%; total mean of bucket activity in the pre-game, 93.8%), individual's performances in the E-portfolio and train activity varied as some had still had higher bucket activity scores (e.g., Abby: 86.2% in grouping and 96.9% in bucket; Dan: 91.7% in grouping and 100% in bucket; Ed: 92.5% in grouping and 96.2% in bucket). However, this is not altogether surprising, given that the categorization requirements (2 categories – unhealthy vs. healthy) for the bucket activity were less precise than for the five-food grouping requirements. In contrast, Beth performed slightly better in the grouping activity at the end of the study (85.2 % in grouping and 80.0% in bucket) while Chris performed almost the same in grouping and bucket activity (95.2% in grouping and 95.5% in bucket).

Application of Nutrition Knowledge to Kids' Reflection upon Their Experiences

After kids' took photos of their meals for two days at the beginning of the study, two nutrition instructional lessons were provided which were followed by the E-portfolio activity). Then, kids recorded their eating with voice logs and conducted a food-train activity right after each meal for three days.

To investigate the connection between nutrition concepts and kids' reflection upon their eating, kids' self-assessment about each meal they ate as well as self-assessment about overall eating for the day before and after the instruction were analyzed. The researcher expected that kids would be engaged in reflection on their experiences utilizing increased nutrition concepts after the instruction, and it would help kids to modify their behaviors positively.

Kids' Self-Assessment about Each Meal and Application of Nutrition Concepts

Before the instruction, kids' eating for two days was recorded with self-captured food photos and voice logs. While recording their logs, kids were asked to assess if their eating was healthy and to explain why they thought so after each meal. During the train activity, after kids categorized the food photos to the right food group (box car) of the train, specific self-assessment questions were asked about their eating of each meal as well as their efforts to improve their eating.

Kids' self-assessments of each meal before the reflection activity (36 cases) and during the train activity (after the reflection activity, 12 cases) were analyzed. Table 4.8 shows the summary of kids' assessment about their own eating. Considering that the question was asked less frequently after the reflection activity (12 times after the reflection activity vs. 36 times before the reflection activity), 80.6% of the kids rated

their eating as “healthy” and 13.9 % as “so-so” before the reflection activity. However, after the reflection activity, the rate of “healthy” responses decreased (58%) and the “so-so” category increased to 33.3%. Both before and after the reflection activity, kids rarely rated their eating as “not-healthy” (5.6% and 8.3% respectively).

Table 4.8.
Self-assessment of healthiness of each meal before and after the reflection activity.

	healthy	**So-so**	**Not healthy**	**Total (%)**
Before the reflection activity	29 (80.6%)	5 (13.9%)	2 (5.6%)	36 (100.0%)
After the reflection activity	7 (58.3 %)	4 (33.3 %)	1 (8.3 %)	12 (100.0%)

The purpose of the kids’ self assessment of each meal was to facilitate their reflection as well as to understand the level of awareness of their eating with application of proper nutrition concepts. Kids’ explanations of their healthfulness ratings show that they attempted to bridge nutrition knowledge and their eating, whereas before the instruction, kids’ assessments were intuitive and the explanations were often disconnected from their own eating. For example, before the reflection, among 29 “healthy” ratings, 44.8% of the explanations for that choice were “I don’t know” or “there is nothing unhealthy about these foods” when they ate unhealthy foods such as muffins, lots of crackers, or brownies. Moreover, 20.7% of the explanations for that rating were “because it is healthy for you” or “because it is good for you (your body)”, but none of them was able to address further reasons for why it was healthy for you or good for the body. Table 4.9 shows some other examples of kids’ explanations for their self-assessment before the instruction activity.

Table 4.9.
Examples of student explanations of their self-assessment before the reflection activity.

Child	Date	Meal	Self-assessment and why
Healthy			
Abby	Nov 29	Lunch Snack Dinner	*Healthy, because I ate many things.* *Yes, because I ate crackers and milk.* *Healthy because God makes you healthy.*
Chris	Nov. 29	Lunch Dinner	*I ate healthy because you can feel good.* *I ate healthy because you should always be healthy.*
	Nov. 30	Snack	*I ate healthy because cookie is healthy because cookie is good for your body*
Dan	Nov. 29 ~ Nov. 30	All 8 meals	*I ate healthy because vitamins.* *I ate super healthy because vitamin is in it and it is tasty.*
Ed	Nov 29	Lunch	*Yes, because there is no bad stuff in it.*
So-so, little healthy, healthy and not healthy			
Beth	Nov 30	Lunch	*...milk is healthy but the others (chili, muffin, lima beans, and mixed fruits) are not… because it is not!*
Not healthy			
Dan	Nov 30	snack	*I ate pizza for snack: it is not healthy because some of them taste yucky.*
Ed	Nov 30	Breakfast	*Not healthy because cereal has sugar in it. Sugar is not healthy. (* note that he ate no-sugar added cereal at school)*

During the food-train activity, however, students' explanations about their assessment of eating were reflective of their eating. For example, "*I ate healthy because I ate from all groups"; "I ate healthy because corn, apple, sloppy joe's are healthy"; "I ate little bit healthy because I tried vegetable pizza (instead of cheese pizza) for my goal"; "I ate a little bit of not healthy because … the muffin [I ate] has lots of sugar in it*".

As has been shown, in the self-assessment about each meal during the train activity, kids not only made the connection of their eating with nutrition concepts, but also showed evidence of appropriate application of concrete nutrition constructs that was not apparent before the instruction.

Kids' Self-Assessment of Overall Eating and Application of Nutrition Concepts

Each child was asked to evaluate his/her overall eating for the day three times: before (pre), during (mid), and after (post) the study in terms of healthiness. The data analyses of the total self-assessments of the kids (from pre, mid, and post assessments) showed that, most of the time, kids rated their eating as "healthy" (11 out of 15 cases, 73.3%); two cases as "so-so"(13.3% of ratings); 2 cases as "not-healthy"(13.3% of ratings).

The pre-rating was a self-assessment about kids' routines of eating without any visual data or new nutrition knowledge; the mid-rating was an assessment about habitual eating with self-captured photos and nutrition concepts learned in the class; and the post rating was an assessment about their optimal eating with photos of food kids ate and nutrition concepts. Given these differences in context, kids' self-assessment of their

eating did not change much between the three assessments (4 kids rated “healthy” and one as “not healthy” for the pre-assessment; three kids as “healthy” and two as “so-so” for mid-assessment; 4 kids as “healthy” and one as “not healthy” for the post-assessment). However, kids’ explanations for why their eating rating was healthy, so-so, or not healthy show some evidence that kids constructed nutrition knowledge and applied them to their eating differently. Table 4.10 shows the self-assessments of kids’ eating with explanations.

These data show that before the study, kids had some nutrition knowledge (e.g., vegetable is healthy, healthy food is good, or eating lots of candy is not healthy). However, kids’ nutrition concepts were superficial and disconnected from the context; therefore they were not able to provide further explanation or logical reasons for their assessments. In the mid self-assessment about habitual eating with self-captured food photos, some of the explanations of kids show that kids reflected on their personal data while making connection to the nutrition concepts they learned in the class. For instance, two kids reviewed their eating in terms of eating balanced meals (eating a variety of food groups) and one child reviewed her eating in terms of the quality of food choices (minimizing unhealthy foods). It is more evident in the post-assessment that kids reflected upon their eating and applied proper nutrition concepts to make decisions about healthiness of their eating. For instance, two kids accounted for their eating in terms of eating balanced meals; two kids explained it in terms of quality of food choices, and one provided both explanations (e.g. “I have all the groups and a few things in the caboose”). In addition, during the interview process, the researcher observed that kids needed some prompting to come up with explanations in the mid-assessment (e.g. “why did you circle

Table 4.10.
Self-assessment of the healthiness of kids' eating before the study (Pre), after e-portfolio activity (Mid), and at the end of the study (Post).

