Radiation Science Educators’ Perception of Obstacles in the Use of Critical Thinking

A Thesis

Presented in Partial Fulfillment of the Requirements for the Degree Master of Science in the Graduate School of The Ohio State University

By

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ABSTRACT

The purpose of this study was to discover educators’ perceptions of their current level of competence in teaching and assessing critical thinking. It defined the difficulties educators are faced with and their perceived confidence in their level of skill. Radiation science educators from both radiography and radiation therapy programs were surveyed on-line through Survey Monkey®. A four part survey was completed by 317 educators for a 46% response rate. Sections of the survey included demographics, perceptions on teaching critical thinking skills to students, frequency of obstacles impeding the use of critical thinking, and open ended questions providing further comments on obstacles, methods, skill development and assessment of critical thinking.

Radiation science educators are confident in their use of critical thinking skills and perceive critical thinking to be an essential element in the education of the student. Educators were satisfied with their self-reported level of skill in critical thinking, but identified several areas needing improvement such as the ability to demonstrate, implement and assess critical thinking skills as well as the need to develop and implement new strategies. The confidence and skill level showed a significant difference when comparing the education level of the program director, particularly between those with a master’s degree and a doctoral degree. Several factors were identified in the study
as being obstacles impeding the educators’ development of critical thinking in the classroom. The findings provide a basis for the educators to begin to improve their skills and methods for teaching critical thinking.
DEDICATION

This thesis is dedicated to my husband, Ed, my children, Colin and Abby, as well as my family and friends. Thank you for all of your love and support to allow me to achieve my educational goal.
ACKNOWLEDGEMENTS

I would like to express my gratitude to all those individuals who assisted me in completing my Masters Degree. To Jane Case-Smith, my advisor, thank you for your patience, support, encouragement and guidance throughout my thesis. I really appreciate all you have done. To my committee members, Nina Kowalczyk, for your assistance with Survey Monkey® and insight into critical thinking research, and Jill Clutter, for your expertise in statistics. Thank you for your time and valuable input regarding this project.

I also want to thank Tim Nelson, Dr. Nilendu Gupta, and all of my co-workers in the Radiation Oncology Department at the James Cancer Hospital for supporting me throughout my graduate program. I would not have been able to complete this endeavor without your encouragement and flexibility.
VITA

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CHAPTER 1

INTRODUCTION

Background of the Problem

The complexity of the radiation science profession is rapidly increasing as the methodologies and technological advancements in treatment continue to develop. To provide expert quality patient care in this fast paced environment, it is essential for the professional to apply strong critical thinking skills. A student’s ability to assess, analyze, and infer knowledge is not an inherent trait but a learned skill (Halx & Reybold, 2005a). It is developed through education and practice as well as experience. Educators play a strong role in fostering the student’s ability to think critically. Students often learn by role modeling; therefore, it is up to the educator to display effective critical thinking in their interaction with the students (Walsh & Seldomridge, 2006).

Over the years, critical thinking has been an emphasis in many professional disciplines resulting in different interpretations and definitions of critical thinking. The American Philosophical Association (APA), under the direction of Facione (1990), conducted research utilizing a panel of critical thinking experts to assess critical thinking in terms of cognitive skills and affective dispositions. The panel describes critical thinking skills as interpretation, analysis, evaluation, inference, explanation and self-
regulation. Educators must learn to apply these same principles in the academic and clinical setting to help students develop the critical thinking skills required in the professional practice. Students often learn by role modeling; therefore, the educators should display effective critical thinking in their interaction with the students. For the purpose of this study, critical thinking will be defined as meaningful, unbiased decisions or judgments based on the use of interpretation, analysis, evaluation, inferences, and explanation of information as it relates to the evidence applied to a specific discipline (Facione, 1990).

The introduction of outcomes based education provided a new insight into education and the changes faculty needed to make in regard to their teaching style. In 1996, the Joint Review Committee on Education in Radiologic Technology (JRCERT) incorporated a new set of accreditation standards for programs. These standards included areas that would specifically focus on the promotion and assessment of critical thinking skills (Bugg, 1996). Thus, critical thinking became a new strategy radiation science educators needed to incorporate into their classroom and clinical environment. Educators needed to move from their comfortable teacher-centered education to a learner-centered education which was a new learning experience for many (Mangena & Chabeli, 2005). This approach to education was an unfamiliar concept considering that critical and reflective thinking strategies were not emphasized during most of the instructors’ undergraduate education. As stated by Mangena and Chabeli (2005, p. 292), “One cannot teach critical thinking if one is not a critical thinker oneself.”
Significance of the Problem

The ability to infuse the conceptual knowledge into the minds of students is a rewarding yet challenging venture. Radiation science educators have been challenged with the task of incorporating critical thinking skills into their curriculum and instilling the analytical thought process into the minds of the students. For students to be able to use critical thinking skills in their professional careers, they must first be taught how to develop those skills. Are educators being effective in their strategies of teaching critical thinking skills or are their underlying difficulties incorporating the strategies in the classroom? The educators are the ones to begin to mold the students. Do they feel competent in their task or do they think improvement is needed? If one can define the changes that need to be made to improve critical thinking, solutions can then be formulated and applied to help educators improve students’ ability to think critically.

Purpose of the Study

Critical thinking is, and always will be, an important concept in education. The need for critical thinking will assuredly be increasing in the professional practice. Therefore, the purpose of this study is to discover educators’ current level of competence in teaching and assessing critical thinking skills. The study will define the difficulties educators are faced with and their perceived confidence in their level of skill. Implementing critical thinking in the classroom and clinic is not something inherent to the skills of an educator. Critical thinking is something that is developed through time and experience. Once the perceived problem areas are identified, methods can be
developed to help educators improve their instructional skills. With practice of these skills, instructors will become better critical thinkers as well. This study will serve as the beginning steps to help educators overcome difficulties when implementing critical thinking in the classroom. It will create educators who are better equipped to utilize teaching methods that improve the critical thinking.

Research Questions

1. What level of perceived confidence do educators have in their use of strategies and assessment of critical thinking in the classroom and clinical setting?

2. What level of perceived importance do educators place on the use of critical thinking in the classroom and clinical setting?
   a. How does the education level of the instructors influence the importance they place on critical thinking?
   b. How does the level of the education program influence the level of importance placed on critical thinking?
   c. How does age of the instructor relate to their perceived importance of critical thinking?

3. What is the educators’ perceived level of skill in using critical thinking strategies in the classroom?
   a. How does the educators’ experience relate to their perceived level of skill?
   b. How does the age of the educator relate to perceived level of skill?
4. To what extent do certain factors impede the educators’ use of strategies and assessment of critical thinking in the classroom?

5. To what extent do educators assess students’ ability to think critically?

Variables

- Confidence in the use of strategies and assessment of critical thinking.
- Importance of critical thinking in education.
- Skills in using critical thinking strategies.
- Ability to assess students’ critical thinking skills.

Constitutive Definitions

The following are terms related to the research study as ascribed within the study.

1. Confidence – the assuredness or certainty in one’s abilities to utilize and assess critical thinking.

2. Importance – the value or significance educators place on critical thinking.

3. Skill level- the ability to incorporate critical thinking

4. Impeding factors – something that stops the progress or development of critical thinking.

5. Assessments – assessment tools and strategies to determine a student’s ability to think critically.

6. Age – the period in one’s life that corresponds to potential exposure to critical thinking as a student themselves.
7. Type of institution – refers to the degrees offered within the institution, e.g., community college, state college, research intensive.

8. Level of education – the number of years of formal education and the degree accomplished.

9. Number of years as an instructor – the degree of experience the instructor has in formal instruction.

10. Percentage of time teaching – the amount of time spent in instruction and in preparation of instruction.

Operational Definitions

Educators’ perceived level of confidence in their own teaching strategies and ability to assess critical thinking skills will be measured using a six point Likert type rating scale ranging from one for strongly disagree to six for strongly agree.

The degree to which educators perceive critical thinking to be of importance in their instruction or instructional methods will be measured using a six point Likert type rating scale ranging from one for strongly disagree to six for strongly agree.

Educators’ perceptions of their level of skill in utilizing and assessing critical thinking strategies will be measured using a six point Likert type rating scale ranging from one for strongly disagree to six for strongly agree.
Perceived awareness of obstacles of implementation is defined by the frequency in which limitations occur for educators when implementing critical thinking skills. The frequency will be measured using a 5 point Likert type rating scale ranging from one implying the obstacle is never a factor to five implying it is always a factor.

Experience of the educator is measured by the number of years they have been an instructor in the radiation sciences.

Age range is measured to determine the effect of maturity on the positive or negative perceptions of critical thinking. Educators will be asked to record their age.

Type of institution relates to the level of education (i.e., degrees) offered by the institution and if instructors in the programs vary in their perception and awareness of critical thinking due to the degree awarded.

