

Assessment of critical thinking skills in a low-income population: Development of a methodology

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Abstract

Developing critical thinking skills in adults empowers them to make sound decisions. Seventy-one parents in a low-income preschool program took part in a study to develop their critical thinking skills. A two-group (experimental, control) randomized, pretest-posttest design was used. The experimental group participated in two 45-minute sessions about vegetables and physical activity. The development of a methodology to assess critical thinking included a context-specific definition, problem solving, and the use of scenarios. After the intervention, parents in the experimental group showed improvement in problem solving, especially in areas of problem identification, gathering relevant information to solve the problem, and providing solutions to the problem. Little change was seen in areas of providing rationale and judging the soundness of decisions. Interventions of longer duration could lead to a change in these higher levels of critical thinking. The development of critical thinking skills seems plausible in informal educational settings with low-income audiences.

Keywords: critical thinking, assessment, low-income, scenarios, vegetables, physical activity

Introduction

Adults confront complex and value-laden choices daily (Thomas and Litowitz 1986; Contento 1981). Which foods should they purchase, prepare, and consume, and how should they engage in physical activity given their time constraints? Brookfield (1987) states that adults, by reason of their many experiences, are predisposed to critical thought. However, having the predisposition to think critically does not guarantee sound decision-making, and individuals must be provided with opportunities to develop skills that would promote critical thinking. Norris (1985) asserts that many young people and adults do not have the critical thinking skills necessary for sound decision-making, reasoning, initiative-taking, and problem-solving. Research shows that, with instruction, anyone can improve his or her critical thinking skills (Brookfield 1987; D'Angelo 1971; Halpern 1993; Norris 1985).

Critical thinking is viewed as an intellectual function of adulthood (Thompson et al. 2003), and developing critical thinking skills in adults enables them to make sound decisions. The development of such critical thinking skills requires the conceptualization of a critical thinking methodology (Nitzke, Harwood, and Way 1992), which includes decisions about (a) how critical thinking should be defined, (b) what skills and abilities should characterize the definition of critical thinking, and (c) what instruments should be used to determine the attainment of critical thinking skills. Assessing critical thinking skills is an important aspect of developing a critical thinking methodology but the assessment of any thinking process is never an easy task (Laster 1998). The purpose of this research was to (1) develop a critical thinking methodology for the assessment of critical thinking and (2) determine if there were changes in critical thinking skills after a brief intervention related to vegetable offerings and physical activity.

Review of literature

Definition of critical thinking

The literature is replete with critical thinking definitions that are often varied and inharmonious. Some definitions focus on the nature of the thought process (Halpern 1996; Lipman 1988; Norris 1985), while others equate critical thinking with the use of logic or the science of correct reasoning, such as asking the right question, identifying fallacies in a line of reasoning, proposing lucid arguments, and evaluating ideas and claims (Dauer 1989; Epstein 2000). Other definitions concentrate on the processes that comprise critical thinking, such as problem-solving, (Kurfiss 1988; Mayer 1992), decision-making (Dawes 1988), and reflection (Halpern 1996, 1998). The conception of critical thinking definitions is based to a large extent on the context and the discipline from which the definition originates (Brookfield 1987; McPeck 1981). Bissell and Lemons (2006) suggested that selecting a definition that meets our needs is more important than obtaining consensus.

In this study, the intervention focused on low-income parents making decisions to increase vegetable offerings and physical activity in their 3- to 5-year-old children. Within this context, and based on the tasks that needed to be performed, the author developed a critical thinking definition: Critical thinking was defined 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.

Critical thinking skills and abilities

Several lists of critical thinking skills exist in the literature (American Psychological Association, Burnard 1989; D'Angelo 1971; Darkenwald and Merriam 1982; Dressel and Mayhew 1954; Kurfiss 1988). Our study used skills and abilities, such as defining the problem, selecting pertinent information for the solution of a problem, selecting relevant and promising hypotheses, drawing valid conclusions, and judging the validity of inferences. These skills and abilities reflected the tasks that study participants needed to perform in order to increase physical activity and offer specific vegetables to their children.

Instruments to assess critical thinking

After deciding which skills and abilities to include in assessing critical thinking, the next step was to choose an instrument for evaluation. Preexisting instruments may not be appropriate for every situation (Brookfield 2006; Laster 1998; McPeck 1981). Laster (1981) suggested that an effective approach would be to refine or develop instruments for assessing thinking. Kerka (1992) pointed out that scenario analysis is one of the newer forms of evaluation determining higher order thinking skills, and other authors agree (Halpern 1993; Paul 1993; Reicks et al. 1994; Stone 2002). This study focused on the role of scenarios in evaluating the critical thinking skills of low-income individuals.