	Pre	Mid	Post
	Self assessment Explanation (because…)	**Self assessment** Explanation (because…)	**Self assessment** Explanation (because…)
Abby	Healthy *mmm… green beans, carrots and pepper*	So-so *…sour cream. I want to eat less sour cream.*	Healthy *…I ate less unhealthy foods; and I ate lots of healthy foods.*
Beth	Not healthy *…I ate lots of candy*	Healthy *I don't know.*	Not healthy *…I had a lot of unhealthy and I want to erase my unhealthy in my caboose.*
Chris	Healthy *…healthy food is good for you?*	Healthy *…I eat healthy. I ate all my groups.*	Healthy *…I eat healthy, I have all the groups and a few things in the caboose*
Dan	Healthy *…I ate a lot of healthy foods…but, sometimes I don't.*	So-so *I…could have done a little better in fruits, veggies, and milk*	Healthy *[I ate]…all five groups*
Ed	Healthy *… I eat broccoli*	Healthy *[I]…have something from all the groups*	Healthy *[I]…have something from all five groups…I tried to eat healthy.*

the healthy face? Is it because of something you ate?"); however little guidance was necessary for the post assessment. All the kids agreed that having a picture (printed personal food pyramid picture) was helpful for answering the questions.

Kids Reported Application of Nutrition Concepts to Their Food Choices

To address whether kids' decisions about the foods they ate were influenced by the nutrition concepts they were learning, post interview data of their perceptions were analyzed. Since Ed was out of town for a family trip at the end of the study, only four students participated in the post interview, and Ed was interviewed briefly after the trip. Kids' responses to the structured interview show evidence that kids were conscious about the foods they ate, before, during, and even after their eating. Their knowledge about food groups and their ability to differentiate healthy foods from less healthy foods helped kids evaluate foods in terms of their goals and make better food choices.

Overall kids' eating improved as evidenced by accomplishment of their goals and by eating balanced meals from all five groups. Kids' responses to the following questions indicate how this improvement occurred. Three out of four kids responded that they thought about their foods before they ate, considering whether it was healthy or not. Kids chose to eat particular foods that they were not interested in before, because they were healthy or needed to accomplish their goals (e.g., "*beans"; "yogurt"; "fruit and vegetables*"). Moreover, kids decided not to eat particular foods in spite of the fact that they liked it because they were not healthy (e.g., "*ice cream"(2); "cookie*"). Kids also reported that they thought about their food while they were eating –about whether it was healthy or not. Kids even stopped eating sometimes because they realized or were reminded that the food they were eating was not healthy (e.g., "*cookies", "muffin", "marshmallow*"). Two kids reported that they also reflected after eating and regretted having eaten an unhealthy food such as candy or cake (e.g., "*I felt bad because of*

candy"). Overall, all the kids said that they felt proud of themselves since they were eating healthy foods.

The post interview prompted kids to compare the healthiness of their personal e-portfolio pyramid and their train. Three kids chose their performance during the train activity as healthier than the pyramid since the train had all five groups (e.g., "*The train has more vegetables. Everyday, I kept eating vegetables.…because it was my goal*", Dan in the post interview). Meanwhile, Beth perceived that her choices were healthier in her pyramid because her pyramid reflected better choices in the grain group, although her train had more foods from all five groups. Beth agreed that she made more balanced choices across the vegetables, fruits, milk, and meat & bean groups in the train, but was very reluctant to change her mind from the idea that the e-portfolio pyramid was healthier. The researcher observed that kids were very excited about and engaged in this study because of they were able to see and analyze their own self-captured individualized data as well use technology in more advanced ways (such as the e-portfolio). In sum, the researcher found that once kids saw their actual eating behaviors and set individualized goals, kids continued reflecting upon their eating in light of the nutrition knowledge they learned. Hence kids were able to make better choices of foods to eat.

Delayed Effect: One Month and Five Months after the Study

To investigate long term effects of the study, two interviews were conducted one month and five months after the study. The classroom teacher and Abby were interviewed one month after the study, and Abby and her mother were interviewed five

months after the study. The data from the interviews were analyzed in terms of nutrition knowledge and behavior changes over time.

One Month after the Study

The interview data showed that kids were still conscious of their eating, and they were applying nutrition knowledge gained during the study to their everyday eating one month after the study.

[In the interview with teacher after winter break (one month after the study)]

> *"They are still talk about it. It is not always initiated by me; like it is initiated by one of the children at the table … 'oh, I need vegetables'…it was very funny that yesterday, one of the kids said "you know, we don't have yellow group"...they are very aware of how everything falls, what they are eating…whenever we bring it up, they are all into it…they all definitely have figured out their foods, definitely what foods go into which groups"*

As shown here, kids were continuing good conversation about food groups not only with teachers but also among themselves. The parents reportedly also informed the teacher that kids were talking about it at home, as well. The teacher reported that kids were knowledgeable particularly of food groups, as shown here:

> *"… yesterday, the chef (a kid chef for the day) had passed the food with red sauce on it, somebody said, "This is not just one group". They still remember that two groups can be combined, vegetable groups as well as grain group something like that. They really really got a strong hold on it…"*

The conversation with Abby supported these findings. Abby remembered all five food groups and colors of food pyramid for each group after one month. Abby addressed that she was still trying to eat healthy and would keep doing that.

> *"I will go to Korea next summer… I will eat lots of lots of vegetables and kimchi there so I can grow up and be stronger like my dad, and will be back"*

In addition, according to the teacher, one child came to the teacher after the winter break and proudly said how he made healthy choices by not eating unhealthy snacks on the table during the Christmas holidays.

Overall, although they didn't talk about nutrition as much as when they were participating in the study, what they learned during the study was still visible in their conversations and in some of their food choices.

Five Months after the Study

The data from the interviews with Abby and Abby's mom five months after the study show somewhat different but interesting results from the earlier (one month after the study) investigation. According to her mom, although Abby didn't typically apply nutrition knowledge to improve her eating, she explained why she ate certain foods she liked in terms of healthiness or the food pyramid.

> *"Abby doesn't like vegetables and she tried to eat more vegetables a few times but not many…if she wanted to eat some vegetables, she used to say "I have to eat more vegetables"…"I have to eat this because it is healthy food". If I asked "how do you know that?" then she said," I learned this from the food pyramid"… But, she didn't change her eating if she didn't want to eat it."*

Along with this observation, Abby was able to name six food groups in the food pyramid and to come up with 4~5 food examples for each group with referring to a food pyramid picture during the interview. Although Abby still retained some nutrition facts she learned during the study, evidence of applying this knowledge to regulate her daily eating was not obvious.

> *"She eats what she likes to eat among the foods being served... but is aware of [whether they are] good or bad foods and she can control her eating behavior. If I say, "ice-cream is not healthy", then she says "I am not going to eat it after this…Sometimes she keeps it for two weeks. If I ask her in the market "don't you want to buy ice-cream?" then she said "I promised not to eat". I think she understood it logically after the study.*"

Although Abby still remembered that she had tried to eat lettuce and beans at school to eat healthy while participating in the study, she said she did not try to improve her eating any more. But, she reported some evidence that some changes in her eating that occurred during the study had remained. For example, the lunch menu Abby ate for the interview day was as same as one of the study days. (e.g., sloppy Joe, corn, whole wheat roll, milk and fruit (grape)). During the study, it was observed that Abby didn't like corn, but she tried to eat more vegetables that day. At the lunch of the interview day, Abby ate corn without resistance: "Well, I mixed corn and sloppy Joe together and it was yummy!" Adding one more vegetable food she was not interested in before on her favorite list may be regarded as a small step towards eating healthy and a subtle change influenced by the reflection activities.