Level of education is defined by the degree held by the instructor and will measure the level of emphasis placed on critical thinking.
CHAPTER 2

LITERATURE REVIEW

Educators must be able to understand the meaning of critical thinking and embrace the concept before they can become effective in a classroom setting. Critical thinking has been defined in many different contexts throughout the past 30 years. In a project sponsored by the American Philosophical Association, Facione (1990), conducted a panel of 46 experts, utilizing the Delphi method, and defined critical thinking as: “a purposeful, self-regulatory judgment which results in interpretation, analysis, evaluation, and inference, as well as explanation of the evidential, and conceptual, methodological, criteriological, or contextual considerations upon which that judgment is based” (Facione, 1990). Scheffer and Rubenfeld (2000) describe it as a component of professional accountability in which nurses practice the cognitive skills of analyzing, applying standards, discriminating, information seeking, logical reasoning, predicting and transforming knowledge. The Foundation for Critical Thinking (2004) defines critical thinking as: “thinking that explicitly aims at well-founded judgment and hence utilizes appropriate evaluative standards in the attempt to determine the true worth, merit or value of something” (p.2). Other authors have described critical thinking as a cognitive reasoning process involving problem solving and decision making skills (Chabeli, 2007).
The true meaning of critical thinking has been a topic of much debate leading to the confusion or misunderstanding of critical thinking (Castle, 2009; Mundy & Denham, 2008; Raymond & Profetto-McGrath, 2005). Educators find it difficult to apply concepts of critical thinking if they are unsure of its meaning.

The nursing profession embraced the concept of critical thinking long before the radiation sciences profession. A review of literature shows that although nursing has more developed concepts and definitions for critical thinking, the educators have not demonstrated significant improvement of critical thinking skills in their graduates (Brock & Butts, 1998; Fitzpatrick, 2005). The student’s ability to think critically when making professional decisions is often developed in the classroom; therefore, the teaching strategies used should promote critical thinking rather than content memorization. Unfortunately, research shows that educators continue to focus their instruction on providing practice information rather than teaching reasoning and problem solving. Often graduates are unable to analyze problems, adapt techniques and make decisions in practice (Forneris, 2004; Zygmont & Schaefer, 2006). This may partially be due to the fact that many educators have not been taught how to critically think; therefore, continue to model the same strategies used in their previous education.

According to Mangena and Chabeli (2005), educators face obstacles in the facilitating student’s critical thinking. Focus group interviews were conducted with 7 nurse educators and 12 fourth year nursing students to explore and describe their perceptions of critical thinking in nursing education. One obstacle that was identified by the group was that some educators lacked knowledge of critical thinking often because
the educator stopped learning after he or she completed educator training. Also, when outcomes based education was emphasized in programs, educators were uncomfortable with the transition from a teacher-centered to learner-centered approach to education. This inadvertently caused some resistance to the change in instruction. Instructors also had difficulty incorporating critical thinking skills when students of a poor education background were selected into the program (Mangena & Chabeli, 2005).

Shell (2001) conducted a survey of 262 nurse educators in Baccalaureate programs in Tennessee regarding their perceptions of barriers that impeded implementation of critical thinking strategies. She identified several barriers faculty encounter when incorporating critical thinking strategies into their curriculum. The greatest was the students’ lack of motivation and resistance to active learning. Another was the time constraints instructors felt when trying to prepare and plan critical thinking activities. This did not allow them ample time in class to incorporate the task. The amount of content or factual information required in the courses was overwhelming to both the instructor and student. Even though many barriers were identified within the survey, Shell also stated that instructors still expressed confidence in the ability to teach critical thinking skills but were only slightly confident of their skills in promoting students’ skills. Instructors felt additional education in teaching critical thinking was needed (Shell, 2001).

In 1997 a survey of deans and directors of nursing programs was conducted by O’Sullivan and colleagues. At that time, only 20 percent of the undergraduate nursing programs had implemented critical thinking strategies within the classroom. Difficulty in
developing methods to teach critical thinking was the common cause for the lack of implementation as well as the resistance of faculty to change their teaching style (O'Sullivan, Blevins-Stephens, Smith, & Vaughan-Wrobel, 1997).

In the allied medical professions, specifically the radiation sciences, a review of literature corroborates the fact we are behind other professions such as medicine and nursing. Much of the instruction requires students to memorize information rather than synthesis and application of knowledge (Kowalczyk & Leggett, 2005). Critical thinking is most effective when educators embed it into the subjects already taught. Instructors need to change the focus of the lessons from instructor centered to student centered (Ellis & Miller, 2004). As Ellis and Miller (2004) stated, “It is imperative that teachers stimulate students to ask additional questions to increase their depth of understanding” (p. 2). Some radiation science educators have applied critical thinking techniques in their classroom and clinical environment. Discussions, reflective journal writing, case studies, debates and poster presentations are just a few of the methods used to facilitate critical thinking (Mangena & Chabeli, 2005). Until radiation science educators can define the skills needed and the obstacles they face to promote the critical thinking skills, this concept may not be fully embraced by the profession.
CHAPTER 3

METHODOLOGY

Research Design

This survey research study is a descriptive analysis of educators’ perceptions of critical thinking as well as their self-reported ability to use and assess critical thinking in the classroom. It defines obstacles which impede the instructors’ development as well as use of critical thinking strategies. A web based survey of radiation science educators provided quantitative and qualitative data to answer the study’s research questions.

Sample Selection

Participants of the survey consist of radiation science program directors from radiation therapy and radiography education programs in the United States. Surveys were elicited from 692 program directors from all programmatic accredited education programs in radiation therapy and radiography. This population was chosen because of the effect they have on the development of the students’ critical thinking abilities. Program directors are also directly responsible for the accreditation standards of which require outcomes on critical thinking and problem solving. The institutions solicited represented each type of degree or certificate institution which incorporates radiation
sciences programs. The names and email addresses of radiation science program
directors were obtained from the Joint Review Committee on Education in Radiologic
Technology (JRCERT). Frame error was controlled by assuring a current and accurate
list was obtained from the JRCERT. The list of educator’s names and addresses were
reviewed to assure duplicates were purged and selection error was controlled.

Instrumentation

The instrument used was modeled after Shell’s (2001) survey of nurse educators
in baccalaureate programs in Tennessee. The survey identified perceived barriers that
impeded the implementation of critical thinking strategies in the nursing profession.
Many of the same questions were used and some were deleted and replaced with
questions concerning the assessment of critical thinking. Open response questions were
added to give educators a chance to voice ideas and opinions. Demographics were
adjusted to correlate to a radiation science educator.

A survey instrument containing four sections was developed. See Appendix A.
The first section solicits demographic information, which includes type of institution,
region education program is located, discipline of education, educators level of education,
age, and the number of years as an instructor. Section two determines the level of
importance educators place on critical thinking. It provides information regarding the
educators level of confidence and skill they have in their abilities to implement critical
thinking strategies. It consists of 24 questions evaluated with a six point Likert type
rating scale, ranging from “strongly disagree” to “strongly agree.” Section three
determines the obstacles the educators face and the frequency in which they occur. This section consists of 17 questions evaluated using a five point Likert type rating scale ranging from “never a factor” to “always a factor.” The fourth section requested educators to further define the obstacles they have encountered when incorporating critical thinking in the class room as well as providing explanations regarding their development, use and assessment of students’ critical thinking. The study was approved by the IRB committee at The Ohio State University before implementation of the questionnaire.

Reliability & Validity

Content validity of the survey was established by a panel of experts. The panel consists of four highly regarded radiation science educators chosen by the investigator for their expertise in critical thinking. The educators were asked to critique the instrument to determine if the content truly measures the desired affective variables and to provide suggestions for improvement.

A field test was used to establish the face validity and suitability of the instrument. The instrument was sent to four hand selected radiation science educators to determine if the instrument appears to be valid and is clearly understood. The educators were asked to determine if they are able to comprehend the meaning of the questions and if the questions are relevant to the study. All suggestions from the panel of experts and the field test were taken into consideration. Suggestions from the panel were incorporated in the final draft of the instrument to improve the clarity of the questions.
The reliability of the instrument was judged for internal consistency at the completion of the web based survey. The survey was measured using Cronbach’s Alpha for questions pertaining to each of the variables listed in table 3.1. When measuring educators’ confidence in the use of critical thinking strategies and assessments, item #21 did not correlate with the other subscale items. With item #21 eliminated from the Confidence Subscale, internal consistency was high (Cronbach Alpha = 0.84). The Cronbach Alpha for survey questions measuring the importance of critical thinking was 0.77, skill in teaching critical thinking was 0.77, and the ability to assess of students’ critical thinking skills was 0.62.

Data Collection

The survey was developed on Survey Monkey®, providing the educators with an easy mechanism of completing the survey. An email announcement was mailed to 692 directors of accredited radiation science programs in the United States describing the research study and providing a link to the Survey Monkey® site to access the survey. One and two weeks following the initial mailing of the survey, a reminder email was sent including the website for the survey. All data were collected through Survey Monkey®, transferred to an excel spreadsheet and entered into SPSS for statistical analysis.

Data Analysis

The percentage of responders of the total number sent was computed. Each item of the survey was identified with the appropriate variable as listed in Table 3.1. The
variables were measured in questions 1 – 24 in the questionnaire. Obstacles to critical thinking were measured in questions 25 – 41. The questions identified both positive and negative statements. The positive statements were reversed before the data analysis was performed. The percentages, mean, standard deviation and frequency of response were calculated for questions 1 – 41 of the survey.

To answer research questions 1 through 5, the total mean and standard deviation were calculated for the subset of items that measure each variable and obstacle. These items are listed in Table 3.1. Answers to the open ended questions were categorized and examined to identify consistent themes. Information was tabulated concerning the frequency and nature of the responses. For question 2a, the instructor’s level of education was compared with the importance educators place on critical thinking (2nd variable). To determine the difference across the types of institutions surveyed, question 2b, an ANOVA was conducted to identify differences in the importance placed on critical thinking (2nd variable) in 4 year institutions, 2 year institutions, and hospital based programs. Question 2c determines the influence of age on the perceived level of importance placed on critical thinking. Experience of the educators, question 3a, was compared to the instructors perceived level of skill in using critical thinking. An ANOVA was calculated for question 3b to determine if age of the educators varies the level of skill the educator portrays (3rd variable).
### Table 3.1: Survey questions that measure each of the variables.

