

## **A Critical Thinking Approach Increases Offerings of Dark Green Leafy, Yellow / Orange, Cruciferous Vegetables, and Tomatoes in the Diets of Low-income Children**

**Ingrid Karen Richards Adams**

Assistant Extension Professor  
University of Kentucky

**Cheryl O. Hausafus**

Associate professor  
Iowa State University

**Suzanne Hendrich**

Professor  
Iowa State University

### **Abstract**

To evaluate the effectiveness of a critical thinking (CT) educational approach for Head Start parents in increasing offerings of dark green leafy, yellow/orange, cruciferous vegetables, tomatoes (specific vegetables), in their children's diets. A two-group (experimental, control) randomized, pretest-posttest design was used. The experimental group participated in two 45-minute sessions on vegetables based on the CT approach. A CT definition, model, curriculum and lesson plans were developed. Significant differences were found between the experimental and control groups in mean posttest scores for vegetable knowledge 3.72 (SE 0.26) and 2.99 (SE 0.26), for critical thinking 2.34 (SE 0.63) and 0.73 (SE 0.47), and offerings of specific vegetables 6.11 (SE 0.48) and 4.97 (SE 0.45). There was no change in attitudes towards vegetables during the study. Participants already possessed positive attitudes before the intervention. Future work should continue the development of the critical thinking methodology.

**Key words:** Vegetables, critical thinking, low-income, chronic diseases, evaluation, Head Start.

## Introduction

Vegetables provide a broad variety of essential and non-essential nutrients and offer multiple health benefits, including a decrease in the risk for chronic diseases such as cancers, cardiovascular disease, cataracts, diverticulosis, chronic obstructive pulmonary disease, and hypertension (Buzzano 2006; Dauchet et al. 2006; Kant 2004; Lock et al. 2005; Nöthlings et al. 2008; Steinmetz and Potter 1996; Van Duyn and Pivonka 2000).

Scientific studies show particularly dark green leafy, yellow-orange, and cruciferous vegetables as being leaders in the fight against chronic diseases (Hung et al. 2004; Joshipura et al. 1999; Joshipura et al. 2001; Liu et al. 2001; Van Duyn and Pivonka 2000; Zhang et al. 2009). These vegetables could significantly impact the public's health if eaten more often (Nanney et al. 2004). Low-income individuals and their children consume lower amounts of these vegetables and experience higher incidences of chronic diseases than individuals with higher income (Anderson and Butcher 2006; Lock et al. 2005; Herman et al. 2008; Perry, Lytle, and Feldman 1998).

There is a need for interventions with low-income individuals who are more likely to consume diets low in vegetables (Bazzano 2006). Determining what type of interventions is appropriate with low-income individuals is the first step. Devine (1980) mentioned that one goal of nutrition education is to provide adequate knowledge and skills necessary for critical thinking regarding diet and health so that individuals can make appropriate food choices from an increasing array of contextual factors. Previous studies have used critical thinking and related strategies in nutrition interventions. For example, an instrument was developed to assess critical thinking constructs in nutrition audiovisual materials (Nitzke, Harwood, and Way 1992), and the effectiveness of a food safety teaching strategy to promote critical thinking was undertaken (Reicks et al. 1994). Facilitated group discussions (Abusabha, Peacock, and Achterberg 1999) and "think aloud" techniques have also been employed (Reicks et al. 2003). This study proposed critical thinking methodology specific to andragogy to encourage low-income parents to increase offerings of dark green leafy, yellow-orange, cruciferous vegetables, and tomatoes (hereafter referred to as specific vegetables) in diets of their children.

A critical thinking approach was chosen because it provides individuals with the tools necessary for reasoning, problem solving, and sound decision making. Adult learners are a diverse group with many experiences and it is strongly suggested that andragogy facilitates learning rather than imparts knowledge. (Brookfield 1987; Darkenwald and Merriam 1982; Delahaye and Ehrich 2008; Garrison 1991; Kelly 2006; Knowles 1980; Knowles, Holton III, and Swanson 2005; Trotter 2006). The approach used in this study provided individuals with opportunities to think critically, solve problems collaboratively, and make decisions in their best interests—consistent

with adult learning practices.