During the study, some data showed that the kids were influencing changes in meal selections at home (e.g., Dan's mom bought new vegetable to accommodate her child's efforts to eat healthy). Abby's mom reported the biggest changes at home after the study were her own awareness changes in addition to increased knowledge of Abby.

> *"We used to talk [like]"you are getting fat like your daddy" or "if you eat this, you will get strong". So it was more about fat vs. strong than healthy vs. unhealthy. I didn't realize this before, but now I think it could give Abby a negative impression. Just talking about physically getting fat and making daddy as a bad example could give her a negative influence about her self-image as well as her daddy. But now the words 'strong' and 'fat' have disappeared at our home. As we talk about healthy vs. unhealthy and good for my body, it could give her*

> *more self-respect, I think. I think it was the biggest change. If we didn't do this study, we may still talk about [nutrition] as fat and strong."*

As shown here, the parents' active involvement in the study may have resulted in an unexpected positive change in the nature of nutrition education at home.

Overall, from Abby's case, it was found that the factual knowledge remained longer while reflection on daily eating or changes of behavior faded away in some cases after five months of the study. However, the nutrition knowledge did not remain inert, as she could often apply it to evaluate her eating although it didn't lead to changes in her behavior.

CHAPTER 5

GENERAL DISCUSSION

To many school-age children, nutrition is a subject learned in the classroom; the integral role of connecting this information to individual everyday experiences is often overlooked. Accordingly, children's learning of nutrition information is decontextualized and has little connection to adopting healthier eating habits. In actuality, once a child has developed unhealthy eating habits, it is hard to modify this habitual eating later, and it is well known that excess weight in childhood and adolescence predict overweight in adults. Conversely, the earlier a child learns about healthy eating and begins to practice these skills in everyday life, the more adept he or she will be as a healthy eater, consequently mitigating obesity in the future. Pediatric obesity is a significant public health concern in that it inhibits a child's proper development and causes a higher risk of long term health problems such as heart disease, diabetes, cancer, arthritis and other diseases. Yet, the last three decades have seen a dramatic increase in pediatric obesity in America. Approximately 30.3 percent of children (ages 6 to 11) are overweight and 15.3 percent are obese and for adolescents (ages 12 to 19), 30.4 percent are overweight and 15.5 percent are obese (American Obesity Association, 2007). Although recent educational programs have emerged to identify and intervene with pediatric obesity, there has been minimal focus on considerations of working with younger children by adopting reflection upon everyday experiences as an integral step to cultivate a healthier lifestyle.

The goals of the this study were twofold: 1) to introduce digital imaging to young children as a technique to capture everyday experiences and 2) to support young children to be engaged in reflective practice and ultimately to use reflection as part of their routine behavior in order to make wise food choices. The e-portfolio and food-train intervention were designed to help young children capture their eating experiences, reflect upon them, and practice making healthful choices. Specially, this study tried to answer 1) if reflection on everyday experiences influenced children to make healthier choices; 2) if using captured data representations (e-portfolio and train activity) were effective in increasing self-awareness; and 3) how children applied developing nutrition knowledge to their food choices.

The findings from this study are discussed below by research foci: 1) Using digital images to foster reflection-on-action and increased self-awareness, 2) The role of reflection –on past eating experiences in children's health-related behavior changes, 3) Application of nutrition knowledge to behavior change and reflection-in-action, and 4) Delayed effect. Implications for instructional design, future research and limitations of this study are discussed next.

Using Captured Data Representations to Foster Reflection- on- Action and Increased Self-Awareness

Self-captured digital photos enabled children to record accurate two-day-dietary journals and to monitor their past eating behaviors with supplemental voice logs. Previous studies that used photographs to elicit responses from young children (Aschermann, Dannenberg, and Schultz, 1998; Ching and Wang, 2006) and that used

photos as visual references to estimate accurate portion sizes of food consumption of children and young adults (Frobisher and Maxwell, 2003, 2001; Foster, Anderson, and Adamson, 2001; Foster, Nelson, and Adamson, 2003.) showed promising results of using imagery as a memory aid. Self-captured photos in this study did not directly mirror children's eating in that sometimes, children's pictures missed food items they ate, the picture was fuzzy and hard to see, or information about the amounts they ate was missing. However, voice logs may have mitigated these weaknesses by providing verbal information about the food items a child ate and the serving sizes. Using self-captured food photos with supplemental voice logs in this study may have optimized children's ability to report their two-day-eating behaviors, and enabled children to use captured experiences as data for reflection.

Nutrition education literature has shown that nutrition knowledge is necessary for behavior change, but it does not always impact behavior or attitude towards foods (Contento, 1991). Other studies found that reflection on dietary behaviors in conjunction with goal setting is promising to improve dietary behaviors (Schonoll, 1997). The findings from this study are consistent with previous research in that children's reflection upon daily dietary behaviors and goal setting during the e-portfolio activity preceded behavior changes of children during the three-day-food-train activity. Children reportedly were highly motivated to accomplish their goals at school as well as at home during the train activity, and the strong association of changes in behavior and their goals were shown in children's total goal accomplish rate score, 86.4%. The procedures of this study also match Cullen's development of the 'four-step goal-setting process' for the successful employment of goal setting to nutrition education: 1)recognizing a need for change, 2)

establishing a goal, 3) adopting a goal-directed activity and self-monitoring it, and 4) self-rewarding goal accomplishment. In this study, first, children's 'surprises' about their past eating acted as recognitions of a need for change. Then, children formulated their goals with the guidance of the teacher, and they tried to accomplish it for the rest of the study. During the process, it was observed that kids monitored and reflected on their eating represented in personal food-train frequently. At the end of each day at school, children received smiley stickers or 'Nittany Lion'(the symbol of PSU) stickers as a reward and at the end of the study, their train was (assumed) to be able to move fast based on their healthy eating.

Although there are many studies about goal setting effects on dietary behavior changes in nutrition education literature, they have been rarely implemented in children under 12 years old, and previous researchers suggested that formulating a goal is too complex of a skill for these children (Shilts, Marilyn, & Townsend, 2004). However, the findings from this study showed otherwise; with appropriate supports, a goal-setting strategy can be employed to nutrition education for younger children and be effective to change their behaviors.

The purpose of the e-portfolio and food-train interventions was to allow children to recall past experiences as a platform for learning about their routine of eating and to prompt children to turn everyday experiences into knowledge about practice. The interventions used visualization as a strategy to foster children's reflection on daily experiences. For instance, it allowed children to conduct exercises of categorizing food photos that they consumed in the past into five food pyramid groups and identify their healthiness. This exercise of visualizing children's own eating experiences was then used

as a platform to reflect on captured experiences and to learn about their unconscious eating habits, which led children to recognize the need for the change and then elicited individually relevant goals to inform their future behaviors. The data suggest that those reflections and goal-setting behaviors played a role in leading children to construct and transform their own unique learning experiences.

The Role of Reflection-on-Everyday Experiences in Children's Health-Related Behavior Changes

Fiol and Lyles (1985) noted that learning is "the process of improving actions through better knowledge and understanding". Similarly, Schön (1983) contends that knowledge must be embodied in direct action, and reflection-on-action plays an important role in learning from experiences. Although Schön's 'reflective practitioner' is regarded as the learning theory for adult professionals, Karmilof-Smith and Inhelder's experiment about "children's processes of discovering in action" (Karmillof-Smith and Inhelder, 1975) focuses on reflection-in-action in children. According to the description of the experiment in Silva's article (2001), "young children are asked to balance wooden blocks on a metal bar. Some blocks are normal, but some have been conspicuously or inconspicuously weighted at an end. They found that when counterweighted blocks failed to balance at the geometric center, children 7 to 8-year-olds would begin to decenter the blocks. They began with the conspicuously counterweighted and later with the others. During this phase, they paused and reflected much. It was like as if they were discovering a new theory-of-action: "things balance at their center of gravity". Those children also began to see their failures to center the blocks not as errors but as experiments to discover

the correct point" (Silva, 2001). As Inhelder asserted (1975), the use of theory-in-action doesn't mean that children have the capacity to conceptualize explicitly what they are doing, but they do have implicit views that can be tested and refined during action.. Inherently, the findings of this study are consistent with previous researchers' notions of learning by doing and reflecting on those activities. The children in this study transformed their self-captured experiences into data and actively interpreted those experiences. Children's reflections were comprised of not only what they consumed but also how they could improve an area identified as inadequate, with little guidance. Reflection-on-experiences enabled children to discover new information about discrepancies between their conceptions of their eating and actual eating, and it led them to formulate individualized goals. This experience of surprise of children, an important element of the experiential learning cycle (Kolb, 1984), seemed to initiate further reflection on eating behaviors, and facilitated children to improve their eating behaviors by setting realistic and behaviorally focused goals.