Methodology

Parents whose children participated in the Drake University Head Start (DUHS) program within Polk County, Iowa, were recruited for the study. DUHS serves low-income families through 16 centers under six different program options. Researchers used the six programs to randomly assign the 16 centers to either the experimental or control groups. The study was approved by Iowa State University and Drake University Institutional Review Boards: Human Subjects.

Parents in the experimental group completed pretest and posttest questionnaires at the beginning and end of the study, and were exposed to the intervention. Parents in the control group also completed pretest and posttest questionnaires but were not exposed to the intervention. The intervention consisted of two 45-minute sessions—one session per week for two consecutive

weeks. During each session, parents received information on vegetables and physical activity. Lesson One focused on what parents should do regarding increasing offerings of specific vegetables in their children's diets and the importance of physical activity in the lives of children. Lesson Two was similar to Lesson One, but focused on the positive environment in which to offer vegetables, the benefits of physical activity, and ways to overcome barriers to physical activity. At the end of each session participants prepared two food items, and ideas for physical activity were shared.

A six-part critical thinking model consisting of stimulus, empowerment, critical response, outcome, action, and reflection was developed by the researcher and guided the development of the lessons and the implementation of the intervention. The critical thinking model and other aspects of the intervention are discussed in details elsewhere (Adams, Hausafus, and Hendrich, 2010).

Instrument

Researchers used two scenarios (one related to vegetables and the other to physical activity), and five questions to collect pretest and posttest data on parents' problem-solving. The vegetable scenario stated, "At the WIC clinic, Joan was told that she needed to offer her children more vegetables. Joan mentioned that she is afraid that she would not have enough money to do this." The series of questions included (1) What is Joan's problem? (2) What other information will you need to know about Joan's situation if you are to help her? (3) What can Joan do to offer her children more vegetables? (4) What do you think is the best way to solve Joan's problem? (5) Why do you think that solution is the best?

The physical activity scenario stated, "Henry enjoys watching television and playing computer games. He spends at least 4 hours a day on these activities. His father tells him to turn off the television and be active. Henry complains that he does not want to be active." The five questions related to physical activity included (1) What is Henry's problem? (2) What other information do you need to know about Henry's situation if you are to help him? (3) Suggest some things that Henry's dad can do to make Henry more active. (4) What do you think is the best solution to Henry's problem? (5) Why do you think that solution is the best?

The scenarios were ill-defined and characterized as having no single correct answer, making them suitable for assessing critical thinking (Huba and Reed, 2000; Kurfiss 1988; Laster 1998). The five questions that followed each scenario were hierarchical in terms of the level of thinking required. See Table 1.

Validity

Four experts not involved with the study reviewed the scenarios for content validity. Four low-income individuals who were not part of the study provided feedback in terms of readability, clarity, and time taken to complete the questionnaire.

Data analysis

Measures

Researchers used both quantitative and qualitative methodologies to analyze the data (Abrahamson 1983; Berg 1998; Smith 1975). Quantitative measures included word count of responses and a count of the number of times respondents did not provide a response to a question. Content analysis was used as the qualitative measure.

Word count analysis. A word count was derived by tallying the entire phrase or sentence participants provided. This method was undertaken to determine changes in the number of words parents used to describe the problem. The assumption was that as critical thinking skills and abilities increased, parents would use more words to describe or provide solutions to the problem.

No response. To determine if differences existed in the number of no responses between the control and experiment groups following the intervention, researchers recorded and analyzed the number of questions that respondents left blank.

The quantitative data was analyzed using SPSS computer software (version 14.0, for Windows). We used Analysis of Covariance (ANCOVA) on posttest scores with word count and with number of no responses. To determine if the observed number of no responses for each question was due to chance, we analyzed the number of no responses for each question using chi-square and a *p* value less than or equal to .05 as the level of significance.

The open-ended responses from the vegetable and physical activity scenarios were analyzed using content analysis (Berg 1998; Krueger 1997). Two reviewers read the responses to identify reoccurring themes, and the themes were categorized and tallied.

Findings and discussion

Responses from 71 individuals were included in the analysis, 28 from the experimental and 43 from the control group. The experimental group had fewer individuals because they had to attend two sessions of the intervention. Difficulties in recruitment, high attrition, and fluidity are often observed when working with low-income populations (Treiman, Freimuth, and Damron 1996).

Word count for vegetable and physical activity responses

Parents in the experimental group used more words to solve problems related to the vegetable scenario after the intervention, $F(1, 44) = 5.42, p \leq .05, h^2 = .11$. No difference existed in mean posttest scores in the experimental and control groups for the word count for physical activity, $F(1, 45) = 2.50, p \geq .05, h^2 = .05$. See Table 2 for results of means and standard deviations.