### Critical thinking definition and model

A critical thinking definition and a six-part critical thinking model were developed for the intervention. Critical thinking was viewed as the process whereby individuals analyze and evaluate information, a situation, or their behaviors in order to make fully informed decisions while reflecting on their thought processes. This definition captured the critical thinking tasks needed to be performed by this particular group and as a result, was context specific. Authors suggest that critical thinking is both discipline and context specific (Brookfield 1987; McPeck 1981). Bissell and Lemons (2006) proposed that consensus in definition is less important than selecting a definition that meets our needs.

The critical thinking model consisted of stimulus, empowerment, critical response, outcome, action, and reflection. See Figure 1. Critical thinking model. In the literature, the stimulus for critical thinking may take the form of a statement, a claim, a problem, an issue, or an argument (Brookfield 1987). In this study, the stimulus was presented in the form of statements, problems, and issues such as statistics on vegetable use and chronic diseases in low-income individuals, the benefits of specific vegetables in the diets of children, and questions of the best gift parents could give to their children. The issues presented in the stimulus were used to initiate participants' thinking processes.

Empowerment was viewed as increasing one's capacity to define, analyze, and act on his or her own problem (Kent 1988). The philosophical underpinnings of empowerment suggest that individuals have valid and essential knowledge of their own needs, values, and goals, and as a result, they possess the strength and competencies to solve their own problems (Cochran 1986; Kent 1988; Rappaport 1981; Sigot 1996; Vanderslice 1984). Brookfield (1987) stated that adults are predisposed to critical thought mainly because of their experiences. In the present study, to empower participants, they were asked why they think adults are predisposed to critical thoughts. The main response was because of their many experiences. Participants were then informed that because of their many experiences, they have the ability to examine their situations, solve problems and make decisions in the best interests of their children.

Critical response consisted of the presentation of scenarios related to barriers parents encounter while offering vegetables to their children. Participants were asked to identify the problem and state contextual factors needed for its solution. In addition, they were asked to suggest solutions to the problem, choose the best way to solve the problem, and to provide justification for their choice.

During the outcome process, participants were asked to identify problems they encountered while offering their children vegetables and to suggest possible solutions.

In the action stage, participants identified two steps they might take to increase offerings of specific vegetables in the diets of their children. They were asked to put those steps into practice in the upcoming week.

Reflection was a central component in the model and was encouraged after each of the steps mentioned above. For example, during stimulus (statistics on vegetable use and chronic diseases in low-income individuals, the benefits of specific vegetables in the diets of their children, and the question of what is the best gift parents could give to their children), parents were asked several other questions: What surprised you the most about the information that you just heard? Why did this surprise you? How can you best remember this information? After the empowerment stage, parents were asked: Are you doing what is best for your child in terms of vegetable offerings? What is the greatest barrier you must overcome in increasing the number of these specific vegetables you offer your child? What has worked for you in the past when offering vegetables to your children? (Richards-Adams 2006). See Figure 1. Critical thinking model.

## **Methods**

### ***Participants***

The Head Start program serves children from birth to five years of age who meet federal poverty guidelines. Parents of the children enrolled in 16 centers in the Head Start program in Polk County, Iowa were invited to participate in the study. Incentives such as bean bags, salad bowls, and cups were given to parents for participation. The Iowa State University and the Drake University Institutional Review Boards: Human Subjects approved the study.

### ***Research design***

A two group randomized pretest-posttest design was used for the study. Head Start operates six different program options in 16 different centers in Polk County. The six program options were used to assign the 16 centers to either experimental or control groups. This ensured that parents in the various program options were equally represented in both the experimental and control groups. Student's *t*-tests used to compare experimental and control groups on the dependent measures assessed prior to the intervention indicated that the random assignment succeeded in equating the two groups of participants. Parents in the experimental group completed the pretest and posttest questionnaire at the beginning and end of the study, and were exposed to the intervention. Parents in the control group also completed the pretest and posttest questionnaire but were not exposed to the intervention.