The improvements of children's dietary behaviors became evident in behaviors such as eating more balanced meals across the five food groups and making more healthful choices within the food group during the three-day food-train activity. Children became conscious about their eating at school as well as at home, as evidenced by their increased dialog around their food choices. At school, children often initiated discussions about the foods on their plates, whether the food was healthy or not, and which food group the food belonged to during the meal time. Children were reportedly proud of themselves when they gave up unhealthy foods and made healthier food choices. At home, children also frequently talked about eating healthy and tried to improve their

eating in relation to their goals as well. Consequently, most of the children in this study tried more vegetables voluntarily and gave up unhealthy snacks such as cookie, marshmallow, lollipops, and ice cream. During the food-train activity, it was observed that children evaluated each meal presented in the personal food-train and set new plans for the next meal to eat healthy. As children frequently reflected on what they were eating and , if their eating behaviors met personal goals, and/or if their eating was well balanced, children came to modify their eating behavior in a positive way almost every time they ate during the three-food train-activity. (e.g., *"I ate corn at lunch to accomplish my goal*."). If children didn't try anything to improve their meal at school, they reportedly committed to try something healthy or to meet their goal during the next meal at home. As a result, children made more healthful food choices, and their eating for the day was closer to the daily recommendations of the USDA. According to the perceptions of the teacher, visually presenting children's eating and letting them find inappropriate dietary behaviors made the biggest impact on children and changing their dietary behaviors.

In sum, the nutrition education literature shows that children do understand the link between nutrition and health (Reusser and McCarron, 1994), however, barriers exist to translate this knowledge into actual behavior (Story & Rensick, 1986; Halveson, 1987). Supporting children's reflection on their habitual eating behaviors during the e-portfolio activity may have empowered children to transfer their learning into practice and make more healthful choices

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Application of Nutrition Knowledge to Behavior Change and Reflection-in-Action

Previous studies have demonstrated the reluctance of young children to eat fruits and vegetables (Otiono, 2005, Murphy et al., 1995; and Lytle et al., 1994). Likewise, most of the children in this study were observed to consume lower amounts of the vegetable group (Total mean of vegetable consumption to the daily recommendation, 67%) and the meat and bean group (total mean of meat and beans consumption to the daily recommendation, 65.6%) before the instruction. But, in contrast to previous research findings, children in this study had sufficient amounts of fruit intake.

After the instruction, children demonstrated improvement in knowledge including the concepts of the food guide pyramid and the association of food items to food groups (15.1% increases in accuracy scores for categorization of food items into food groups of the pyramid). Furthermore, the total mean score for each activity of categorizing food groups and of distinguishing healthy from unhealthy food was 85.0% and 93.0% respectively after the instruction. In addition, children's conceptions of 'healthy foods' evolved from "something good for the body" to concrete examples of healthy foods (e.g., vegetables, yogurts, milk). Children's initial understanding of healthy foods was vague and implicit, however after the study, all five children elaborated with food examples and showed subtle understanding about its need in their growth and overall health.

Nutrition education literature has shown that nutrition knowledge is an essential, but insufficient, condition for dietary change (Contento, 1991). Consistent with the previous research, active application of nutrition knowledge was observed while children were evaluating their eating and trying to improve their diets. For example, in comparing children's explanations of their self-assessment of their eating before and after the instruction, children applied more specific and logical reasoning to evaluate their eating

after the instruction. The overall changes in children's eating also moved in a positive direction to meet their goals. The greatest change of behavior observed in the children as a result of the study activities was the higher intake of meat and beans group (rate of change, 40.8%) and vegetables (rate of change, 25.8%). The total consumptions relative to the daily recommendation increased to 92.4% in the meat and beans group and 85.3% in vegetables. These changes matched children's goals and suggest that children were aware of their needs and applied proper nutrition knowledge to accomplish their goals. On the whole, children exhibited improvement in overall dietary behaviors, and these positive changes along with a reduction in the number of unhealthy food choices may have not been possible without application of their developing nutrition knowledge.

While children tried to improve their eating, they were reportedly conscious about the foods they ate before and/or during their meals. Schön (1983) asserted that we learn by noticing and framing problems in particular ways, then experimenting with solutions. Along with the notion of Schön, children's experience of surprise initiated a good deal of reflection-in-action by continuously evaluating if their food was good for them in light of their current nutrition knowledge as well as their goals. For instance, children made better choices of foods by eating more of the food groups set as their goal and choosing not to eat or limiting the amounts of foods they liked but were unhealthy, such as ice cream, cookies, marshmallow, etc. Afterward, children looked back and reflected on their eating, examining what they ate and what alternative options existed to improve their choices in terms of their current understanding. Hence, children's eating behaviors were likely improved by the process of repeated experience with reflection-in-action and application of current nutrition knowledge to new experiences.

Delayed Effect

One month after the study, children were reportedly conscious of their eating and tried to improve their diets. However, five months after the study, the interview of a child and her parent showed somewhat different results. The child was still knowledgeable of nutrition concepts she had learned during the study, but the link to her food choices were not as apparent. This child reportedly continued thinking about her eating, however, her reflection was limited to explaining why her eating was healthy or not, and it didn't lead to changes in her behavior. This may suggest that children's reflection-on-action alone may not always motivate dietary behavior changes in the long term and other strategies may be necessary to help children's motivation for long-term changes in behavior.

American Dietitian Association (ADA) suggests that education involving parents may be more likely to result in long term behavior change (Position of the American Dietetic Association, 1996, appeared in Eboh and Boye, 2006). However, little research is available about the long-term impact of parental involvement on children's food selections. Instead, current studies focus more on parental influences on nutrition knowledge scores (e.g., Ajzen and madden, 1986; Food Marketing Institute, 1994) or parental monitoring influences (parents' inspecting children's lunch tray) on children's immediate food selection (Perry, Baranowski, and Parcel, 1987).

Despite the fact that this child did not maintain her behavioral goals five months after the study, the study made an unexpected impact on the parent-child interactions at home by informally improving parents' nutrition understanding. Considering that nutrition understanding of a person may reflect patterns established during early childhood, the impact of this study on the home environment in the long term in this one

case (Abby) may indicate promise for this approach to reach the family as a unit. In addition, when considering all nutrition interventions happen in a community whether they make use of the community as a resource or not, community level of long-term nutrition education programs such as mass media health campaigns, grocery store's point-of-choice program, restaurant's labeling campaign, and other activities within groups of teachers, school foodservice personnel, workplace, or entire community, can be moderately effective in changing dietary behavior of communities (Cerqueira, 1991b) and may be beneficial for strengthening long-term effects of a short-term nutrition intervention. Kelder and his colleague's study about the long-term outcomes of a community-wide youth nutrition education program (1995) showed that school plus community interventions had an impact on changing eating patterns of school aged children. Participating in an intensive nutrition education program along with community involvement could be a more powerful approach in changing dietary behaviors in the long term.