Count of number of no responses

There was no significant difference in mean overall posttest scores between the experimental and control groups for no responses related to both vegetable and physical activity following the intervention. See Table 2 for results.

Content analysis of vegetable responses

Question 1: What is Joan's problem?

Individuals in both the control and experimental groups identified money issues as being the main source of Joan's problem at pretest and posttest. Individuals in the experimental group also included a lack of knowledge and a range of other contextual factors, such as "she needs to look at prices more," "she does not know all the resources," "lack of transportation," and "she does not know that veggies can be economical," as the source of Joan's problem after the intervention. This range of responses was not observed in the control group. A higher percentage of individuals in the control group did not respond to this question in the posttest. See Table 3.

Question 2: What other information will you need to know about Joan's situation if you are to help her?

Both groups stated they needed information on Joan's income, her budget, government assistance, and her likes and dislikes. The control group suggested the need for information on the number of kids and Joan's shopping habits. After the intervention, the experimental group suggested a need for a range of information such as "Is she working?" "what she has tried before," and "what worked for her." The control group did not give this range of responses. See Table 3.

Question 3: What can Joan do to offer her children more vegetables?

Purchasing, serving, cooking, and other strategies were mentioned by individuals in both the control and experimental groups as ways Joan can offer her children more vegetables. After the

intervention, more individuals in the experimental group suggested purchasing, serving, and cooking strategies. See Table 3.

Question 4: What do you think is the best way to solve Joan's problem?

Both groups suggested getting assistance from the government or charitable organizations, budgeting, and teaching shopping and cooking skills as the best ways to solve Joan's problem. Again, the experimental group suggested more options after the intervention. Some of these included "education," "help her menu plan," "she could try growing her own," "find a job," and so on. See Table 3.

Question 5: Why do you think that solution is the best?

Responses were similar in both the control and experimental groups. Participants thought their solutions were best because they would provide food or vegetables for Joan and/or the children, meet her needs, provide money or money management skills, improve the health of her children, or develop cooking or shopping skills. See Table 3.

Content analysis of physical activity responses

Question 1: What is Henry's problem?

Responses for both the experimental and control groups included (1) too much TV or computer, (2) laziness, and (3) lack of interest or motivation. Responses were similar between the groups. There were a higher number of no responses in the control group in the posttest. See Table 4.

Question 2: What other information do you need to know about Henry's situation if you are to help him?

Parents in both groups suggested that they needed to know information on Henry's likes and dislikes, his parents' activities, reasons for his inactivity, time available for activity, his environment, his age, and his health, diet, or weight if they were to help him. Few differences were seen in the answers for both groups. See Table 4.

Question 3: Suggest some things that Henry's dad can do to make Henry more active.

Most individuals in both groups suggested that Henry's dad should engage in activities with him, take away or limit the TV, and increase his level of physical activity. More parents in the experimental group suggested the need for Henry's parents to increase his level of activity after the intervention. See Table 4.

Question 4: What do you think is the best solution to Henry's problem?

Responses in both groups included increased activity, parental involvement, setting limits, taking away the TV, and motivation or education. Parents in the control group also suggested motivation or education as the best solution to Henry's problem. See Table 4.

Question 5: Why do you think that solution is the best?

Parents in both groups stated that the solution was the best because it would lead to family involvement, an increase in Henry's level of activity, and an improvement in his health. Parents in the control group also suggested that the solution was best because it would motivate Henry to be more active or that it would lead to less conflict. See Table 4.

Discussion

In developing a critical thinking methodology, we need a clear contextual definition, a list of skills that characterize the definition, and an appropriate means for assessment. Critical thinking has an identifiable meaning, and the criteria for its correct application vary from field to field. In addition, the way critical thinking is defined is based on the context or situation (Brookfield 1987; McPeck 1981). For example, Facione (1996) defined critical thinking based on the fast-paced nature of the nursing profession. She viewed critical thinking as higher order reasoning used in reaching professionally informed judgments in high-stakes, time-constrained, and, many times, novel problem situations. Likewise, in nutrition, we need to define critical thinking based on the tasks we need to accomplish and the problems that are unique to the profession (Adams, Hausafus, Hendrich 2010). For example, recent statistics showed that one-third of all adults, and one in three children, are overweight or obese; less than five percent of adults participate in 30 minutes of physical activity each day, and seven out of ten deaths are a result of chronic disease such as heart disease, stroke, cancer, and diabetes (Flegal, Carroll, Ogden, Curtin 2010; Ogden et al. 2010; U.S. Department of Health and Human Services 2010). Our study used a context specific definition based on the tasks low-income parents needed to accomplish. It is, therefore, suited for the problems and challenges we encounter in nutrition.