<table>
<thead>
<tr>
<th>Variables</th>
<th>Survey Questions</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Confidence in use of strategies and assessment</td>
<td>3, 4, 17</td>
</tr>
<tr>
<td></td>
<td>16, 21, 23</td>
</tr>
<tr>
<td>2. Importance of critical thinking</td>
<td>5, 7, 15, 24</td>
</tr>
<tr>
<td></td>
<td>1, 2, 12, 19, 20</td>
</tr>
<tr>
<td>3. Skill in teaching critical thinking</td>
<td>3, 4, 6, 7, 8, 9, 10, 11, 14, 17, 22</td>
</tr>
<tr>
<td></td>
<td>2, 13, 16, 18, 21, 23</td>
</tr>
<tr>
<td>4. Assessment of students’ critical thinking skills</td>
<td>8, 14, 15</td>
</tr>
</tbody>
</table>


CHAPTER 4

RESULTS OF DATA ANALYSIS

Description of Sample

The radiation science educator’s survey on perceptions of obstacles in the use of critical thinking was sent through Survey Monkey® to 692 radiation sciences program directors. Of the 692 emailed surveys, 6 were returned stating they were either on sabbatical, no longer teaching, or the email was not deliverable leaving a total sample of 686. The initial mailing yielded 232 responses from program directors. A second email was sent a week later and yielded another 85 responses with a total sample of 317 providing a 46.2% response rate (see Table 4.1).

The demographic data defined the population of program directors completing the survey. The largest number of program directors (41.3%, n = 131) were affiliated with a 2 year Community College. The second largest population (29.3%, n = 93) represented the Hospital/Medical Center Certificate programs followed by the 4 year College/University with 18.6% (n = 59) and by the 2 year Technical College with 8.8% (n = 28) of the respondents. The Proprietary programs represented 1.9% (n = 6) of the program directors completing the survey.
Program directors were well represented from each region of the United States. The majority of the survey respondents resided in the Midwest (30.6%, n = 97) and the Southeast (26.2% n = 83) (see Figure 4.1). Three hundred and seventeen program directors from both radiography and radiation therapy participated in the survey. The majority of the respondents represented the radiography programs with 88.0% (n = 279) and with radiation therapy program directors providing 12% (n = 38) of the responses (see Table 4.1).

<table>
<thead>
<tr>
<th>Discipline</th>
<th>Survey Sent</th>
<th>Respondent Count</th>
<th>Response percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Radiography</td>
<td>607</td>
<td>279</td>
<td>45.9%</td>
</tr>
<tr>
<td>Radiation Therapy</td>
<td>79</td>
<td>38</td>
<td>48.1%</td>
</tr>
<tr>
<td>Total</td>
<td>686</td>
<td>317</td>
<td>46.2%</td>
</tr>
</tbody>
</table>

Table 4.1: Total response rate and response rate per discipline

![Response Percent per Region](image)

Figure 4.1: Percentage of educators responding from each region in the United States (n = 317).
The vast majority of participating program directors held a Masters degree (83.9%, n = 266). The program directors with a doctorate degree consisted of 6.9% (n = 22), bachelor degrees represented 5.7% (n = 18), associate degree represented 2.5% (n = 8) and .9% (n = 3) reported having some other level of education. The average age of the respondents was 50 (SD = 8.2) yrs, ranging from 29 to 69 years. Program directors reported to have an average of 18.21 (SD = 9.29; range: 1-40) years experience as an instructor. Overall, the respondents spent an average of 53% (SD = 25.4) of their time teaching the students.

Program directors were asked to rate a series of questions regarding their perceptions on teaching critical thinking to students. There were a total of 24 questions worded both positively and negatively as demonstrated in table 3.1. The respondents selected one of the six responses on a Likert-type scale, strongly disagree (1), disagree (2), slightly disagree (3), slightly agree (4), agree (5) and strongly agree (6). The negatively worded questions were scored and the number was reversed prior to analysis.

Research Questions

Perceived Level of Confidence in Use of Strategies and Assessments

The program directors’ level of confidence in their use of strategies and assessment of critical thinking in the classroom and clinical setting was evaluated using survey questions 3, 4, 16, 17, 21 and 23 of the survey as shown in table 4.2. Question #21 was removed due to the inconsistency of measurement. The remaining questions,
with negative scores reversed, provided a mean of 3.81 (SD = 0.63) out of a 6 point scale for the level of confidence.

<table>
<thead>
<tr>
<th>Confidence Measure</th>
<th>Mean</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Positively worded questions</td>
<td></td>
<td></td>
</tr>
<tr>
<td>16. I am satisfied with my present teaching strategies for critical thinking</td>
<td>3.85</td>
<td>1.07</td>
</tr>
<tr>
<td>23. I am satisfied with my critical thinking assessment skills</td>
<td>3.78</td>
<td>1.07</td>
</tr>
<tr>
<td>Negatively worded questions</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. I am not sure of my abilities to teach critical thinking skills</td>
<td>2.74</td>
<td>1.25</td>
</tr>
<tr>
<td>4. I am not sure how to “model” or demonstrate critical thinking</td>
<td>2.63</td>
<td>1.28</td>
</tr>
<tr>
<td>17. I need further professional development in the area of incorporating critical thinking activities in the classroom</td>
<td>4.23</td>
<td>1.15</td>
</tr>
</tbody>
</table>

Table 4.2: Percentage of Responses for Confidence level with the Mean and Standard Deviation for each Survey Question.

When asked “I am not sure of my abilities to teach critical thinking skills”, 37.62% of the population disagreed, indicating they felt confident in their abilities. Forty percent of the program directors indicated they could “model” or demonstrate critical thinking. Measurement for satisfaction with their present teaching strategies provided a large range from 26% indicating they slightly disagreed, 32% slightly agreed, and 26% agreed. When asked whether they needed further professional development in the incorporating critical thinking, 39.14% and 34.87% indicated they either agreed or
slightly agreed respectively. Only 36% slightly agreed they were satisfied with their critical thinking skills, yet 26% slightly disagree (see table 4.2).

**Perceived Level of Importance Placed on Critical Thinking in the Classroom and Clinical**

The importance educators place on critical thinking in the classroom and clinical setting was measured using nine survey questions as indicated in Table 4.3. Four of the questions were worded negatively and the scores were reversed for measurement. The mean measurement of importance was a 5.05 (SD = .54) indicating there was a high level of agreement with critical thinking being an important concept in education and it should be implemented and further developed by the students and the educators. A large percentage of the respondents agreed or strongly agreed that critical thinking was necessary for success of the student, it is a valuable education outcome and that it is a primary objective of their teaching. Most of the educators believe that using critical thinking skills in the classroom can enhance the students’ skills, and that it is important to assess the students’ ability to think critically. When asked if course content is more important than encouraging critical thinking task, 30% and 34% either slightly disagreed or disagreed with the statement (see Table 4.3).
<table>
<thead>
<tr>
<th>Importance Measure</th>
<th>Mean</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>From strongly disagree (1) to strongly agree (6)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Positively worded questions</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Helping students develop critical thinking skills is a primary objective of my teaching efforts</td>
<td>5.25</td>
<td>0.84</td>
</tr>
<tr>
<td>2. Most of my teaching strategies are designed to promote critical thinking</td>
<td>4.78</td>
<td>0.94</td>
</tr>
<tr>
<td>12. I value the development of critical thinking skills as an educational outcome</td>
<td>5.33</td>
<td>0.65</td>
</tr>
<tr>
<td>19. I feel the development of skills in critical thinking is necessary for student success</td>
<td>5.35</td>
<td>0.76</td>
</tr>
<tr>
<td>20. I would attend a continuing education class on critical thinking based teaching methods</td>
<td>5.12</td>
<td>0.78</td>
</tr>
<tr>
<td>Negatively worded questions</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. Teaching strategies cannot change students’ critical thinking skills</td>
<td>2.0</td>
<td>1.06</td>
</tr>
<tr>
<td>7. Teaching course content is more important than encouraging critical thinking tasks</td>
<td>2.67</td>
<td>1.06</td>
</tr>
<tr>
<td>15. It is not necessary to assess students’ critical thinking skills</td>
<td>1.69</td>
<td>0.85</td>
</tr>
<tr>
<td>24. I only include critical thinking strategies in my classes because it is required by accreditation</td>
<td>1.92</td>
<td>1.06</td>
</tr>
</tbody>
</table>

Table 4.3: Means and Standard Deviations for importance of critical thinking without negative scores reversed.

To determine if the program directors education level was associated with their perceptions of importance of critical thinking, a Spearman correlation was conducted. The correlation coefficient of $r = .009$ (p=0.88) indicated there was no relationship between the two factors. There were no significant differences when perception of importance was compared to educational level of the institution ($f=1.44$; df=3; p=0.23). Educators from each education level agreed on the importance of critical thinking (see Table 4.4).
<table>
<thead>
<tr>
<th>Level of Education</th>
<th>Mean</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Associate degree</td>
<td>5.11</td>
<td>0.61</td>
</tr>
<tr>
<td>Bachelors degree</td>
<td>5.21</td>
<td>0.56</td>
</tr>
<tr>
<td>Masters degree</td>
<td>5.03</td>
<td>0.54</td>
</tr>
<tr>
<td>Doctorate</td>
<td>5.23</td>
<td>0.49</td>
</tr>
</tbody>
</table>

Table 4.4: Means and Standard Deviations for Importance According to Respondents’ Level of Education. Rating scale measuring Importance = Strongly Disagree (1), Disagree (2), Slightly Disagree (3), Slightly Agree (4), Agree (5), Strongly Agree (6).