In general, the findings from the current study went beyond the expectations of the researcher in that even young children were able to 1) use capturing devices (camera and voice recorder) and make accurate dietary records,2) reflect on past behaviors, and 3) accomplish their goal by modifying their eating behaviors. We had investigated first graders and fifth graders in two previous studies about supporting children's reflection on everyday experiences (Land et al, 2005; Land et al, 2006) but, had never worked with kindergarteners. Based on the previous studies, the researcher predicted that the children in this study would increase some degree of nutrition knowledge but not be able to change much of their food choices since they have even less control over daily food

selections and are less capable of reflecting upon everyday experiences than the first and fifth graders. The results of the study, however, were consistent with the recent understanding about children's cognitive abilities (Duschl, Schweingruber, and Shouse, 2007). Children in this study were able to understand highly abstract relations in nutrition and health and showed the subtle capability of logical reasoning skills and self-evaluation which is regarded as the most advanced reflective stage (King and Kitchener, 1994), with the technology assisted scaffolds. Electronic portfolio and food-train may have played a central role in supporting children's reflections by visualizing their current and past eating behaviors.

Although children may not necessarily perform better with the e-portfolio than with the paper-based portfolio, utilizing computer technology (e.g., using digital camera instead of film camera; using e-portfolio instead of paper based portfolio) benefited the researcher to conduct this study. First, giving children the opportunity to work with one-to-one computer and advanced equipment (digital camera & voice recorder) promoted children's interests and directed their attention. Secondly, the Smartboard© software enabled the researcher to record all the movement and verbalizations of the children during the e-portfolio activity and to save them in movie format, which permitted the researcher to revisit children's learning process later and to understand better what was going on during the study. Thirdly, using digital images made it much easier and faster for the researcher to download children's food photos everyday and allowed editing of them on the computer; thus, it saved considerable time to prepare the e-portfolio templates for each child and the food icons from the food pictures each child had taken. Without technology, the study would have been delayed to prepare e-portfolios for each

child. Therefore, technology in this study played a powerful role to strengthen the research.

In conclusion, the researcher found that there are several advantages to utilizing digital images to capture past experiences in an e-portfolio for the nutrition education of young children. First, it provided a tool for young children with relatively limited cognitive development and writing skills to record their dietary behavior accurately. Then, the e-portfolio gave children the opportunity to discover their routine behaviors and to deepen their understanding of their experiences. It influenced children's new perspectives and ideas about their current and future experiences. In this manner, the e-portfolio with self-captured digital images served as a learning tool for children to construct new understanding that was linked to behavior changes.

Implications for Supporting Reflection on Kids' Everyday Experiences

Current educational strategies in nutrition education at school do not link the dietary message with personal behaviors, and many students, especially younger children, have difficulty applying them in practice. Bransford et al (1990) noted that when learning is anchored in meaningful contexts for learners, it is much easier for them to understand how concepts are applied and why they are important and useful. This understanding then facilitates learners to transfer their learning to new experiences. However, children's reflection on their everyday experiences is not easy to accomplish. It is necessary to provide scaffolds or support strategies to help children monitor and reflect upon their experiences and thus to drive behavior changes, particularly in nutrition education. With

the advent of technology, computers can be used as “cognitive tools” to support learners’ thinking processes as well (Jonassen, 2000; Lajoie, 1993).

On the basis of previous research, the study aimed to design technology-enhanced supports for children to observe, interpret, and reflect upon everyday experiences and thus to facilitate transfer to their experiences outside of the classroom. In this study, visualization, question prompts, and monitoring techniques were strategies that were consistently used to support children to 1) capture their everyday experiences, 2) reflect on captured experiences, and 3) apply what they had learned to their experiences.

First, to record target behaviors, digital cameras and voice recorders were used in this study. The utilization of such technologies to capture children’s eating experiences is promising to bring their everyday experiences to the classroom for reflection. This type of approach could be extended beyond health applications. For instance, kids could be asked to record other aspects of their everyday/home experiences (e.g., plant growth, electricity use/conservation, or perhaps literacy or language applications) and then supported to bring those experiences into the classroom to learn from them. This study showed that even young children were able to manage the demands of taking photos, recording voice logs, and remembering to bring the equipment back and forth between home and school. As technologies become more ubiquitous (e.g., all homes have digital cameras or digital voice recording tools), and as software becomes available that better supports reviewing and sharing of personally-captured data for educational purposes, the approach has implications for larger-scale implementations.

Another implication for design that emerged from this study is the use of representational scaffolds (Toth, n.d.) to display kids’ personally-collected data in a way

that aided reflection on them. In this study, children were supported to visualize their eating within the e-portfolio by displaying captured images in a food pyramid form, which allowed children to easily understand, analyze, and reflect upon their past experiences. Consequently, visualization of personally-captured photos of everyday eating aided children to interpret their pictures as data, and reflect upon their experiences in ways that were directly connected to conceptualizing and applying nutrition concepts. Two recent studies (Toth, n.d.) found the use of representational scaffolds, such as tables, visualizations, graphs and diagrams, enhanced students' scientific inquiry skills in (a) understanding the logic of designing experiments and (b) their ability to coordinate experimental data with theories in the classroom. In one study, a teacher-designed table of variables was provided to scaffold students' process of designing and conducting experiments. The interpretive pre-developed table helped focus the learners' thinking on only items that were important for the task and discover an important variable which was omitted from their experiment, and thus learn what things must be considered when designing the experiments. In the second study, the effects of two different external representations (software tool (evidence mapping) vs. prose writing) were evaluated to scaffold ninth grader's to coordinate experimental evidence with domain theories. It was found that the software tool facilitated learning about how to categorize and label scientific information, and how to evaluate hypotheses based on empirical data. Toth concluded that representational scaffolds could serve as effective strategy to teach scientific inquiry skills. Likewise, findings from the current study indicated that supporting children to visualize their personally-collected data in a food pyramid

representation with the help of the software, MS. Publisher encouraged them to engage in reflective practices using that data easily.

Another implication for design centers on the use of prompts to support reflection on, and self-explanation of, personal experiences. To support children's reflection upon imagery data, the e-portfolio in this study provided a series of question prompts to help children understand better their routine behaviors, view their experience with a new perspective, and think about how to improve it. Question prompts are a well-known scaffolding strategy to facilitate metacognition, comprehension, and reflection (Davis, 2003; Palinscar & Brown, 1984; Salomon et al., 1989; Scardamalia & Bereiter, 1995). The E-portfolio provided prompts to help children articulate their thoughts, to evaluate their eating, elicit self-assessment and self-explanation (White & Federiksen, 1998; Chi et al., 1991), and in turn, reflect on meta level planning (Ge & Land, 2003; King & Rosenshine, 1993). The study results revealed that children were able to respond to question prompts that were read to them, particularly in eliciting goals to improve their eating. However, this approach required significant teacher/researcher one-on-one interactions to accomplish. Implications for design include how to design question prompts to support pre-literate children to reflect on their personal experiences and to engage in goal setting, but in a scalable way. Podcasts or audio-enhanced prompts could be used as techniques to enhance young children's reflection when working independently. These could then be elaborated when working with a teacher or in large-group discussions. Worksheets could also be made that make use of images to help students identify where their choices were limited and to encourage goal setting in a more visual way. Without explicit reflection on personally-collected data, students are unlikely

to do so independently; but, in cases where children are preliterate, creative approaches are needed to help leverage the resources of typical classrooms and classroom teachers.