The scenarios used in this study presented situations similar to those encountered in the real world and served as a means for the development of critical thinking. Additionally, the use of both quantitative and qualitative methodologies provided a more accurate assessment of critical thinking. Future interventions assessing critical thinking skills should also use multiple measures to provide a more accurate assessment of thinking skills.

This intervention showed that individuals are capable of suggesting solutions to problems relating to offering their children vegetables and increasing their level of physical activity. Their

responses reveal their predisposition to critical thoughts. In addition, the study demonstrated that critical thinking skills can be developed with instruction. After the intervention, parents in the experimental group showed an increase in their problem-solving skills for each of the first three questions in the vegetable scenario. For example, they expanded their knowledge about the contextual factors that have an impact on the problem (Question 1). A common theme in the posttest responses in the experimental group was that vegetables are inexpensive. Participants stated, “She needs to look at prices more; vegetables are very inexpensive,” and “She doesn’t know that vegetables can be economical.” After the intervention the experimental group also identified the need for additional information to solve the problem (Question 2). They wanted to know “Is she working?” “what she tried before,” “what worked for her,” reasons for lack of money,” “if she is interested in buying more vegetables when shopping,” and so on. After the intervention, the experimental group also suggested more creative problem-solving approaches such as substituting vegetables for unhealthy snacks, purchasing different forms of vegetables, and using creative ways of cooking and serving vegetables.

As questions (4 and 5) increased in complexity, however, the responses between the groups tended to be similar. More time may be needed to bring about changes at higher levels of critical thinking. For example, changes in the level of critical thinking were evident after a 19-hour unit designed to help students develop practical reasoning skills (Laster 1998; Martin 1998).

Few differences existed between the control and experimental group for the physical activity questions. The physical activity information was presented after the information on vegetables in the intervention. Even though participants had less time for the physical activity information, we were optimistic that parents would transfer knowledge gained from the vegetable problem-solving to that of physical activity problems. However, transfer of thinking skills requires the use of a variety of problem situations so that individuals can make cognitive connections across different contexts (Halpern 1998). As a result, it is necessary to plan specific interventions to achieve transfer, which requires a longer time commitment.

The limitation here is that the intervention was of a short duration. Parents in the experimental group had only two sessions relating to nutrition and physical activity. However, the intervention showed some changes in parents’ problem-solving after a short time frame, especially in areas of identification of the problem, gathering relevant information to solve the problem, and problem solution. Little change was apparent in areas of providing rationale and judging the soundness of decisions. Interventions of longer duration could lead to change in these higher levels of critical thinking.

Implication for research and practice

The development of critical thinking skills seems reasonable and feasible in informal educational settings with low-income audiences where the goal is to have individuals make sound decisions regarding their children's health.

Sufficient time must be allowed for the development of critical thinking skills, and interventions of longer duration should be undertaken. Future interventions should also determine the length of time needed for the acquisition of higher-order thinking skills. One important goal in the teaching of critical thinking is to see the transfer of thinking from one situation to the next. Developing interventions that allow for the transfer of critical thinking is also an important target for future interventions.

When developing programs to improve critical thinking skills the following is recommended:

- A clear contextual definition based on the needs of the particular audience. Our definition focused on the thought processes needed for informed decision making and is applicable in various settings where individuals are required to solve practical problems related to diet, physical activity, and health.
- Specific skills and abilities that are aligned to the critical thinking definition. We used problem-solving skills and abilities as a means of helping low-income individuals overcome barriers they encounter when offering vegetables to their children and engaging them in physical activity.
- The use of scenarios related to appropriate content. Scenarios that are ill-defined and that possess no correct answers are suitable for assessing critical thinking. Validating the scenarios is necessary, and we tested for both content and face validity. The questions that followed the scenarios were hierarchical in terms of the level of thinking required. The questions we used can be applied to most problem solving situations. See Table 1.
- The use of both quantitative and qualitative methodologies for the assessment of critical thinking.

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 (Devine 1980). A critical-thinking approach provides individuals with opportunities to develop decision-making, reasoning, and problem-solving skills and should be an integral part of nutrition intervention and programming.

Table 1: Problem-solving scenarios, questions, and level of thinking

[**Table 1 Summary:** Outline of vegetable and physical activity scenario, questions, and the level of thinking involved.]