## **Intervention**

The intervention consisted of two 45-minute sessions—one session per week for two consecutive weeks. The researcher conducted both sessions. A two lesson critical thinking curriculum developed by the researcher was used in the intervention. The curriculum consisted of objectives, background information, and rationale for focusing on young children, specific vegetables, and critical thinking (Richards-Adams 2006). Each of the two lessons was structured according to the critical thinking model. Lesson one focused on what parents should do regarding increasing specific vegetables in their children's diets. Lesson two was similar to lesson one but focused on the positive environment in which vegetables should be offered. At the end of each session, two food items were prepared using some of the specific vegetables emphasized in the intervention. For example, spinach salad, pumpkin smoothie, and other recipes were prepared. The intervention was conducted at six sites with two sessions per site. Twenty eight individuals participated in the intervention. Groups ranged from two to six individuals. A total of twelve parents attended both sessions of the intervention; seven attended only session one, and nine only session two.

## **Data Collection**

Data were collected during a four month period using the Knowledge, Attitude, and Critical Thinking Questionnaire (KACQ).

## **KACQ**

The KACQ contained a demographic section and measures of the dependent variables: knowledge, attitudes, critical thinking skills, and vegetable offerings.

**Knowledge.** This section consisted of four multiple choice questions. One question listed eight vegetables and asked parents to circle those that best helped their child avoid chronic diseases. One point was awarded for each correct response. The scores on question one ranged from 0 to 4. The other three multiple choice questions focused on vegetable serving size for a 2- to 4-year old child, the approximate time it may take for children to accept a new vegetable, and the best environment in which to offer vegetables. One point was awarded for each correct multiple choice response. Total scores ranged from 0 to 7.

**Attitudes.** Parents used a four-point Likert-type scale (1 = very unimportant to 4 = very important) to rate the importance of offering their children vegetables daily, finding new ways of offering their children vegetables, purchasing vegetables instead of candies and snacks, and purchasing vegetables when limited finances were available. Responses to the four attitudinal statements were summed to obtain a composite score for attitude with each statement carrying

equal weight. Total scores ranged from 4 to 16 with higher scores denoting more positive attitudes. Cronbach's alpha, used to measure the reliability of the set of attitudinal items, was high for both the pretest (.92) and posttest measures (.86).

**Critical thinking.** The following scenario was used to determine parents' critical thinking. At the Special Supplemental Nutrition Program for Women, Infants, and Children (WIC) clinic, Joan was told that she needed to offer her children more vegetables. Joan mentioned that she was afraid that she would not have enough money to do this.

A scorecard for evaluating the problem solving framework was adapted from work conducted by Martin (1998) and Laster (1998) and was used to score the critical thinking responses. Based on the scenario mentioned above, parents were asked to identify: (i) the problem, (ii) contextual factors or information needed to solve the problem, and (iii) problem solving strategies. They were asked to choose what, in their opinion, was the best strategy for solving the problem and to provide a justification for their choice. Based on the problem solving framework, one point was awarded if the problem, contextual factors or problem solving strategies were related to money while two points were given if responses were not related to money. In addition, one point was provided if more than one problem, contextual factor or problem solving strategy was given. In the area of choice and justification, one point was given if a choice was made with no justification, two points were awarded if a choice was made with justification, and one point was awarded if more than one reason was given for justification. Therefore a respondent could receive scores on a range from 0 to 12. Three educators trained in administering the scorecard graded the responses collaboratively and opportunities were provided to discuss inconsistencies or disagreements. See Table 1. Scorecard for Evaluating Problem Solving.

**Vegetable offering recall.** From a list of 36 vegetables, participants selected the vegetables they offered their child during the previous week. The 2005 Dietary Guidelines for Americans (U.S. Department of Agriculture) was used as a guide for the vegetables selected on the vegetable recall measure.