ANOVA’s were calculated to determine if the program directors’ level of skill, confidence in their critical thinking skills, level of importance and ability to assess critical thinking was significantly different by education level of the program director or the level of education taught at the institution. The four variables did not differ based on the level of education of the respondent’s institution. As indicated in Table 4.5, there were no significance differences between the education level and the level of importance or between the education level and their ability to assess. Level of confidence and level of skill were significantly different based on program directors’ educational level (see Table 4.5). A post hoc analysis using the Scheffe method was used to further analyze the differences in the program directors education level compared to level of confidence and level of skill. The test reported the greatest significance was between the Masters level and the Doctorate level program directors for both confidence (Mean Difference = 0.58; p=0.05) and skill level (Mean Difference = 0.37; p=0.03).
Table 4.5: ANOVA based on education level of the program director and level of institution.

**Perceived Level of Skill in Using Critical Thinking Strategies in the Classroom**

Evaluation of the educators’ skill level was determined utilizing 16 questions relating to their ability to demonstrate, model or utilize strategies when incorporating critical thinking into their teaching. This subscale also measured their satisfaction with their critical thinking methods or if they felt a change was needed. The mean score for the questions relating to the level of skill, with negative questions transposed to positive results, was a 4.09 (SD = 0.56) (see Table 4.6).
<table>
<thead>
<tr>
<th>Survey Question</th>
<th>Mean</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Positively worded questions</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Most of my teaching strategies are designed to promote critical thinking</td>
<td>4.78</td>
<td>0.93</td>
</tr>
<tr>
<td>13. I am willing to implement new teaching strategies</td>
<td>5.37</td>
<td>0.62</td>
</tr>
<tr>
<td>16. I am satisfied with my present teaching strategies for critical thinking</td>
<td>3.85</td>
<td>1.07</td>
</tr>
<tr>
<td>18. I see a need to change my style of teaching</td>
<td>3.34</td>
<td>1.08</td>
</tr>
<tr>
<td>23. I am satisfied with my critical thinking assessment skills</td>
<td>3.78</td>
<td>1.07</td>
</tr>
<tr>
<td>Negatively worded questions</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. I am not sure of my abilities to teach critical thinking skills.</td>
<td>2.74</td>
<td>1.25</td>
</tr>
<tr>
<td>4. I am not sure how to “model” or demonstrate critical thinking</td>
<td>2.63</td>
<td>1.28</td>
</tr>
<tr>
<td>6. Lecturing is my primary method of teaching</td>
<td>3.81</td>
<td>1.26</td>
</tr>
<tr>
<td>7. Teaching course content is more important than encouraging critical thinking tasks</td>
<td>2.67</td>
<td>1.06</td>
</tr>
<tr>
<td>8. I am not sure of how to assess critical thinking assignments</td>
<td>2.91</td>
<td>1.25</td>
</tr>
<tr>
<td>9. I find it difficult to combine teaching for content coverage with the promotion of critical thinking skills</td>
<td>3.12</td>
<td>1.35</td>
</tr>
<tr>
<td>10. I find it difficult to change my teaching strategies</td>
<td>2.68</td>
<td>1.21</td>
</tr>
<tr>
<td>11. I have difficulty implementing new, innovative teaching strategies</td>
<td>2.58</td>
<td>1.23</td>
</tr>
<tr>
<td>14. I avoid teaching critical thinking skills because I have difficulty assessing them</td>
<td>2.2</td>
<td>0.92</td>
</tr>
<tr>
<td>17. I need further professional development in the area of incorporating critical thinking activities in the classroom</td>
<td>4.23</td>
<td>1.15</td>
</tr>
<tr>
<td>22. My teaching load interferes with my ability to incorporate critical thinking skills in the classroom</td>
<td>3.07</td>
<td>1.36</td>
</tr>
</tbody>
</table>

Table 4.6: Means and Standards Deviation for level of skill in teaching critical thinking (without negative scores reversed). Rating scale measuring Importance = Strongly Disagree (1), Disagree (2), Slightly Disagree (3), Slightly Agree (4), Agree (5), Strongly Agree (6).

Educators do agree (52%) their teaching strategies are designed to promote critical thinking (question 2), but provided variable responses, between strongly disagree to agree, when responding on abilities to teach, demonstrate, implement or assess critical thinking.
thinking skills or new strategies (questions 3, 4, 8, 11). Program directors indicate there is need for further professional development and are willing to implement new techniques (questions 13 and 17). Educators defined in open ended responses methods of how they developed their own critical thinking skills. Attendance of professional seminars or continuing education was the most common development strategy as defined in Table 4.7. Others included reading or researching topics pertaining to critical thinking, completion of advanced degree course work in either a Masters or Doctoral degree program. Others developed critical thinking skills on their own and with practice while others worked with other instructors or faculty to share and improve on ideas.

<table>
<thead>
<tr>
<th>Method</th>
<th>Response Percentage (n = 206)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Attendance of professional seminars, workshops or continuing education</td>
<td>37%</td>
</tr>
<tr>
<td>Research by reading textbooks or journal articles</td>
<td>27%</td>
</tr>
<tr>
<td>Completion of graduate level courses in Masters or Doctoral Programs</td>
<td>19%</td>
</tr>
<tr>
<td>Developed own skills through practice, trial and error, material online</td>
<td>9%</td>
</tr>
<tr>
<td>Collaborate with other educators in developing methods</td>
<td>8%</td>
</tr>
</tbody>
</table>

Table 4.7: Methods used by educators to developing skills in teaching critical thinking.

A Pearson Correlation was used to determine if the program director’s age or years of experience related to confidence, importance, skill level or ability to assess as shown in Table 4.8. Age or experience did not correlate with the four variables. There was however, a high correlation between the program directors’ level of skill and their
confidence in critical thinking ($r = 0.81; p < 0.001$). In addition, their level of skill was highly correlated with the program directors’ ability to assess the students’ critical thinking ($r = 0.76; p < 0.001$).

<table>
<thead>
<tr>
<th>Variable</th>
<th>Age</th>
<th>Experience in education</th>
</tr>
</thead>
<tbody>
<tr>
<td>Level of Confidence</td>
<td>0.01</td>
<td>0.83</td>
</tr>
<tr>
<td>Level of Importance</td>
<td>0.04</td>
<td>0.51</td>
</tr>
<tr>
<td>Level of Skill</td>
<td>0.05</td>
<td>0.36</td>
</tr>
<tr>
<td>Ability to Assess</td>
<td>-0.02</td>
<td>0.80</td>
</tr>
</tbody>
</table>

Table 4.8: Correlations between variables and the age and experience of program directors.

Assessment of Students Ability to Think Critically

Assessment of critical thinking skills is imperative to the evaluation of the students’ ability to think critically. Educators agree assessment is necessary to produce critical thinkers and continue to use critical thinking. The results showed a greater deviation in their ability to assess critical thinking assignments (see Table 4.9).

<table>
<thead>
<tr>
<th>Survey Question</th>
<th>Mean</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>8. I am not sure of how to assess critical thinking assignments</td>
<td>2.91</td>
<td>1.3</td>
</tr>
<tr>
<td>14. I avoid teaching critical thinking skills because I have difficulty assessing them</td>
<td>2.2</td>
<td>0.92</td>
</tr>
<tr>
<td>15. It is not necessary to assess students’ critical thinking skills</td>
<td>1.69</td>
<td>0.85</td>
</tr>
</tbody>
</table>

Table 4.9: Means and Standard Deviations for assessment of students’ critical thinking skills (without negative scores reversed).
Factors Impeding the Use of Critical Thinking

The third section of the survey elicited response from the program directors regarding the obstacles they face when using critical thinking skills. The respondents were asked to score the frequency that each of the factors inhibits their ability to use critical thinking strategies or their ability to assess critical thinking in the classroom (see Table 4.10). A 5 point Likert-type scale was used ranging from never a factor (1) to always a factor (5). The biggest impediment the program directors stated to have concern with was “Need to deliver a large amount of information to cover content” (m=3.48; SD = 0.97). They also expressed difficulty with “Students concerns of “getting a good grade” versus “learning” as another negative factor when trying to implement critical thinking. The third largest concern was the “Insufficient time to learn new teaching methods.” “Lack of student motivation to become critical thinkers” proved to sometimes become a barrier when incorporating critical thinking in the instruction. Program directors implied their time for preparation and planning critical thinking strategies was limited, therefore it was more difficult to use in their instruction. The least important factor impeding the use of critical thinking implementation was the program director’s fear of negative student evaluations, implying value in developing critical thinkers more than avoiding negative comments from students. Table 4.10 identifies the percentage of respondents with the frequency in which they face each of the obstacles.

Respondents further clarified the obstacles that limit the ability to incorporate critical thinking in the instruction through an open ended question. As defined in Table 4.11, lack of time in class or in preparation was cited by 38% of the respondents. Other
major obstacles included lack of critical thinking strategies or ideas, student inhibitors, curriculum content, and lack of support from administration via funding, or technology.