Table 1: Problem-solving scenarios, questions, and level of thinking

Vegetable scenario	Questions	Level of thinking
At the WIC clinic, Joan was told that she needed to offer her children more vegetables. Joan mentioned that she is afraid that she would not have enough money to do this.	1. What is Joan's problem?	Problem identification
	2. What other information will you need to know about Joan's situation if you are to help her?	Gathering relevant information for problem solving
	3. What can Joan do to offer her children more vegetables?	Problem solution
	4. What do you think is the best way to solve Joan's problem?	Providing rationale for decision
	5. Why do you think that solution is the best?	Judging the soundness of decision

Physical activity scenario	Questions	Level of thinking
Henry enjoys watching television and playing computer games. He spends at least 4 hours a day on these activities. His father tells him to turn off the	1. What is Henry's problem?	Problem identification
	2. What other information do you need to know about Henry's situation if you are to help him?	Gathering relevant information for problem solving

television and be active.	3. Suggest some things that Henry's dad can do to make Henry more active.	Problem solution
	4. What do you think is the best solution to Henry's problem?	Providing rationale for decision
	5. Why do you think that solution is the best?	Judging the soundness of decision

Table 2: Results of word count and no responses for vegetable and physical activity scenarios

[**Table 2 Summary:** Significant differences were observed for word count for the vegetable scenario. No change was seen in word count for the physical activity scenario and both no response for vegetable and physical activity.]

Descriptor	Control			Intervention			Significance		
	<i>N</i>	Mean	<i>SD</i>	<i>N</i>	Mean	<i>SD</i>	<i>F</i>	<i>p</i> value	<i>h</i> ²
Word count for vegetable scenario	25 ^a	30	22	22 ^b	39	27	5.42	*	.11
Word count for physical activity scenario	25 ^a	37	22	23 ^b	36	22	2.50	n.s.	.05
No response for vegetable questions	43	1	1	28	1	1	1.21	n.s.	.02
No response for physical activity questions	43	1	1	28	1	1	.02	n.s.	.00

* $p \leq .05$. n.s. = non significant

a= number of individuals in the experimental group who responded to both pre- and posttest.

b= number of individuals in the control group who responded to both pre- and posttest.

Table 3. Summary of responses based on questions 1–5 of the Vegetable Critical Thinking Scenario.

Table 3. Categories of Response Based on Questions 1–5 of the Vegetable Critical Thinking

Scenario: At the WIC clinic, Joan was told that she needed to offer her children more vegetables. Joan mentioned that she is afraid that she would not have enough money to do this

Questions	Experimental group Pretest (n=28)	Experimental group Posttest (n=28)	Control group Pretest (n=43)	Control group Posttest (n=43)
1. What is Joan's problem	Money = 14 Budget/money management = 6 No response = 6 Other = 2 -Lazy -Does not like veggies	Money = 12 Budget/money management = 4 Lack of knowledge = 3 No response = 8 Other = 11 -Look at prices more -Does not know all the resources -Lack of transportation -She does not know veggies can be conomical, etc.	Money= 27 Budget= 4 No response= 5 Lack of knowledge = 3 Other= 4 -Go to Famer's market -Buy frozen, they are cheaper -Not offering -Economic situation	Money= 18 No response = 22 Other = 3 -Buy canned veggies -Other programs -Buy veggies instead of snacks
2. What other information you will need to know about Joan's situation if	Income = 10 Budget = 6 Government programs= 2 Likes and dislikes = 3 No response = 7 Other = 6	Income = 5 Budget = 4 Government programs = 1 Likes and dislikes = 1 No response = 9 Number of kids-3	Income = 11 Budget = 8 Government programs = 2 Likes and dislikes = 2 No response = 8	Income = 6 Budget = 4 Government programs = 4 Likes and dislikes = 1 No response = 22