**Validity of the KACQ.** Four university professors with expertise in education examined the KACQ for clarity and readability. Four low-income individuals not involved with the study completed the KACQ and provided information on ambiguity and time needed to complete the instrument. An expert in curriculum and evaluation examined the critical thinking section of the KACQ to determine whether the content adequately assessed critical thinking, and appropriate changes were incorporated. The study was piloted with seven parents from the Child Development Laboratory School at Iowa State University.

## Data Analysis

The data were analyzed using SPSS computer software (version 13.0). In analyzing the data, descriptive statistics were first computed. Analysis of Covariance (ANCOVA) was conducted with the posttest scores of each outcome variable as the dependent variable. Group (experimental versus control) was used as the independent variable and the pretest score of each dependent variable was used as the covariate.

## Results

Of the 77 individuals who participated in the study, 23 did not provide complete data and were excluded from the analysis. Results of a 2x2 ANCOVA, group (experimental versus control) by data (complete versus incomplete), revealed that there were no significant differences in mean pretest scores on the dependent measures (knowledge, attitude, critical thinking, and vegetable offerings) between those who completed the post-test and those who did not.

Most parents were Caucasian, female, between the ages of 18 and 39 and had a high school or above high school education. Approximately half were married. The mother was the person who shopped for and prepared foods for the children. See Table 2. Demographic Information for Participants in Experimental and Control Groups.

There was a significant difference in vegetable knowledge between the experimental and control groups,  $F(1, 45) = 3.83, p \leq .05$ . The adjusted means were 3.72 ( $SE = 0.26$ ) and 2.99 ( $SE = 0.26$ ) for the experimental and control groups, respectively. See Table 3. Effects of the Critical Thinking Intervention.

In this study, ANCOVA was used to control for pre-intervention scores of participants on the dependent measures. An initial step in conducting the ANCOVA is to test whether or not the data meet the assumption of homogeneity of regression. The results indicated that this assumption was not met for vegetable attitudes. Therefore, an analysis of variance (ANOVA) was conducted. The results of the ANOVA revealed no significant differences on this measure between the experimental and control groups in terms of post-intervention attitudes toward vegetables,  $F(1,45) = 1.06, p > .05$ . The adjusted means were 3.57 ( $SE=0.51$ ) for the experimental group 3.31 ( $SE=0.53$ ) for the control group. (Table 3). Effects of the Critical Thinking Intervention.

Results for critical thinking skills indicated a significant difference between the experimental and control groups,  $F(1,40) = 4.67, p < .05$ . The adjusted means for the two groups were, experimental = 2.39 ( $SE = 2.66$ ) and control = 0.73 ( $SE = 2.21$ ). See Table 3. Effects of the Critical Thinking Intervention.

Parents in the experimental group reported significantly more offerings of specific vegetables than the control group following the intervention,  $F(1, 42) = 6.17, p < .05$ . The adjusted means were 6.11 (SE = 0.48) and 4.97 (SE = 0.45) for the experimental and control groups, respectively. See Table 3. Effects of the Critical Thinking Intervention.

There was no significant difference in mean posttest scores on other vegetables, that is, vegetables not designated as specific vegetables  $F(1, 42) = 0.34, p > .05$ . The adjusted mean for the experimental group was 6.81 (SE = 0.36) and for the control group 6.51 (SE = 0.35) See Table 3. Effects of the Critical Thinking Intervention.

## Discussion

This study used a critical thinking instructional approach to increase offerings of specific vegetables in the diets of low-income children. It provided opportunities for parents to examine their situations, think about alternative courses of action, discuss and solve problems collaboratively, and personally determine which solution is in the best interest of their children's health.