<table>
<thead>
<tr>
<th>Obstacle</th>
<th>Percentage of respondents</th>
<th>Mean (SD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>32. Need to deliver a large amount of information to cover content</td>
<td>2.42% 13.49% 30.80% 39.79% 13.49%</td>
<td>3.48 (.97)</td>
</tr>
<tr>
<td>39. Student concerns of &quot;getting a good grade&quot; versus learning</td>
<td>6.23% 13.15% 26.99% 38.06% 15.57%</td>
<td>3.44 (1.1)</td>
</tr>
<tr>
<td>25. Insufficient time to learn new teaching methods</td>
<td>2.77% 13.84% 51.56% 28.03% 3.81%</td>
<td>3.16 (.81)</td>
</tr>
<tr>
<td>36. Lack of student motivation to become critical thinkers</td>
<td>7.96% 15.57% 39.10% 32.18% 5.19%</td>
<td>3.11 (1.0)</td>
</tr>
<tr>
<td>35. Lack of time for preparing/planning critical thinking teaching strategies</td>
<td>6.23% 22.84% 41.18% 24.57% 5.19%</td>
<td>3 (.97)</td>
</tr>
<tr>
<td>38. Student expectation of lecture format instruction</td>
<td>9.00% 21.45% 34.26% 31.14% 4.15%</td>
<td>2.91 (1.0)</td>
</tr>
<tr>
<td>37. Student resistance to active learning</td>
<td>8.65% 25.61% 34.95% 27.68% 3.11%</td>
<td>2.88 (.99)</td>
</tr>
<tr>
<td>41. Lack of appropriate instructional materials</td>
<td>9.00% 23.88% 41.18% 21.80% 4.15%</td>
<td>2.87 (1.05)</td>
</tr>
<tr>
<td>31. Insufficient class time</td>
<td>11.76% 22.49% 37.02% 24.57% 4.15%</td>
<td>2.87 (.89)</td>
</tr>
<tr>
<td>40. Lack of time in assessing students critical thinking skills</td>
<td>5.88% 26.99% 43.60% 21.45% 2.08%</td>
<td>2.6 (.82)</td>
</tr>
<tr>
<td>33. Lack of knowledge of how to promote students' critical thinking skills</td>
<td>7.96% 37.02% 42.91% 11.42% 0.69%</td>
<td>2.55 (.88)</td>
</tr>
<tr>
<td>34. Difficulty in assessing student work that reflects critical thinking</td>
<td>11.76% 34.95% 40.83% 11.42% 1.04%</td>
<td>2.49 (.85)</td>
</tr>
<tr>
<td>27. Feelings of unpreparedness to teach critical thinking skills</td>
<td>12.11% 38.41% 38.41% 10.73% 0.35%</td>
<td>2.38 (.83)</td>
</tr>
<tr>
<td>26. Lack of knowledge of what constitutes critical thinking</td>
<td>14.88% 39.79% 37.37% 7.96% 0.00%</td>
<td>2.11 (1.09)</td>
</tr>
<tr>
<td>30. Large number of students per class</td>
<td>34.60% 35.99% 17.30% 8.30% 3.81%</td>
<td>1.98 (1.02)</td>
</tr>
<tr>
<td>29. Lack of administrative support in developing new teaching methods</td>
<td>39.10% 34.95% 16.96% 6.57% 2.42%</td>
<td>1.75 (.86)</td>
</tr>
<tr>
<td>28. Fear of negative student evaluations</td>
<td>47.06% 35.29% 14.53% 2.08% 1.04%</td>
<td>1.75 (.86)</td>
</tr>
</tbody>
</table>

Table 4.10: Percentage of respondents and the frequency in which they encounter each of the obstacles. Never (1), Seldom (2), Sometimes (3), Often (4) Always (5)
<table>
<thead>
<tr>
<th>Obstacle</th>
<th>Response Percentage (n = 198)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lack of time in class or in preparation</td>
<td>38%</td>
</tr>
<tr>
<td>Lack of critical thinking strategies or ideas</td>
<td>24%</td>
</tr>
<tr>
<td>Student inhibitors</td>
<td>19%</td>
</tr>
<tr>
<td>Curriculum Content</td>
<td>12%</td>
</tr>
<tr>
<td>Lack of support from administration via funding, or technology</td>
<td>12%</td>
</tr>
<tr>
<td>Assessment of critical thinking</td>
<td>5%</td>
</tr>
</tbody>
</table>

Table 4.11: Common obstacles defined by educators.
The ability to think critically has been the topic of many research studies. The student’s ability to master critical thinking has been a more common interest to researchers than the educator’s abilities to master and implement critical thinking. Inquiry of students’ development of this cognitive ability as it relates to their age, scholarly level, and type of instruction has often been reported in the research literature. A student’s ability to apply critical thinking skills is not only developed by the individual but is fostered in the classroom setting. Educators play a vital role in the overall process, yet little is known about educators’ perceptions and abilities to apply critical thinking skills in the classroom (Browne & Freeman, 2000; Halx & Reybold, 2005a). It is assumed that educators are experienced critical thinkers therefore they are able to effectively use teaching strategies to help students develop their own skills. The research evidence demonstrates gaps between what the educators believe to be critical thinking and their abilities to promote it within the classroom (Adams, 1999; Brunt, 2005; Hickman, 1993; Mundy & Denham, 2008).
Perceived Confidence in Use of Strategies and Assessments

The results of this study identified radiation science educators’ confidence levels and the skills they have in assessing and using critical thinking strategies. They also define the importance educators place on critical thinking and the barriers that limit their use. The educators confidence in their use of strategies and assessment of critical thinking was determined by 5 survey questions using a Likert type scale ranging from 1 (strongly disagree) to 6 (strongly agree). Educators were fairly confident in their abilities to teach or to demonstrate critical thinking. Although many educators either slightly agreed or agreed with their satisfaction in their teaching methods, they also expressed a need for further professional development. These findings seem to indicate that educators are always looking for better methods of developing critical thinking strategies and are always looking for improvement. Even the best educator may never be completely satisfied with his or her methods. These findings support the study by Zygmont and Schaefer (2006) that suggests that although most educators are very skilled in critical thinking, a certain percent may not have completely developed their skills and are therefore, not confident. Lack of confidence may relate to how well they were taught to critically think themselves. Halx and Reybold (2005b) stated, “Most faculty members are never trained to teach, much less to teach critically” (p. 309). Within the health professions, educators were initially trained in their professional practice and later became teachers, sometimes without additional training on teaching.

Confidence in using critical thinking strategies may take years to develop and often requires advanced education to formulate methods and ideas. The Doctoral level
program directors produced the highest confidence level within the study. The results show a significant difference in the program directors confidence when compared to their level of education. The greatest difference was between the Masters level educator and the Doctoral level educator. Typically, one might expect the Doctoral degree educator to be better prepared in methods and strategies of critical thinking. This is also supported through the open ended response in which program directors stated they have developed their critical thinking skills through advanced level education courses. As stated by one Doctoral Candidate program director, “Critical thinking has been a major focus of my studies throughout graduate school.” It was rather surprising to find no significant difference between the associate level and baccalaureate level educator. This finding is somewhat supported by the research of Saarman et al. (1992) in which they compared the critical thinking abilities of nursing faculty to those of sophomore nursing students. With the influence of age controlled, they found no significant difference between the two groups (Saarman, Freitas, Rapps, & Riegel, 1992).

**Perceived Importance Placed on Critical Thinking in the Classroom and Clinical**

Radiation science educators were also asked questions regarding the importance they place on critical thinking in the classroom and the clinical setting. Unsurprisingly, the respondents agreed or strongly agreed with the necessity of critical thinking in the classroom and they valued its development as an educational outcome of the student. Teaching strategies are used to promote critical thinking and with the use of these strategies, educators can enhance students’ critical thinking skills and ability to make
complex decisions. The need for developing high level critical thinking strategies and decision making is imperative in most health care professions. One question which produced a wide range of results was “Teaching course content is more important than encouraging critical thinking tasks.” Program directors varied in responses from disagree to slightly agree. This implies that educators may be unsure of how to combine content coverage with the development of critical thinking skills (Shell, 2001).

Research has shown critical thinking strategies to be an integral part of the classroom. Walsh and Seldomridge (2006) explored the role and place of critical thinking in an undergraduate nursing program and examined whether critical thinking was being strengthened or diminished in the classroom and clinical sites. They identified several issues in reinforcing critical thinking in the nursing education. It is understood that educators realize the role they play in developing the students’ critical thinking skills yet are under significant pressure to cover content material required of the profession within a limited time frame. Therefore, lecture seems to be the strategy most often used. Students not only need the content material to understand their profession but they also need instruction on how to think critically with the knowledge they have obtained. Educators should review their content and determine how it can be taught to develop critical thinking (Irionside, 2004; Saarman et al., 1992).

Critical thinking has been the “gold standard” for education in most professions. The results clarified the fact that critical thinking is important to all program directors regardless of their education level, age or the type of program in which they are affiliated. When measuring the importance of critical thinking, there was not a significant
difference between program directors from different education levels, age or types of education programs. Research studies did however; show a difference in critical thinking when comparing students at different levels of education. Stadt and Ruhland (1995) found there was a significant difference between the baccalaureate and the associate degree radiography students. According to their study, baccalaureate students showed a higher level of critical thinking skills in the five subtests (Inference, Assumption, Deduction, Interpretation, & Argument) of the Watson-Glaser Critical Thinking Appraisal.