you are to help her?	<p>-Number of kids=1</p> <p>-Reasons why she might not afford it</p> <p>-Is she interested in work?</p> <p>-If she has job transportation, etc.</p>	<p>Shopping habits=2</p> <p>Other = 12</p> <p>-If she checks the season specials</p> <p>-Is she working?</p> <p>-what she tried; what worked for her</p> <p>-If she is interested in working to get more money etc</p>	<p>Number of kids = 6</p> <p>Shopping habits = 4</p> <p>Other = 5</p> <p>-Does she have a yard?</p> <p>Her needs, etc.</p>	<p>Number of kids = 3</p> <p>shopping habits = 2</p> <p>Other = 3</p> <p>-Background information</p> <p>-Why no money, etc.</p> <p>- Information on importance of vegetables</p>
3. What can Joan do to offer her children more vegetables?	<p>Purchasing strategies=5</p> <p>Serving/cooking strategies=7</p> <p>Offer more=3</p> <p>Budget=1</p> <p>Substitution=2</p> <p>Resources=2</p> <p>No response=7</p> <p>Other=0</p>	<p>Purchasing strategies=7</p> <p>Serving/cooking strategies=10</p> <p>Offer more=2</p> <p>Budget=0</p> <p>Income=2</p> <p>Substitution=2</p> <p>Resources=2</p> <p>No response=10</p> <p>Other=1</p>	<p>Purchasing strategies=11</p> <p>Serving/cooking strategies=9</p> <p>Offer more=4</p> <p>Budget=2</p> <p>Income=2</p> <p>Substitution=0</p> <p>Resources=9</p> <p>Grow a garden=7</p> <p>No response=8</p> <p>Other=3</p> <p>role model=2</p>	<p>Purchasing strategies=4</p> <p>Serving/cooking strategies=3</p> <p>Offer more=4</p> <p>Budget=1</p> <p>Income=2</p> <p>Substitution=1</p> <p>Resources=7</p> <p>No response=21</p> <p>Other=4</p> <p>grow a garden =2</p> <p>make food interesting=2</p>
4. What do you think is the best way to solve Joan's problem?	<p>Provide resources = 8</p> <p>Budgeting = 5</p> <p>shopping/cooking skills= 4</p> <p>No response= 11</p> <p>Other = 3</p> <p>-education</p> <p>-job</p> <p>-give information</p>	<p>Resources = 4</p> <p>Budget = 1</p> <p>Shopping/cooking skills = 3</p> <p>Keep offering = 2</p> <p>No response = 8</p> <p>Other = 15</p>	<p>Provide resources = 6</p> <p>Budgeting = 1</p> <p>shopping/cooking skills= 6</p> <p>Garden=1</p> <p>Offer more=4</p> <p>Education=2</p> <p>No response=8</p> <p>Other = 7</p>	<p>Provide resources = 10</p> <p>Budgeting =6</p> <p>shopping/cooking skills= 1</p> <p>Garden=2</p> <p>Offer more=1</p> <p>Education=3</p> <p>No response=24</p> <p>Other = 0</p>
5. Why do you think that	<p>Will provide veggies/food=4</p>	<p>Will provide veggies/food=6</p>	<p>Will provide veggies/food=5</p>	<p>Will provide veggies/food=4</p>

solution is best?	Will meet needs=2 Help with money/money mgt= 4 Improve health=0 Develop skills=1 Other=5 No response=12	Will meet needs=1 Help with money/money mgt= 4 Improve health=1 Develop skills=0 Other=3 No response=9	Will meet needs=5 Help with money/money management= 10 Improve health=2 Develop skills=2 Other=13 No response=6	Will meet needs=3 Help with money/money mgt= 4 Improve health=3 Develop skills=0 Other=5 No response=26
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Table 4. Summary of responses based on questions 1–5 of the Physical Activity Critical Thinking Scenario

Table 4. Categories of Response Based on Questions 1–5 of the Physical Activity Critical Thinking

Scenario: Henry enjoys watching television and playing computer games. He spends at least 4 hours a day on these activities. His father tells him to turn off the television and be active. Henry complains that he does not want to be active.

Questions	Experimental group Pretest (n=28)	Experimental group Posttest (n=28)	Control group Pretest (n=43)	Control group Posttest (n=43)
1. What are Henry’s problems?	TV/computer = 12 Inactivity= 8 Lazy= 3 Lack of interest/motivation= 1 Other= 4 No response= 4	TV/computer = 10 Inactivity= 5 Lazy= 2 Lack of interest/motivation= 0 Other= 2 No response= 7	TV/computer = 13 Inactivity= 13 Lazy= 4 Lack of interest/motivation=5 Other= 12 No response= 4	TV/computer = 7 Inactivity= 8 Lazy= 2 Lack of interest/motivation= 3 Other= 1 No response= 20
2. What other information do you need to know about Henry’s situation if	Likes and dislikes=5 Parents’ activities=4 Reasons for inactivity=3 Time available for activity=2	Likes and dislikes=6 Parents’ activities=0 Reasons for inactivity=2 Time available for activity=6	Likes and dislikes=12 Parents’ activities=4 Reasons for inactivity=4 Time available for activity=2	Likes and dislikes=6 Parents’ activities=1 Reasons for inactivity=2 Time available for activity=1