Positive results were achieved from this critical thinking approach. Following the intervention, parents in the experimental group increased their knowledge of specific vegetables, and the benefit of these vegetables in their children's diets. Increases in knowledge also were observed in a study of Head Start mothers in New York City and Maryland ( $N = 171$ ). The mothers in the treatment group ( $n = 89$ ) received 13 weekly nutrition sessions and had the opportunity to attend four, two-hour nutrition workshops. Knowing the recommended daily number of servings of vegetables was found to be a predictive factor in vegetable consumption, and it was suggested that mothers in the treatment group use knowledge obtained from the intervention to include these dark green and yellow vegetable choices in their children's diets (Koblinsky 1992). In this study, information was also provided on the recommended number of vegetable servings and what counts as an appropriate vegetable serving. Additional information was provided on the importance of offering specific vegetables to children.

The use of specific nutrition information may have been a factor in facilitating increases in knowledge. A report of the United States General Accounting Office indicated that one of the reasons the consumption of dark green or yellow/orange vegetables falls below what is recommended for disease prevention is because many individuals may not be aware of the importance of eating these deeply colored vegetables (United States General Accounting Office 2002). Food supply data showed that dark green or yellow/orange vegetables increased slightly with the introduction of the Food Guide Pyramid, the education tool that provides general guidance for consumers to choose a healthy diet. Nanney et al. (2004) suggested that one reason small increases in consumption were observed over time was that national vegetable and fruit



messages were vague, and specific messages were needed (Krebs-Smith and Kantor 2001; Satia, Kristal, Patterson, Neuhouser, and Trudeau 2002). The use of specific vegetable messages such as how much is needed and what counts as a serving are important factors in the attainment of knowledge.

There was no improvement in attitudes toward vegetables in either the experimental or control groups following the intervention. On a response scale from 1 to 4, participants' pre-attitudes toward vegetables were relatively high in both the experimental (3.57,  $SE = 0.51$ ) and control groups (3.31,  $SE = 0.53$ ) allowing limited room for improvement. Satia and colleagues (2002) assessed psychosocial factors and dietary habits associated with vegetable consumption (N= 838). They also found that participants reported positive attitudes towards vegetable consumption (Satia, Kristal, Patterson, Neuhouser, and Trudeau 2002). Focus groups conducted by Schafer and Nelson (1999) with low-income families also found strong positive attitudes toward healthful behaviors.

Parents in the experimental group improved their ability to think critically about offering specific vegetables to their children. These parents were able to analyze and evaluate their situation and behaviors and make fully informed decisions in terms of offering vegetables to their children. This study developed an instructional methodology to nurture the development of critical thinking skills in low-income parents. This approach is antithetical to lectures or one-on-one sessions that might take precedence in nutrition education. Learning to think critically is one of the most significant activities of adult life and decision making and problem solving are the most relevant tasks faced by adults. As we seek to bring about behavior change in the lives of individuals we serve, our goal in nutrition should be to develop methodologies that would facilitate the development of critical thinking skills.

An important part of developing critical thinking methodology is determining how critical thinking will be defined for the tasks we need to accomplish and for the problems that are unique to the profession. The definition used in this study, the process whereby individuals analyze and evaluate information, a situation, or their behaviors in order to make fully informed decisions while reflecting on their thought processes, was context specific, in that it captured the tasks needed to be performed by the target population. Authors have endorsed this approach (Brookfield 1987; McPeck 1981; Bissell and Lemons 2006).

This study showed that a critical thinking approach where participants are given opportunities to examine their situations, think about alternative courses of action, solve problems collaboratively, and reflect upon their decisions and actions, holds promise for low-income parents increasing offerings of dark green leafy, yellow/orange, cruciferous vegetables, and tomatoes in the diets of their children.

## Implication for Research and Practice

Future research should focus on interventions of longer durations so that it is possible to fully determine the effects of the critical thinking approach. Research shows that it takes repeatedly offering a vegetable before a child learns to accept the food. This study encouraged and measured parents' offerings of specific vegetables to their children. Future studies should measure both the offering and consumption of vegetables. Studies that compare the effectiveness of the critical thinking approach to other instructional approaches should be the next step.

A model consisting of stimulus, empowerment, critical response, action, and reflection was developed for the study. Each of these elements of the model should be tested to determine its effects on critical thinking.