Perceived Skill in Using Critical Thinking Strategies in the Classroom

Utilizing critical thinking strategies in a classroom requires a skilled educator to formulate methods and ideas while integrating content. The results of this study show many differences in the items that measure perceived skills in critical thinking strategies. The program directors agreed that they have adequate skills in using critical thinking. Educators do promote critical thinking in their teaching strategies and are very willing to implement new teaching strategies into their lessons. When asked to rate, “I am satisfied with my present teaching strategies,” the results showed a fairly even distribution between slightly disagree, slightly agree and agree. This corresponded with the results identifying the need for further professional development. Educators will always look for methods to further develop their own abilities in critical thinking. This finding is supported by Shell’s (2001) study on barriers nurse educators experience when teaching critical thinking. The study indicated critical thinking was a valuable and important
concept for nurse educators and has become the goal for teaching. The nurse educators felt confident in their abilities to teach critical thinking skills and perceived themselves as prepared to promote critical thinking in the classroom. Yet, they felt a need for additional education on teaching critical thinking and were willing to attend courses pertaining to implementation of critical thinking.

Radiation science educators described methods they used to help develop their present critical thinking skills and strategies. Many educators have gained valuable insight in their development through attending professional development seminars, workshops, or continuing education courses. One respondent further stated workshops, though helpful, tend to focus on critical thinking strategies relating to patient care or medical ethics courses rather than the hard-based science course content such as physics, math, and quality control. This may be due to the content of the course being more fact based.

According to the results, educators participating in this study have increased their critical thinking skills through researching methods of development, reading journal articles and reading textbooks. Information they obtain is then put into practice. Further research and experience with critical thinking would then provide further improvements to the strategies and methods the educator has implemented. Collaborating with other educators, either within the same program of study, or with educators from other disciplines such as nursing or arts and humanities, has been beneficial for many educators. Professional interaction provides the educator with strategies that can positively or negatively impact the critical thinking skills of their students. Another
common method, expressed by educators participating in this study, of developing skills in critical thinking has been through professional course work while working on or completing the program director’s Master’s degree or Doctoral degree. Accreditation has been the driving force for many to complete advanced education. This has become a benefit to the profession due to educators engaging in advanced level courses designed to teach or model critical thinking strategies. Participating as a student in the instructional methods in a course provides educators with insight in how to improve the courses they teach.

Mangena and Chabeli (2005) found the facilitation of critical thinking was impeded by the lack of critical thinking skill of nurse educators. Educators needed to keep abreast of changes in nursing education and the need for critical thinking in developing lifelong learners in the students. To do so educators should continually reflect on their teaching skills, update critical thinking methods, and increase their knowledge of critical thinking. Attending seminars, workshops and conferences, guest lecturers, program committee work on curriculum development, reading research articles on critical thinking and discussion of critical thinking with faculty and colleagues where highly recommended methods to increase one’s skills in critical thinking (Mangena & Chabeli, 2005; Raymond & Profetto-McGrath, 2005).

In a study conducted by Raymond and Profetto-McGrath (2005), educators identified positive and negative factors that influenced their critical thinking abilities in the classroom. Positive influences to critical thinking included faculty development opportunities, administrative support, freedom to experiment with new ideas, and
mentorship. The negative barriers to implementation included intensive work loads, strict content delivery, not allowing time for new ideas, fellow faculty members who were unreceptive to critical thinking and students who displayed negative attitudes towards critical thinking ideas used in class. Educators not only need assistance in developing critical thinking but would benefit from strategies used to combat the negative interaction with students and peers (Raymond & Profetto-McGrath, 2005).

Covering course content with the use of critical thinking strategies appeared to be a greater issue with program directors than their willingness to implement critical thinking. Of the respondents, 34 – 38% either slightly agreed or agreed that they found it difficult to combine teaching for content coverage with the promotion of critical thinking and that they were not sure of how to assess the students’ skills in critical thinking. This implies educators are willing to use critical thinking strategies but lack the resources of implementation. Program directors appear to struggle with the idea of giving up content for critical thinking strategies. They are faced with less class time to cover more content but still try to incorporate strategies to promote critical thinking. In a study by Ironside (2004), it is suggested that educators review the content and determine how the content can be covered through techniques developed by the educator. They should acknowledge that total coverage of content is the purpose of textbooks and educators should avoid spoon-feeding the facts and instead provide the student with guidelines to help develop their problem solving or decision making skills. In one experiment in Ironsides’ study, it was found that by practicing critical thinking tasks in the classroom, students would reveal content that was difficult to understand that should be further explained.
The results of this study clarified that the program directors’ age and experience were not related to their skills in teaching critical reasoning. This contradicts the findings of Zygmont and Schaefer (2006) who suggest educators who advance in age are less likely to be able to assess the content of the statements, the strength of the arguments and to state results to justify one’s reasoning. The authors also concluded that the educator’s experience in teaching presented a greater likelihood of developing individuals who are able to see alternative viewpoints but apply a more inflexible approach to situations. It was suggested that these results could be influenced by factors such as heavy workloads, or educators’ feeling that they must know all the answers rather than becoming a co-learner with students in the student-centered approach to learning. Discussions in class between educators and students or among a group of students in which differences in opinions and values are shared will enable them to increase their knowledge and skill of the subject. (Shin, Jung, Shin, & Kim, 2006).

Assessment of Students’ Ability to Think Critically

The educators’ ability to assess the students’ critical thinking in the classroom was determined by 3 survey questions. Program directors agreed that assessment of the students’ critical thinking is necessary to determine if their methods of teaching are successful. However, 34% of the respondents were not completely sure of how to assess critical thinking strategies. Assessment is a crucial part of understanding a students’ development. Educators may possess highly evolved critical thinking skills themselves
but may lack a clear understanding of the methods available to best assess the student (Mundy & Denham, 2008).

A study by Ennis (1993) on Critical Thinking Assessment takes an in-depth look at methods of assessing students’ ability to think critically and verifies the importance of proper assessment techniques. Defining the purpose of the assessment is the first step of development. Ennis (1993) states a few of the main purposes of assessment are; diagnosing the levels of students’ critical thinking, student feedback, student motivation toward critical thinking, and obtaining feedback regarding the teachers instruction. The study further describes the difficulties of clinical thinking assessment to be: the lack of making a test comprehensive, the inability to allow for altered viewpoints between the student and the educator in a subject, limited time in giving a test, and extensive grading time. Ennis clarifies the difficulties with multiple choice testing and with open ended response or essay testing. Both types of test have problems, but the open ended or essay will provide a more comprehensive method of testing the students’ ability to critically think. It suggests the use of multiple choice questions with written justification as a better method of assessing critical thinking without being too labor intensive for the educator. Using just one method of testing will not necessarily meet the goals of the educator when trying to evaluate a student’s complex thought process. Assessment should consist of various kinds of testing mechanisms in which students interpret, analyze and evaluate problems and will reflect the competencies required in the professional practice (Segers & Dochy, 2001).
Factors Impeding the Use of Critical Thinking

Implementation of critical thinking strategies in a classroom, although important, may be subject to obstacles when developing or implementing critical thinking. The program directors identified, in survey questions and open ended response, several impediments they come across when incorporating critical thinking strategies. The need to cover a large amount of information to cover content was stated as the biggest obstacle they faced. Course content is driven by the profession. It states what the students will need to know but doesn’t state how they should obtain the information. It is up to the educator to define the mechanism in which the student will grasp the knowledge (Aaron & Haynes, 2005; Kowalczyk & Leggett, 2005). Students must be able to create a relationship between content and the professional practice. Research studies have noted a more positive method to cover content would be to reviewing the content material, and then manipulate it to focus on critical thinking strategies (Halx & Reybold, 2005a; Mangena & Chabeli, 2005). This allows students to think about content in a different perspective. Critical thinking may also be driven by the type of course. Some courses are from the scientific discipline while others are from the behavioral discipline. Jones and Brown (1993) associated the scientific courses with problem solving techniques and the behavioral courses with critical thinking techniques. The type of course may cause difficulty when trying to introduce critical thinking strategies. As one program director stated in the survey, “Some classes seem to lend themselves to more critical thinking types of exercises than others. For some reason it seems easier for me to allow different types of activities in ethics class than in principles or physics which is mostly lecture.”
Student’s lack of willingness to engage in critical thinking in the classroom has caused conflict with the effectiveness of the critical thinking strategy. Comments from the survey clarify, some students are more concerned about “getting a good grade” rather than obtaining in depth knowledge of the subject matter. Students often show lack of motivation to become critical thinkers. They expect the educator to deliver the content through lecture format and when approached with a different learning strategy, will often show resistance to the active learning technique. One participant of the survey responded, “Students today want all the information handed to them and don’t want to have to think. They don’t want to know why something is a certain way.” These student inhibitors impede the educators’ development of new techniques and limit the students’ ability to become critical thinkers. The educators approach should be to change the behavior and thought process of the student. They should encourage students to engage in the critical thinking process and help recognize the benefits of thinking beyond the memorization of facts (Halx & Reybold, 2005b).

Time was another impediment of critical thinking for program directors. Questions regarding insufficient time to learn new techniques, lack of time preparing and planning strategies, insufficient class time, and lack of time to assess critical thinking skills ranked as sometimes being an inhibitor to critical thinking: Although educators responded as if time were not a strong inhibitor, through the open ended questions regarding obstacles of critical thinking, the educators listed time as being their greatest obstacle. It was most commonly associated with content in which there was not enough time to cover the content required and still implement critical thinking strategies. One
respondent stated, “The largest obstacle is TIME. With the curriculum requirements growing each year and the institution not wanting to increase credit load, this is difficult to accomplish.” The support of time constraints as a limiting factor in critical thinking is supported by the research of Clarke and Gabert (2004) who verified that educators are often limited in time to prepare critical thinking activities. They suggest learning may have a negative impact on the student’s development of critical thinking due to the ill prepared educator.