you are to help him?	Built environment=2 Age=3 Health/weight/diet=2 Other=2 No response=8	Built environment=1 Age=1 Health/weight/diet=3 Other=0 No response=10	Built environment=1 Age=0 Health/weight/diet=5 Other=9 No response=9	Built environment=1 Age=0 Health/weight/diet=3 Other=4 No response=22
3. Suggest some things that Henry's dad can do to make Henry more active.	Parental involvement=13 Take away TV=6 Increase activity=3 Limit TV=2 Other=4 No response=4	Parental involvement=9 Take away TV=2 Increase activity=8 Limit TV=3 Other=2 No response=8	Parental involvement=28 Take away TV=2 Increase activity=5 Limit TV=3 Other=7 No response=2	Parental involvement=10 Take away TV=0 Increase activity=9 Limit TV=2 Other=3 No response=21
4. What do you think is the best solution to Henry's problem?	Increase activity=6 Parental involvement=7 Set limits=4 Take away TV=2 Motivation/Education=0 Other=3 No response=5	Increase activity=9 Parental involvement=7 Set limits=2 Take away TV=1 Motivation/Education=0 Other=1 No response=9	Increase activity=11 Parental involvement=11 Set limits=9 Take away TV=3 Motivation/Education=2 Other=4 No response=6	Increase activity=7 Parental involvement=6 Set limits=5 Take away TV=3 Motivation/Education=2 Other=2 No response=23
5. Why do you think that solution is best?	Lead to family involvement=4 Increase activity=4 Improve health=5 Less conflict=0 Motivation=0 Limit TV=0 Other=7 No response=9	Lead to family involvement=4 Increase activity=6 Improve health=2 Role model=2 Motivation=1 It's what I would do =1 Other=5 No response=9	Lead to family involvement=10 Increase activity=4 Improve health=2 Less conflict =2 Motivation=3 Limit TV=3 Other=5	Lead to family involvement=5 Increase activity=4 Improve health=5 Role model=2 Motivation=1 It's what I would do=3 Other=5 No response=24

			No response=10	
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References

- Abrahamson, M. 1983. *Social research methods*. Englewood Cliffs, N.J.: Prentice Hall.
- Adams, M.H., L.M. Stover, and J.F. Whitlow. 1999. A longitudinal evaluation of baccalaureate nursing students' critical thinking abilities. *Journal of Nursing Education* 38:139-141.
- Adams, I.K.R., S. Hendrich, C.O. Hausafus. 2010. A critical thinking approach increases offerings of dark green leafy, yellow/orange, cruciferous vegetables, and tomatoes in the diets of low-income children. *The Forum for Family and Consumer Sciences Issues (FFCI)* 15(1). <http://www.ces.ncsu.edu/depts/fcs/pub/ltc.html>
- Anderson, J. 1982. Acquisition of cognitive skill. *Psychological Review* 89:369-406.
- Berg, B.L. 1998. *Qualitative research methods for the social science*. Boston: Allyn and Bacon.
- Bers, T. 2005. Assessing critical thinking in community colleges. *New Directions for Community Colleges* 130:15-24.
- Beyer, B.K. 1985. Teaching critical thinking skills: A direct approach. *Social Education* 49:297-303.
- Bissell, A.N., and P.P. Lemons. 2006. A new method for assessing critical thinking in the classroom. *BioScience* 56(1):66-72.
- Brookfield, S.D. 2006. Assessing Critical Thinking. *New Directions for Adult and Continuing Education* 75:17-29.
- Brookfield, S.D. 1987. *Developing Critical Thinkers: Challenging adults to explore alternative ways of thinking and acting*. San Francisco: Jossey-Bass Publishers.

Burnard, P. 1989. Developing critical abilities in nurse education. *Nurse Education Today* 9:271-275.

Contento, I. 1981. Thinking about nutrition: Assessing and enhancing the reasoning skills of college non-major nutrition students. *Home Economics Research Journal* 10:160-174.

D'Angelo, E. 1971. *The teaching of critical thinking*. Amsterdam: B.R. Gruner.

Dauer, F.W. 1989. *Critical thinking: An introduction to reasoning*. New York: Oxford.

Devine, M. 1980. Statement of nutrition education policy. *Journal of Nutrition Education* 12(3):138-140.

Dressel, P.L., and L.B. Mayhew. 1954. *General education: Exploration in evaluation*. Washington, D.C.: American Council on Education.

Ennis, R. 1962. A concept of critical thinking. *Harvard Educational Review* 32:17-20, 39.

Epstein, R.L. 2000. *The pocket guide to critical thinking*. New York: Wadsworth.

Flegal, K.M., M.D. Carroll, C.L. Ogden, L.R. Curtin. 2010. Prevalence and trends in obesity among US adults, 1999-2008. *Journal of the American Medical Association* 303(3): 235-241.

Garrison, D.R. 1991. Critical thinking and adult education: A conceptual model for developing critical thinking in adult learners. *International Journal of Lifelong Education* 10:287-303.