Table 1: Scorecard for Evaluating Problem Solving Framework

[1 Scorecard for Evaluating Problem Solving Framework.]

<b>Scenario:</b> <i>At the Special Supplemental Nutrition Program for Women, Infants, and Children (WIC) clinic, Joan was told that she needed to offer her children more vegetables. Joan mentioned that she was afraid that she would not have enough money to do this.</i>		
<b>Instruction:</b> Do not judge the content of the participant's response but only whether or not the participant gives an indication of the specified indicator (Martin, 1998).		
	<b>INDICATOR</b>	<b>POINTS PER INDICATOR</b>
<b><i>What is Joan's problem?</i></b>		
<b>Problem Identification</b>	No response or statement of the problem	0
	Identifies a problem related to money	1
	Problem not related to money identified	2
	More than one problem identified	1
<b><i>What other information you will need to know about Joan's situation if you are to help her?</i></b>		

<b>Identification of contextual factors/information</b>	No response or identification of contextual factors	0
	Contextual factor stated related to money	1
	Stated factor related to something other than money	2
	More than one contextual factors stated	1
<i>What can Joan do to offer her children more vegetables?</i>		
<b>Problem solving strategies</b>	No response or strategy	0
	One problem solving strategy stated that related to money	1
	Problem solving strategy related to something other than money stated	2
	More than one strategy stated	1
<i>What do you think is the best way to solve Joan's problem?</i>		
<i>Why do you think that solution is the best?</i>		
<b>Choice and justification</b>	No response or choice and justification	0
	A choice was made with no justification	1
	A justified choice was made with justification	2
	More than one reason given for justification	1

Adapted from: Martin, 1998; and Laster, 1998

Table 2: Demographic Information for Participants in Experimental and Control Groups

[Table 2 Summary: Demographic Information for Participants in Experimental and Control Groups.]

		Total (experimental & control)		Control		Experimental	
Demographic		Frequency (#)	Percent (%)	Frequency (#)	Percent (%)	Frequency (#)	Percent (%)
<b>Gender</b>	Male	4	7.5	3	12.5	1	3.4
	Female	49	92.5	21	87.5	28	96.6
<b>Total</b>		53	100	24	100	29	100
<b>Marital Status</b>	Married	27	54	14	63.6	13	46.4
	Other	23	46	8	36.4	15	53.6
<b>Total</b>		50	100	22	100	28	100
<b>Ethnicity</b>	Caucasian	28	54.9	14	60.9	14	50.0
	Hispanic	10	19.6	4	17.4	6	21.4
	African American	6	11.8	2	8.7	4	14.3
	Other	7	13.7	3	13	4	14.3
<b>Total</b>		51	100	23	100	28	100
<b>Age</b>	18-29	28	52.8	13	54.2	15	51.7
	30-39	23	43.4	10	41.7	13	44.8
	40 and over	2	3.8	1	4.2	1	3.4
<b>Total</b>		53	100	24	100	29	100
<b>Education</b>	< high school	5	9.4	2	8.4	3	10.3
	High school	24	45.3	16	66.6	8	27.5
	College	24	45.3	6	25	18	62
<b>Total</b>		53	100	24	100	29	100
<b>Food Shopper</b>	Mother	42	79.2	16	66.7	26	89.7
	Other	11	20.8	8	33.3	3	10.2
<b>Total</b>		53	100	24	100	29	100

<b>Food Preparer</b>	Mother	44	84.6	17	70.8	27	96.4
	Other	8	15.4	7	29.2	1	3.6
<b>Total</b>		52	100	24	100	28	100