Other inhibiting factors towards implementation of critical thinking included support from administration through either work load demands on the educator or lack of funding for tools needed to implement meaning critical thinking strategies. Another factor often expressed in the open ended response was the lack of materials, instructional resources, exercises or tools needed to teach critical thinking.

The results of the study were similar to the results found by Shell (2001) which identified the most common barriers perceived by nursing faculty to be student characteristics, time constraints and content coverage. The student characteristics mirrored the results of this study by identifying lack of student motivation, resistance to active learning, expectation of lecture format and concerns of getting good grades. The student characteristics were listed as the greatest set of barriers within Shell’s research. Time constraints and content coverage were also listed as barriers with the greatest negative effect towards implementation of critical thinking. Once again, educators identified insufficient time to learn new teaching methods, lack of time for preparation and planning, and inadequate class time as key impediments. Nursing programs also
require an overwhelming amount of content to be covered within the education program; therefore, educators must distinguish what information must be disseminated in the classroom and what information should the student be required to develop independently.

Implications for Practice

This study was designed to determine the perceptions educators have on the critical thinking skills and strategies used in their education programs. It analyzed educators’ confidence in utilizing critical thinking, the importance they place on it, the level of skill they possess, educators’ ability to assess critical thinking, and the factors which impede the use of critical thinking. The findings indicate that program directors value critical thinking as a necessary tool to prepare students for the profession. Several limitations to critical thinking were identified by educators as key stumbling blocks towards their implementation of critical thinking.

Continuous development of critical thinking skills improves upon the strategies and methods used by educators. Professional course work, journal articles and seminars provide useful information to guide the educators toward the steps of critical thinking development. Results of the study verified that educators with Doctoral degrees were the most confident in their critical thinking abilities. Confidence was often provided by participating in advanced level course work and conducting research to fully understand the meaning and usefulness of critical thinking strategies. Seminar attendance is useful if educators can then apply the concepts to the classroom. Educators most commonly are in search of new ideas and strategies to implement in the classroom. Collaboration with
fellow educators in the same profession or a different profession may stimulate the thought process and assist in developing and improving techniques that may or may not work. Applying critical thinking concepts is the goal of most educators and will often take years to develop. It requires knowledge and experience to effectively implement this multidimensional cognitive process (Jones & Brown, 1993).

Content and the time required to implement critical thinking is a deterrent to many educators who lack experience or confidence. To incorporate critical thinking in a fact based curriculum requires an open minded educator and one who is willing to take a few risks. Reviewing course content and defining the necessary information to cover in class versus the information that the student takes responsibility to independently learn through the textbook or through research, is a big first step for most educators. Students must become aware of their own responsibilities in the learning process. Making the student a part of the solution rather than a part of the problem. To teach students to think critically, the educator should focus on a student centered environment with thought provoking tasks to engage the student in the learning process (Mangena & Chabeli, 2005). Instructors can cover content by using the knowledge the student has gained on their own, guiding them through the learning tasks that allow them to synthesize concepts together. Educators must first understand how the student learns and thinks about content, and then devise strategies to enhance their ability to learn.

Student motivation may enhance or deter the critical thinking efforts proposed by the educator. Focusing on the students’ learning style and adapting and engaging them in strategies to fit their learning style may provide a more comfortable environment to learn.
(Zygmont & Schaefer, 2006). The student needs to be a part of the instruction and openly provide analysis of their own thoughts and ideas. Using open discussion in the class with participation from both the students and instructor can promote a trusting relationship, thereby allowing students to further pursue their intellectual curiosity of a subject. This may provide greater depth to the topic than what would have been presented in a lecture format. Educators who display critical thinking skills may motivate the students to become critical thinkers themselves (Mangena & Chabeli, 2005; Raymond & Profetto-McGrath, 2005; Zygmont & Schaefer, 2006). Eventually, students will discover the benefits of becoming a critical thinker in their profession.

Limitations

The study has a several possible limitations. The radiation sciences education programs consist of a wide variety of programs throughout the United States to include various degree and certificate granting institutions. Of the 817 radiation sciences programs, 86.5% maintain JRCERT program accreditation. The survey was solicited from only the JRCERT accredited programs due to the accessibility of email addresses. The results will be generalized to include only the view points from JRCERT accredited programs. Another limitation is that only program directors were surveyed in the study due to the known a set list of email address. Access to email addresses for other educators within the programs was unknown. Therefore, information could not be solicited from all levels of educators within the radiation sciences programs. A final
limitation was the percent response rate. Of the 686 sampled, only 317 responded for a 46.2% response rate. Results may have shown a difference with a higher response rate.

Recommendations for Future Research

The study provided great insight on the radiation science educator’s perceptions of obstacles to using critical thinking. It is evident that educators feel strongly about critical thinking but have some reservation in their abilities to teach and assess critical thinking skills. Many studies in the past have measured the student’s critical thinking skills using standardized exams such as the Watson-Glaser Critical Thinking Appraisal. It is evident that students learn better from an educator who models critical thinking in the classroom. It would be beneficial to determine if the educators are true critical thinkers by implementing the same standardized test on them. For those with sound critical thinking skills, what are the outstanding characteristics which make them a success?

Another possible study would be to further evaluate the effectiveness of the critical thinking strategies educators use. Educators feel confident in their use of critical thinking; however, this study did not examine the results of the methods used to increase their confidence level. Is there an increase in the student’s critical thinking ability from the beginning of their education program to the end of the program? Does the level of education they are receiving, such as an associate degree program versus a baccalaureate degree program, make a difference in critical thinking skills? Nursing educators have
looked at this same idea and have found varying results. Do the radiation science educator’s methods of teaching make a difference?

Conclusion

Radiation science educators are vital elements in developing students into the critical thinkers of our profession. Educators value the importance of instructing students to use critical thinking skills, mentally challenge them, and open their minds to alternative ways of thinking. Though educators feel confident in their ability to teach students with critical thinking skills, they indicate a need to improve their skills. Further education and research into the methodologies of effective critical thinking skills is a goal for many educators. The results showed that doctoral degree educators had experienced the higher level education courses that not only improved their skill level but also increased their confidence in their use of critical thinking strategies.

Program directors expressed satisfaction with their level of skill in using critical thinking strategies within the classrooms and believe their teaching strategies guide students to become critical thinkers. Though satisfied with their critical thinking abilities, the results demonstrate a need for improvement when demonstrating, implementing and assessing strategies in the classroom. Educators are continually striving to better their teaching techniques through research, reading journal articles, attending educational seminars and collaborating with fellow educators.
Improvements in critical thinking skills and strategies would be easier if it weren’t for the obstacles educators’ experience along the way. Educators identified six obstacles inhibiting their success with critical thinking.

- Lack of time in class or in preparing for critical thinking strategies
- Lack of critical thinking strategies or ideas
- Student inhibitors (motivation and resistance)
- Overwhelming amount of curriculum content
- Lack of support from administration
- Lack tools and methods to assess critical thinking

Though educators continually strive to improve their critical thinking abilities, the profession has the opportunity to assist with the overall development of the educator through seminars and content review. Increasing the educator’s skill and alleviating obstacles will aid in successfully preparing students to think critically within their profession. Improving education and how it is implemented will ultimately raise the bar for the profession as well.


APPENDIX A

PERCEPTIONS OF CRITICAL THINKING SURVEY
Radiation Science Educators' Perception of Obstacles in the Use of

1. Demographics

Demographic information will be used to correlate the survey responses to the characteristics of our educators, please provide the following information.

Type of institution in which you are affiliated.
- [ ] 4 year College/University
- [ ] 2 year Community College
- [ ] 2 year Technical College/Institute
- [ ] Hospital/Medical Center Certificate
- [ ] Proprietary

Region your education program resides.
- [ ] Northeast (ME, VT, NH, MA, RI, CT, NJ, PA, NY, DC)
- [ ] Southeast (WV, DE, MD, KY, VA, TN, NC, MS, AL, GA, SC, FL)
- [ ] Midwest (OH, IN, IL, WI, MN, IA, MO, ND, SD, NE, KS)
- [ ] South Central (OK, AR, LA, TX)
- [ ] Northwest (MT, WY, CO, ID, UT, WA, OR, AK)
- [ ] Southwest (AZ, NV, CA, HI, NM)

Education Discipline
- [ ] Radiologic Technology
- [ ] Radiation Therapy

What is your highest level of education?
- [ ] Doctorate
- [ ] Masters
- [ ] Bachelor
- [ ] Associate
- [ ] Certificate
- [ ] Other

What is your age?


Radiation Science Educators' Perception of Obstacles in the Use of

<table>
<thead>
<tr>
<th>How many years have you been an instructor in Radiation Sciences?</th>
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<table>
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<tr>
<th>What percentage of time do you spend teaching?</th>
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</table>
2. Perceptions of Critical Thinking

The following questions (1-24) address perceptions that occur when implementing critical thinking strategies in courses. To what extent do you agree or disagree with each of the following statements. Select the answer which best reflects your level of agreement.

What are your PERCEPTIONS on teaching critical thinking skills to your students?