Halpern, D.F. 1998. Teaching critical thinking for transfer across domains. Dispositions, skills, structure training and metacognitive monitoring. *American Psychologist* 53(4):449-455.

Halpern, D.F. 1996. *Thought and knowledge: An introduction to critical thinking*. (3rd ed.) Mahwah, N.J.: Erlbaum.

Halpern, D.F. 1993. Assessing the effectiveness of critical thinking instruction. *Journal of General Education* 42:239-254.

Hicks, F.D. 2001. Critical thinking: Toward a nursing science perspective. *Nursing Science Quarterly* 14:14-21.

Huba, M.E., and J.E. Freed (2000). *Learner-centered assessment on college campuses: Shifting the focus from teaching to learning*. Boston: Allyn and Bacon.

- Kerka, S. 1992. Higher order thinking skills in vocational education. (ERIC) Document Reproduction Service No ED 350 487.
- Krueger, R.A. 1997. Analyzing and reporting focus group results. Thousand Oaks, CA: Sage.
- Kurfis, J.G. 1988. *Critical thinking: Theory, research, practice, and possibilities*. ASHE-ERIC Higher Education Report No. 2. Washington, D.C.: Association for the Study of Higher Education.
- Lipman, M. 1985. Thinking skills fostered by philosophy for children. In *Thinking and learning skills: Relating instruction to research*. Edited by J.W. Segal. Hillsdale, N.J.: Earlbaum. 83-108
- Norris, S. 1985. Synthesis of research on critical thinking. *Education Leadership* 42:40-45.
- Martin J. L. 1998. Practical reasoning instruction in the secondary family and consumer sciences classroom. In *Family and Consumer Sciences Teacher Education: Yearbook 18, Inquiry into thinking*. Edited by R. Thomas and J. Laster. Peoria, IL: American Association of Family and Consumer Sciences, Glencoe/McGraw-Hill. 75-90.
- Marzano, R., D. Pickering, and J. Pollack. 2001. *Classroom instruction that works*. Alexandria, VA: Association for Supervision and Curriculum Development.
- Mayer, R., and F. Goodchild. 1990. *The critical thinker*. New York: William C. Brown Communications.
- McPeck, J.E. 1981. *Critical Thinking and Education*. New York: St. Martin's Press.
- Norris, S.T. 1985. Synthesis of research on critical thinking. *Educational Leadership* 42:40-45.
- Ogden, C.L., M. Carroll, L.Curtin, M. Lamb, and K. Flegal. 2010. Prevalence of High Body Mass Index in US Children and Adolescents 2007-2008. *Journal of American Medical Association* 303(3): 242-249
- Paul, R., and L. Elder. 2001. *The miniature guide to critical thinking: Concepts and tools*. Dillon Beach, CA: The Foundation for Critical Thinking.
- Paul, R. 1993. *Critical thinking: How to prepare students for a rapidly changing world*. Santa Rosa, CA: Foundation for Critical Thinking.
- Smith, H.W. 1975. *Strategies of social research*. Englewood Cliffs, N.J.: Prentice Hall.

Stemler, S. 2001. An overview of content analysis. *Practical Assessment, Research and Evaluation* 7:17. <http://pareonline.net/getvn.asp?v=7&n=17>

Stone, N.J. 2002. "Use of scenarios to enhance undergraduates' knowledge of organizational psychology." Paper presented at the American Psychological Association Annual Convention "Strategies for Teaching Industrial Organizational Psychology." Chicago.

Reicks, M., A. Bosch, M. Herman, and B.U. Krinke. 1994. Effectiveness of a food safety teaching strategy to promote critical thinking. *Journal of Nutrition Education* 26:97-100

Sternberg, R.J., and J.B. Baron. 1985. A statewide approach to measuring critical thinking skills. *Educational Leadership* 43:40-43.

Thomas, R.G., and L. Litowitz. 1986. *Vocational education and higher order thinking skills: An agenda for inquiry*. St. Paul, MN: Minnesota Research and Development Center.

Thompson, S.D., L. Martin, L. Richards, and D. Branson. 2003. *Internet and Higher Education* 6:185-191.

Treiman K, V. Freimuth, D. Damron, et al. 1996. Attitudes and behaviors related to fruits and vegetables among low-income women in the WIC program. *Journal of Nutrition Education* 28:149-156.

Tucker, R.W. 1996. Less than critical thinking. *Adult Assessment Forum*

I(3-4):2-8.

U.S. Department of Health and Human Services and U.S. Department of Agriculture. **Dietary Guidelines** for Americans, 2010, 7th Edition. <http://www.health.gov/dietaryguidelines/dga2010/DietaryGuidelines2010.pdf>