Another implication for design involves supporting students to take learning beyond the step of goal-setting and to actually try out and monitor accomplishment of their goals, using self-regulation processes of self-monitoring, self-judgment, and self-reaction (Schunk, 1991). Previous studies (Schnoll, 1997; Schnoll and Zimmerman, 2001) found that incorporating two self-regulating strategies, goal-setting and self-monitoring, into nutrition instruction enhanced self-efficacy and had a strong impact on increasing healthy food consumption, particularly as a result of goal setting directed to dietary behavior changes. Although the effectiveness of goal-setting as a vital part of self-regulation on adult learning is well documented (e.g., Schultz, 1993; Cobb et al., 2000; Duncan and Pozehl, 2002), few studies have worked with children under 12 years of age (Shilts et al., 2004). Now, new understanding about children's development is central to contemporary science education that even young children can use a wide range of reasoning processes that form the underpinnings of scientific thinking, and their ability is largely contingent on their prior opportunities to learn (Duschl, Schweingruber, and Shouse, 2007). This study provides some evidence to support the idea that even very young children can be scaffolded to employ some level of self-monitoring and self-evaluation and provides some insights into the conditions under which children are likely to self-regulate their behaviors. In the current study, the food-train strategy helped children to visualize their eating and allowed them to monitor and evaluate their eating goals, and to make healthful choices informed by what they had learned. At this stage, children reflected on their eating and generated alternatives (new plans informed by self-

reflection) almost automatically to improve their current eating at school, as evidence by verbalizations that showed planning the food choices of next meal (e.g., "*I don't have much in vegetables today, I will eat [them] at home tonight*."). Likewise, the food-train served as a technique to help children keep track of their plans, monitor their progress and generate new plans as needed.

Likewise, children reportedly reflected on their eating and generated healthier alternatives without prompts at home. This may serve as evidence of children's "knowing-in-action" (Schön, 1983), as they engaged in reflection as part of their everyday routines to make wise food choices. Although self-regulation has been widely used in a variety of education settings for adults and young adults, providing developmentally appropriate scaffolding strategies to support goal setting, self-monitoring, and self-evaluation may allow young children to utilize these techniques to reflect on their learning.

Another final implication would be to involve parents in the reflection activity. While family-based interventions do not necessarily have a greater impact on children's behavior changes than individual-based interventions (Bourdeaudhuij et al., 2002), involving parents and working together with teachers has been shown to be an influencing factor for young children to increase knowledge and to consume more nutritious foods (Essa et al., 1988; Koblinsky et al., 1992). Other studies (Crockett et al, 1989; Nader et al, 1989) found that parents preferred to participate in their child's nutrition education through activity sheets or homework assignments but were less interested in attending weeknight or weekend sessions or receiving telephone calls (Contento et al., 1995). Given previous research findings, the reflection activity in this

study could be extended to involve parents' participation. For instance, parents could be given paper copies of the child's e-portfolio, along with a general assessment of limitations. Parents could then be asked to discuss this with their children and to generate eating goals together. This could both enhance connections to homes and leverage the one-on-one interaction that parents can more ideally provide for in this context.

Implications for Future Research

Nutrition education at young age would be beneficial to help children make lifelong changes. Furthermore, the home environment is identified as one of the most prominent influences on the development and food knowledge beginning with preschoolers (Vaines, 1999). The current study was not designed to involve parents, but parents' lack of nutrition knowledge is very influential on their children. In this study, as parents became interested and involved in the study, some reported an increase in understanding of nutrition concepts and, in one case, a shift in parent-child interactions about nutrition at home. Interaction with parents about nutrition is likely needed for more long-term behavior changes.

Accordingly, one area of future research that is suggested by this study is to design a study to involve parents to support their children's reflection upon everyday eating experiences. For instance, a future study could investigate reflection and goal-setting behaviors of parents and their children. This would expand the unit of analysis beyond the student to include conceptions and goals of parents as well. Similarly, future research could explore the nature of the interactions of parents and children at home to better understand children's existing nutrition concepts and behaviors as well as any

possible conflicts or barriers to the proposed family-oriented nutrition education intervention. Considering that all the parents of the participants reported that they talked about healthy eating with their kids at least 2-3 times a week at home, a future study may ask children to videotape health-related interactions at home in addition to taking pictures of their eating. It could be used as a basis for understanding children's foundation of nutrition knowledge and behaviors and for identifying any possible barriers to change behavior (e.g., cultural conflicts with what children learned at school and at home). In addition, showing the video footage to the child and parent to reflect on behaviors together could also help them deepen understanding of that experience which could elicit active parental involvement to rest of the learning process.

Each individual has different learning styles and different intelligences (Gardner, 1983; appeared in Smith, 2002). Some may learn better when the information is visually presented as a picture while others could learn better by hands on activity. With the advent of technology, various technology tools are available to capture everyday experiences such as digital cameras, mobile phones, audio recorders, and camcorders. Using different tools to record everyday experiences and to represent them could be beneficial for individuals having different learning styles. For older children, for instance, the effects of taking pictures of experiences verses recording them on paper or on audio could be investigated.

Similarly, in this study, students analyzed their own food data independently, without collaboration with other students. According to Toth (n.d.), collaborative reflection with shared representations could be promising to enhance students' learning. How to involve other students in collaboration about independently-generated data from

experiences was not explored in this study and the effect of peer-interpretation on reflection could be further investigated. For example, instead of working independently, using file sharing software, personal web-blog, or bulletin board supporting multimedia format could be used to upload individual's data, review peer's representation of data, sharing ideas, and prompt reflections of each other. One's dietary habit is not shaped by nutrition knowledge alone, but shaped by various environmental influences such as peer-modeling, availability of foods, parental modeling, and media influences. (Birch, 1999; Birch & Fisher, 1998; appeared in Land et al., 2007). Therefore, exploring the effect of sharing individual experiences and reflections with peers in terms of healthy eating may give us a better understanding of the environmental factors at school which motivate children to behave in particular ways.

Limitations of the Study

Difficulties to Implement in a Larger Classroom Setting

The study required children to carry their cameras and voice recorder everyday to record all their meals. Since participants are young children, their parents were asked to pick up the camera and voice recorder from school and bring them back to school next morning. Often, parents forgot to bring back the camera and voice recorder, and they had to go back home to bring them back to school. It was extra labor for working parents as two parents commented at the interview and survey.

In addition, this study required downloading and management of all the photos and voice logs everyday, in addition to reviewing and organizing them in the e-portfolio for the next activity. If the approach were to be implemented in a larger-scale setting, it

could be too time consuming for a teacher to handle all the photos that children have taken and to prepare them in advance in a timely manner.

Incomplete Dietary Assessment

A single 24-hour dietary recall interview procedure was validated for assessing dietary intakes of preschoolers and pregnant women in the study of Ferguson and his colleagues (Ferguson et al, 1989, 1995). Other studies suggest that three-day food records are a valid and reliable instrument to assess dietary intakes of children (Crawford et al., 1994). In the present study, two-day food pictures were used to assess children's regular dietary intakes before the instruction, and three-day food records were used to observe children's eating after the instruction. Two moms among the participants reported that two-day dietary records before the instruction did not properly represented their children's general intakes. For example, despite the fact that Beth's mom agreed that the goals set by Beth were appropriate (e.g., eating more meat and beans and vegetables), she didn't think two-day food pictures represented Beth's general eating at home in that it included an irregular unhealthy meal (e.g., "*we usually eat healthy. Pizza was really an outlier, we never eat pizza at home...I have been aware [that] she doesn't have enough meat and I have been researching about it...*"). Chris's mom didn't think Chris's goal (eating more fruits and meat & beans) was appropriate for his general eating, although he was trying to eat more healthy foods during the study at home. ("*Chris is a good eater in general including fruits. I have not had any trouble for Chris's eating.*"). When considering children eat more meals at school (breakfast, lunch, and snack) than at home (dinner and desserts) during the week day, two-day food pictures may have represented

children's eating at school more accurately than at home. Otherwise, two-day dietary records may not be able to represent children's usual eating

Generally, to assess long-term dietary intakes, food frequency questionnaires (FFQ) are used, and they are regarded as accurate instruments for that. For children, FFQ is usually conducted with a parent instead. In this study, the researcher didn't conduct a FFQ and only relied on two-day food pictures to assess children's general dietary intakes. Although two-day pictures displayed children's eating for the specific two-day period accurately, it may have not represented some of the children's general dietary intakes.