<table>
<thead>
<tr>
<th></th>
<th>Strongly Disagree</th>
<th>Disagree</th>
<th>Slightly Disagree</th>
<th>Slightly Agree</th>
<th>Agree</th>
<th>Strongly Agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Helping students develop critical thinking skills is a primary objective of my teaching efforts.</td>
<td>○</td>
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<td>2. Most of my teaching strategies are designed to promote critical thinking.</td>
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<td>3. I am not sure of my abilities to teach critical thinking skills.</td>
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<td>4. I am not sure how to &quot;model&quot; or demonstrate critical thinking.</td>
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<td>5. Teaching strategies cannot change students' critical thinking skills.</td>
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<td>6. Lecturing is my primary method of teaching.</td>
<td>○</td>
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<td>7. Teaching course content is more important than encouraging critical thinking tasks.</td>
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<td>8. I am not sure of how to assess critical thinking assignments.</td>
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<td>9. I find it difficult to combine teaching for content coverage with the promotion of critical thinking skills.</td>
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<td>10. I find it difficult to change my teaching strategies.</td>
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<td>11. I have difficulty implementing new, innovative teaching strategies.</td>
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</table>
### 3. Perceptions of Critical Thinking continued

What are your PERCEPTIONS on teaching critical thinking skills to your students?

<table>
<thead>
<tr>
<th>Statement</th>
<th>Strongly Disagree</th>
<th>Slightly Disagree</th>
<th>Slightly Agree</th>
<th>Strongly Agree</th>
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<tr>
<td>12. I value the development of critical thinking skills as an educational</td>
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<tr>
<td>outcome.</td>
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<td>13. I am willing to implement new teaching strategies.</td>
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<td>14. I avoid teaching critical thinking skills because I have difficulty</td>
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<tr>
<td>assessing them.</td>
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<tr>
<td>15. It is not necessary to assess students’ critical thinking skills.</td>
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<td>16. I am satisfied with my present teaching strategies for critical</td>
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<td>thinking.</td>
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<td>17. I need further professional development in the area of incorporating</td>
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<td>critical thinking activities in the classroom.</td>
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<td>18. I see a need to change my style of teaching.</td>
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<td>19. I feel the development of skills in critical thinking is necessary for</td>
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<td>student success.</td>
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<td>20. I would attend a continuing education class on critical thinking</td>
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<td>based teaching methods.</td>
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<td>21. I need additional education on how to incorporate critical thinking</td>
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<td>skills in the classroom.</td>
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<td>22. My teaching load interferes with my ability to incorporate critical</td>
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<td>thinking skills in the classroom.</td>
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<td>23. I am satisfied with my critical thinking assessment skills.</td>
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<td>24. I only include critical thinking strategies in my classes because it is</td>
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<td>required by accreditation.</td>
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</table>
### 4. Obstacles of implementation

Questions (25-41) relate to the obstacles that may be a factor in your ability to implement critical thinking strategies. Select the response which best describes the frequency to which the obstacle occurs.

When considering using critical thinking skills, what level of FREQUENCY do you face the following OBSTACLES?

<table>
<thead>
<tr>
<th>Question</th>
<th>Never</th>
<th>Seldom</th>
<th>Sometimes</th>
<th>Often</th>
<th>Always</th>
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<tbody>
<tr>
<td>25. Insufficient time to learn new teaching methods.</td>
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<td>27. Feelings of unpreparedness to teach critical thinking skills.</td>
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<td>28. Fear of negative student evaluations.</td>
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<td>29. Lack of administrative support in developing new teaching methods.</td>
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<td>30. Large number of students per class.</td>
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<td>31. Insufficient class time.</td>
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<td>32. Need to deliver a large amount of information to cover content.</td>
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<td>33. Lack of knowledge of how to promote students' critical thinking skills.</td>
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<td>34. Difficulty in assessing student work that reflects critical thinking.</td>
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<td>35. Lack of time for preparing and planning critical thinking teaching strategies.</td>
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<td>36. Lack of student motivation to become critical thinkers.</td>
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<td>37. Student resistance to active learning.</td>
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<td>38. Student expectation of lecture format instruction.</td>
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<td>39. Student concerns of &quot;getting a good grade&quot; versus learning.</td>
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<td>40. Lack of time in assessing students critical thinking skills.</td>
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<tr>
<td>41. Lack of appropriate instructional materials.</td>
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</table>
5. Individuals View of Critical Thinking

What additional information can you share regarding your abilities in incorporating critical thinking in your instruction? Questions (42-45) provide an opportunity to further comment on your obstacles, methods, skill development and your assessment of critical thinking.

42. What other obstacles limit your ability to incorporate critical thinking in your instruction?

43. What methods do you utilize to incorporate critical thinking in your classroom?

44. What have you done to develop your skills in teaching critical thinking?

45. How do you assess your students critical thinking skills in the clinical setting?

46. What does critical thinking mean to you?
APPENDIX B: TIME LINE FOR SURVEY

Day 1   -  Submit study to IRB committee at The Ohio State University
Day 14  -  Create Survey using Survey Monkey
Day 16  -  Email invitation to the survey
Day 23  -  1st reminder email
Day 30  -  2nd reminder email
Day 37  -  Collect data from returned surveys
APPENDIX C

LETTER SENT TO PANEL OF EXPERTS
Dear Ms. Belinsky;

I am writing to request your assistance in a survey I am conducting on the perceptions radiation science educators have on teaching critical thinking skills. You have been chosen as one of four experts on critical thinking because of your knowledge and experience. I consider you a valuable asset in determining the validity of the questionnaire I am utilizing and am proposing to distribute.

Critical thinking is of great importance to our profession and to the development of students as critical thinking professionals. It is our duty as educators to do what we can to improve the performance of instruction. The survey is intended to help identify barriers which impede the use of critical thinking as well as the following variables:

- Confidence in the use of strategies and assessment of critical thinking.
- Importance of critical thinking in education.
- Skills in using critical thinking strategies.
- Ability to assess students’ critical thinking skills.

I have attached a questionnaire for your review. The questionnaire has been modeled after a previous questionnaire used in nursing research. Please critique the questions by identifying if they are appropriate and necessary to the purpose of the survey. Are there better questions that should be included or some that should be deleted from the questionnaire? Do the questions accurately measure the affective variables described above? Did I identify appropriate sections of measurement? I would greatly appreciate your valuable input and any suggestions you may have in improving the questionnaire.

Please return the questionnaire and your comments in the self addressed stamped envelope provided by September 14, 2009. If you have questions or would prefer to contact me in person, I can be reached between 8 AM to 4:30PM at 614-293-6203 or 614-571-0157 or by email at ruth.hackworth@osumc.edu.

Thank you very much for your time and effort with this important survey. I look forward to your reply.

Sincerely,

Ruth M. Hackworth
The Ohio State University
Radiologic Sciences and Therapy
Ruth.Hackworth@osumc.edu
614-293-6203
To: [Email]  
From: Ruth.Hackworth@osumc.edu

Subject: Radiation Science Educators' Perceptions of Critical Thinking

Body: Dear Program Director

I would like to request your assistance in a study I am conducting on the perceptions and obstacles radiation science educators have on teaching critical thinking skills. This study (approved by the IRB) is designed to help us determine the difficulties instructors face in preparing students to think critically.

Critical thinking is of great importance to our profession and to the development of students as critical thinking professionals. It is our duty as educators to do what we can to improve the performance of instruction. The survey is intended to help identify the educators’ confidence in their use of strategies and ability to assess critical thinking skills. The educator’s perceptions of the importance and need of critical thinking will be assessed. The awareness of difficulties or obstacles educators are faced with, when implementing the skills, and the frequency in which they occur will be determined. The results will help educators identify areas for improvement.

Here is a link to the survey:
http://www.surveymonkey.com/s.aspx

This link is uniquely tied to this survey and your email address. Please do not forward this message.

The answers to the survey are completely confidential and should only take 15 minutes of your time. The survey is voluntary. However, as a program director and leader in the profession, your input is extremely important to our professional outcomes. The survey will be open for input until October 22, 2009.

If you have questions or would prefer to contact me in person, I can be reached between 8 AM to 4:30PM at 614-293-6203 or by email at ruth.hackworth@osumc.edu.

Thank you very much for your time and effort with this important survey. I look forward to your reply.
Sincerely,

Ruth M. Hackworth
Radiologic Sciences and Therapy
The Ohio State University

Please note: If you do not wish to receive further emails from us, please click the link below, and you will be automatically removed from our mailing list. http://www.surveymonkey.com/optout.aspx
APPENDIX E

FOLLOW UP LETTER SENT TO PROGRAM DIRECTORS 1 WEEK AND 2 WEEKS
AFTER INITIAL MAILING
Dear Program Director;

Critical thinking is obviously of great importance to our profession. I am in need of your support in defining how we can improve our methods of developing critical thinkers in our classrooms by identifying obstacles educators face.

Please take 15 minutes to complete the previously submitted Critical Thinking survey by clicking on the link below.

http://www.surveymonkey.com/s.aspx

Your response is highly valued and it's important that everyone's voice or opinion to be heard. The survey will remain open until October 23.

I sincerely thank you for your support in my study and I look forward to your response. If you have any questions, please do not hesitate to contact me.

Ruth M. Hackworth
Radiologic Sciences and Therapy
The Ohio State University
Ruth.Hackworth@osumc.edu
614-293-6203

Please note: If you do not wish to receive further emails from us, please click the link below, and you will be automatically removed from our mailing list.
http://www.surveymonkey.com/optout.aspx