Table 3: Effects of the Critical Thinking Intervention

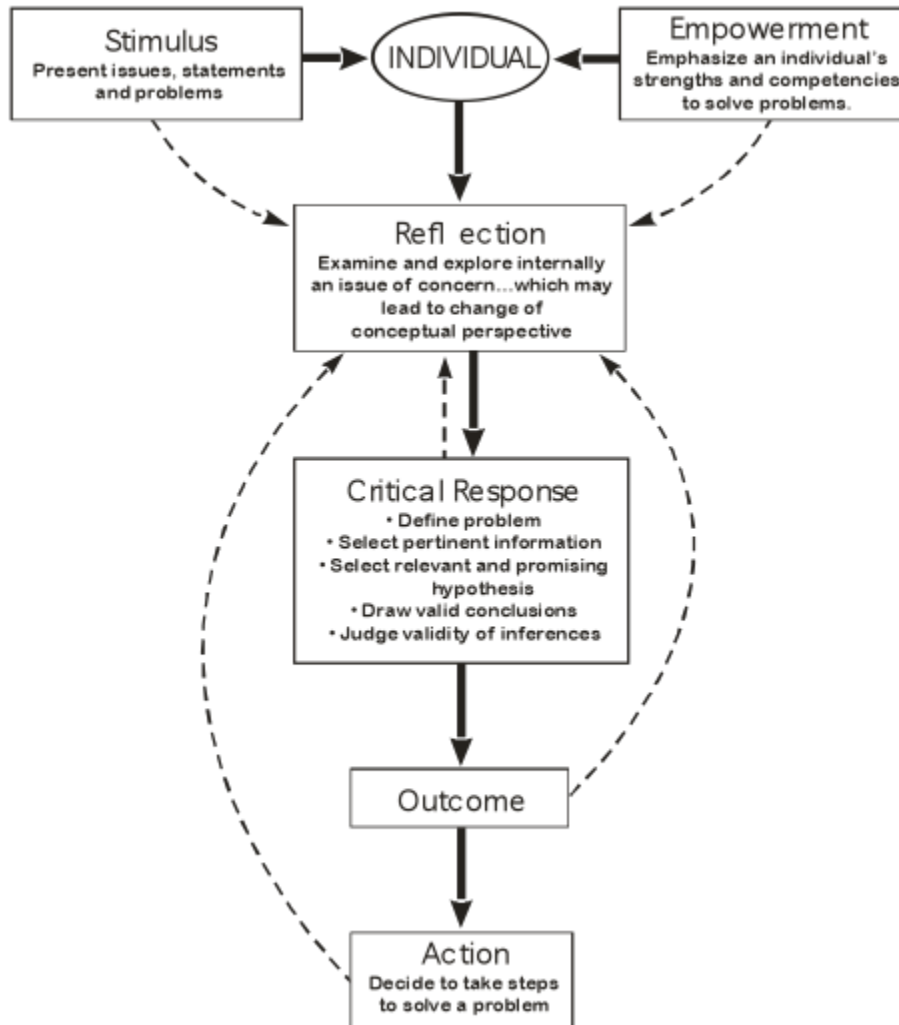
[Table 3 Summary: Significant differences were observed for knowledge, and offerings of dark green leafy, yellow/orange, cruciferous vegetables, and tomatoes offered within one week. No change was seen in attitude score, critical thinking score, and other vegetables offered per week.]

	N		Mean		Standard Error		F	p-value
	Exp.	Control	Exp.	Control	Exp.	Control		
Knowledge score a	24	24	3.72	2.99	0.26	0.26	4.04	*
Attitude score b	24	24	3.57	3.31	0.51	0.53	1.06	n.s.
Critical thinking score a	18	22	2.34	0.73	0.63	0.47	4.67	*
Dark green leafy, yellow/orange, cruciferous vegetable, tomatoes offered within one week a	21	24	6.11	4.97	0.48	0.45	6.17	*
Other vegetable offered per week a	21	24	6.81	6.51	0.36	0.35	0.34	n.s.

aANCOVA performed for dependent measure. bANOVA performed for dependent measure.

\*  $p \leq .05$ . n.s.  $p > .05$

Figure 1. Critical Thinking Model.



### Acknowledgement

We thank the Director of Drake University Head Start, Georgia Sherrif, Ph.D. for her invaluable assistance and support; the program assistants for their help with the intervention; and the parents of Head Start for their participation in the study.

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