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APPENDIX A

Original Informed Consent Form/Student Assent Form

INFORMED CONSENT FORM FOR SOCIAL SCIENCE RESEARCH
The Pennsylvania State University

Title of Project: Reflection on Everyday Food Choices: Using Digital images as artifacts

Principal Investigator: Dr. Susan M. Land
315 Keller Building
University Park, PA 16802
sland@psu.edu; 814-863-5990

Other Investigator(s): Dr. Brian K. Smith
Sunghyun Park
Brian Beabout
KyoungNa Kim
Danita Hill

1. **Purpose of the Study:** The purpose of this research is to study how children use digital cameras to take pictures of their food choices in order to promote better understanding of health and nutrition.

2. **Procedures to be followed:** Your child will be loaned a digital camera, along with instructions for handling it, and asked to photograph all the food they eat for a period of time (3 days to one week). Then, the images will be stored to CD-ROM. Your child will then examine these food choices in terms of their healthiness. Then, your child may be asked to make a plan (with parent assistance) for identifying what changes they could make to at least 3 meals to make them healthier.

3. **Discomforts and Risks:** There are no risks in participating in this research beyond those experienced in everyday life.

4. **Benefits:** Your child might become more aware of his or her eating habits and improve the healthiness of some of these food choices in the future. Your child might have a better understanding of nutrition and how that relates to the food choices they make.

   This research might provide information about how to better teach children about nutrition and healthy eating. This information could help children improve their health and avoid sicknesses related to unhealthy eating habits.

5. **Duration/Time:** The study will take less than one month total. Picture taking will take about one week. Your child will analyze his or her food choices for a maximum of 5 class periods (50 minutes each).

6. **Statement of Confidentiality:** Only the person in charge and her assistants will know your child's identity. The data will be stored and secured at 310-D Keller Building, Penn State University in a locked file. The following may review and copy records related to this research: The Office of Human Research Protections in the U.S. Dept. of Health and Human Services; The Penn State University Social Science Institutional Review Board; The Penn State University Office for Research Protections. Your child's name will not appear on any written publications of results.

7. **Right to Ask Questions:** You can ask questions about this research. Contact Dr. Susan Land at 814-863-5990 with questions. If you have questions about your child's rights as a research participant, contact The Pennsylvania State University's Office for Research Protections at (814) 865-1775.

8. **Compensation:** There is no compensation for participation in the study.

ORP USE ONLY: IRB# 20914 Doc. #3
The Pennsylvania State University
Office for Research Protections
Approval Date: 05-02-2006 DWM
Expiration Date: 04-27-2007 DWM
Social Science Institutional Review Board

STUDENT ASSENT FORM
FOR SOCIAL SCIENCE RESEARCH
The Pennsylvania State University

TO BE READ ALOUD BY THE RESEARCHER

Hi! My name is Susan Land and I have a project that you might like to help with. This project is about "Food Choices." Your parent(s) know about this study, and said they will allow you to be in it, if you want.

ASKS: Is it OK to tell you more about the project? (Circle One)

NO
YES

READS:

I would ask you to take pictures of your food. You would use this camera to take the pictures. Later, when you see the pictures, you would say how healthy you think the foods in the picture are. Then you will get to learn more things about healthful foods from teachers and parents.

Your mom or dad said it is OK for you to do this, but you do not have to. You can say if you do not want to take pictures, or stop if you want. Just say "I want to stop." Also, a video camera might be used in the classroom. You do not have to be on the videotape if you do not want. Just say "I do not want to be on the video, please."

ASKS QUSTION: Would you like to help? (Circle One)

NO
YES

****

THIS SECTION IS TO BE COMPLETED ORALLY BY THE RESEARCHER, WITNESS, AND CHILD

_____
Will you tell me your name?

Sunghyun Park November 29, 2007
Signature of Researcher Date

_____
Signature of Witness: Date
Witness Signature (for verbal assent)

APPENDIX B

Lesson Plan One

The following lesson plans can be modified based on the classroom situation and prerequisites of the students.

THEME: Five food groups

OBJECTIVES: Learners will be able to categorize foods into the groups: l) grains, 2) fruits, 3) vegetables, 4) milk and cheese, 5) meats.

LESSON SEQUENCE:

1. Place food group posters on the board
2. Review the role of each groups in the body
3. Explain that fats and sweets taste good but do not give you building blocks for growth and to be healthy.
4. Categorize two or three pure foods.
5. Explain that some foods are mixed and have parts from different food groups.
6. Choose relatively simple mixed foods (i.e., sandwich) from food model and have children discuss what is in the food.
7. Progress to more complicated mixed foods (from school menu?)
8. Examples:

   Sandwich—meat and bread

   Sandwich—meat, bread, lettuce, tomato

   Spaghetti and meat balls—noodles, tomatoes, meat

   Macaroni and cheese—noodles and cheese

* Introduce that all fried things contain extra fat…

9. Closure: We learned that some foods are mixed and have parts from different food groups. We learned how to put each of these parts in the right food group to see if we are eating a balanced diet.

Lesson Plan Two

THEME: Eating a Balanced Diet *(with general food images/with first children's pictures/with ideal meal pictures)*

OBJECTIVES: Students will be able to utilize the food pyramid to evaluate if you are eating a balanced diet.

LESSON SEQUENCE

1. Introduce the Food pyramid to the children. Show them that there is a section for each food group, and in each section you can put a food image each time you eat it.
2. Show an example: You eat an apple. You would take the apple food card and put it in the fruit section.(with tape??)
3. To see if you are eating a balanced diet: (kids' own food image or general food image?)
4. Describe how we look at what we eat in one day, categorize the foods, put them in the right section, and then see if that section is filled up or not
5. Ask: If one section is not filled up at the end of the day, are you eating a balanced diet? (no)
6. If one section has too many foods in it, it is overfilled. Are you eating a balanced diet? (no)
7. You want to fill up each section, but you do not want to over fill it.
8. Put a sample menu for a day on the board.
9. Have volunteers identify what food group(s) each food belongs with. Have the children who identify the correct food group place the food in the correct section.

10. Have children suggest ways to balance the diet. (More fruits and vegetables, and less meat and fats and sweets.)
11. e.g. Suggestions to help balance diet:

    Substitute spaghetti with tomato sauce for fried chicken

    Put a slice of tomato on the roast beef sandwich

    Eat an apple for lunch instead of the cookies
12. Make substitutions and re-evaluate diet.
13. Put pyramid back together.
14. Have children evaluate each section, one at a time, to see if it is too full or partly empty.
15. Closure: Today we learned how the food pyramid can help us make sure we are eating a balanced diet.

APPENDIX C

Lesson Activities

Food Pyramid game: Assess the knowledge of food groups.

1. Divide students into 2 groups
2. Each student will receive a bag with a variety of food images from all food groups. The images will be previously coded to identify students.
3. When the game begin, students run to the food pyramid outline with food group label and place the food images from the bag onto the food groups in the correct place as fast as possible and then race back to he starting line.
4. The correctness will be examined.

Healthy Snack Games: Assess the ability of distinguishing healthy foods from junk.

1. Students will receive healthy foods and junk foods pictures. . The images will be previously coded to identify students.
2. 2 pieces of poster board marked with green, yellow traffic light will be introduced. Green light means kids should feel free to go ahead and eat lots of healthy foods. Yellow light means slow down, and prepare to stop. Kids should only eat junk foods once in a while, if at all.
3. Children will choose 2-3 healthy and junk food pictures from the given foods, and glue down onto the correct poster.
4. The correctness of the foods glued will be examined.

Challenge the Balance*: A*ssess the behavior changes after the study

1. The class will receive the charts with the picture scale stickers (sad → happy faces). On the chart, students' names, 3 meals and a snack for a week and the identified specific goals for individuals are listed.
2. Students will be asked to come up to the chart after each meal and snack and think about if they made any positive changes to accomplish goal. (The dinner will be marked in the following morning. Parents' helps will be asked) Stickers will be placed in the chart. If the student tried more than one change, more stickers can be added to the chart for the applied meal. (e.g. ate one more vegi and drank up milk in the lunch: 2 smiley stickers)
3. Students will compare their personal and whole class progress with an identified goal.
4. The number of smile stickers will be counted after a week, and the small incentives such as stickers, pencils, etc will be offered when they reach the class goal of collecting # of smile stickers.
5. Interview will be followed with the chart to get more detailed information of behavior changes.

APPENDIX D

Survey and Interview Questionnaires

Mid-interview with children

Mid-Interview Questions Name: _____

After moving all the icons to the pyramid: (To assess reflections on their own eating: self awareness)

1. Ask questions→Review the pyramid together. This is your eating for the day (Nov 29).

1) Do you think you ate from all five groups? (yes ; no)
2) Is there any group (or groups) need to eat some more?

   _____

3) Is there any group (or groups) overfilled?_____
4) Did you eat anything NOT healthy?_____

2. **Do you think you ate healthy? (ask them to circle the smiley face)-refer to kid's own food pyramid activity**

Healthy So-so Unhealthy Don't know

3. **Why do you think so (Why did you circle smiley face)?**

4.Is there anything surprised you? (Yes; No) For example, you ate a lot of grain group(orange color) for the day.

1. Why were you surprised?

6. **How can we make meals for the day better (how?) →guide the kid to set a goal and plan**

Goal:

Plan:

Post interview with children

Post-Interview Questions Name: _____

1. Bucket activity using 3 day food-train icons

2. What are healthy foods?

3. Look at your train and circle the smiley fact how healthy you ate for last 3 days (From Tuesday to Thursday)?


Healthy


So-So


Not Healthy


Don't know

4. Why do you think so? (Why did you circle the smiley face?)

Q5 - 7: Before you eat

5. Did you think about if the food you want to eat is healthy or not before you eat?

6. Did you choose not to eat because the food was not healthy? What was that?

7. Did you choose to eat because the food was healthy? What was it?

Q8 – Q10: While you are eating

8. Did you think about if you are eating foods?

9. Did you stop eat because it is not healthy?

10. Did you eat more only because it is healthy for you? (or to accomplish the gaol?)

Q11-Q12. After eating

11. Did you regret because you ate not healthy food?

12. Were you proud of yourself because you ate healthy meal?

13. (Showing Food pyramid and train) Did you find anything different in the train charts from your previous pyramid activity? (Do you think your eating got better?)

14. Why do you think so?

Electronic Pre-Parents Survey

Parents Survey Form (The study of nutrition education with digital images)

Thank you for your help to the study! We hope your child has enjoyed the activities with digital camera and voice recorder. Please take a moment to fill out and return this survey by Wednesday , December 6th.

1. Please type the name of your child.

2. Do you work a health-related job environment?
   - o Yes. Please specify the job title:
   - o No

3. How often did you talk with your child about nutrition or food healthiness for last 6 months? (for example, XXX has a lots of fat in it; XXX is (not) good for your body)

   - o Never
   - o Less than once a month
   - o 1 to 3 times a month
   - o once a week
   - o 2-6 times a week
   - o Everyday

4. Has your child changed his/her eating behaviors while taking photos and recording their voices in last two days, Nov. 29th (wednesday) and Nov. 30th (thursday) in order to take healthy food pictures?

   - o Yes.
   - o No

* If you answered “yes” for the above Question 4, please describe the behavior change.

5. Has your child talked more often than usual about foods and healthiness at home last week (Between Nov. 28 and Dec. 3rd)?

   - o Yes.
   - o No

6. Has your child tried to change their eating at home last weekends? (Between Dec 1st and Dec. 3rd)?

   - o Yes.
   - o No

* If you answered “yes” for the above Question 6, please describe the behavior change.

7. Please feel free to expand on any of the answers you provided above or any comments on the study.

* * We will contact you again upon conclusion of the study on Friday December 15. At that time, you will have the choice of completing a hard copy of the survey, e-survey, or a short interview when you pick up your child at the Bennett Center. Please specify your preference:

- Hard copy survey
- Electronic survey. Please specify your email address that we can reach you.
- 10 minute interview. Please specify your preferable time slots for the interview on Friday, December 15, with your contact information.

Please contact Sunghyun Park at shp115@psu.edu if you experience any difficulties upon submitting the survey.

Post-Interview with Parents

1. Overall, how was your child doing during the study (for last three weeks?)
    1) Did he/she enjoy the study?
    2) Have he/she talked more about healthy foods during the study than usual?
    3) Have he/she been more conscious about her eating than usual? Why do you think so?
        a. Did he/she eat the new foods that she didn't like or didn't try before?
        b. Did he/she eat more of foods because it is healthy or it is her goal?
        c. Did he/she give up any foods she likes?
    4) When was your cihld more conscious about her eating? Beginning of the study(taking pictures) vs. End of the study (charting activity at school+ recording voice at home)
    5) Overall, did he/she eat healthier than usual during the study periods?
2. In this week (especially from Tuesday through Thursday)
    1) Did your child change his/her eating to accomplish her goal? What was it?
3. Overall about your child's eating
    1) How was his/her eating? Did he/she eat good veggies and fruits (goals)?
    2) Do you think the study affected his/her eating? How?
    3) What was the biggest change in his/her eating after the study, if any?
    4) Were there any comments, suggestions, or difficulties during the periods on the study?

Post Interview with the teacher

1. How were kids eating before the study? Were they good eaters? (Individually)

2. Do you think the study affected the children's eating? Why do you think so?

3. Are there any changes after/during the study?

4. What would be biggest change after the study?

5. Do you think the goal was appropriate for them?

6. Do you think kids get aware of their eating?

6. When were the kids more conscious about their eating? (Beginning of the study: taking pictures vs. end of study : voice recording with train charts)

7. Any additional comments about kids that you want to address?

8. Were there any comments, suggestions, or difficulties during the study?

APPENDIX E

Rubric for the kids' diet improvement scores in relation to their goals

CRITERIA		Score
To improve in the amount/quality of food intakes	**To meet daily recommendation**	
	The improved food group intakes met the daily recommendation of USDA	4
The amount of consumption from the applied food group changed positively MORE THAN 50 % of the amounts that are needed to accomplish the goal. *Abby: More than 50 % of fruit consumption came from fresh fruits.	The improved food group intakes did NOT meet the daily recommendation of USDA	3
The amount of consumption from the applied food group changed positively LESS THAN 50 % of the amounts that are needed to accomplish the goal. *Abby: Less than 50 % of fruit consumption came from fresh fruits.	The improved food group intakes did NOT meet the daily recommendation of USDA	2
The amount of consumption from the applied food group was not changed. *Abby: No fresh fruit was consumed.	The improved food group intakes did NOT meet the daily recommendation of USDA	1
The amount of consumption from the applied each food group was diminished.	The improved food group intakes did NOT meet the daily recommendation of USDA	0

VITA

Sunghyun Park

Ph. D in Instructional Systems (August 2007)

The Pennsylvania State University, University Park, PA

Thesis: “Changing nutrition knowledge and behavior in young children: The role of reflection on personally-relevant, technology-rich representations”

M. Ed in Instructional Systems (December 2001)

The Pennsylvania State University, University Park, PA

Thesis: “The beating the odds project: helping at-risk students through instructional systems design”

Certificate in Mandarin (Chinese) Training Center (July 1996)

The National Taiwan Normal University, Taipei, Taiwan

B.S in Food and Nutrition (February 1995)

Ewha Womans University, Seoul, Korea