LEARNING ACTIVITIES THAT FOSTER CRITICAL THINKING SKILLS

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Critical Thinking

Being aware of **HOW** you think, rather than **what** you think.

Mindful learning
Active learning

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Richard Paul’s 35 Approaches to Critical Thinking

[Link to web site: http://www.criticalthinking.org/resources/k12/TRK12-strategy-list.cfm]
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**Patient Care Courses:**
- Radiography
- Cardiac/Interventional & Vascular
- Nuclear Medicine

**Technical Courses:**
- Positioning
- CVI procedures
- Nuclear Medicine Procedures

**Scientific Principles:**
- Principles of Exposure
- Nuclear physics

**Quality Assurance**
- Ensuring patient safety
- Ensuring quality control

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**LEARNING ACTIVITIES TO FOSTER CRITICAL THINKING:**
- Compare & contrast
- Problem solving
- Content-based journals
- Brainstorming
- Creative drama
- Instructor initiated questions and directions
- Writing across the curriculum
- Cooperative learning
- Learning contracts
- Moral dilemmas
- Values clarification
- Expressing opinions
- Textbook language analysis
- Computer-aided instruction
DETERMINE WHICH TEACHING TECHNIQUE BEST SERVES THE OUTCOME.

EXPLORING THOUGHTS THAT UNDERLY YOUR FEELINGS:

- CREATIVE DRAMA
- EXPRESSING OPINIONS
- CONTENT BASED JOURNALS
- MORAL DILEMMAS
- VALUES CLARIFICATION EXERCISES

GENERIC QUALITIES of CRITICAL THINKING

- Identifying & challenging assumptions
- Exploring alternative ways of thinking & acting
- Engaging in dialogue to interchange our views and the views of others

DETERMINE WHICH TEACHING TECHNIQUE BEST SERVES THE OUTCOME.

• Clarifying issues & claims
• Clarifying ideas
• Examining assumptions
• Clarifying or critiquing text
• Distinguishing facts from ideals
• Integrating critical vocabulary
• Refining generalizations
• Distinguishing relevant from irrelevant facts
• Supplying evidence for a conclusion
• Recognizing contradictions
• Exploring implications and consequences
• Evaluating source credibility

- RESEARCH
- WRITING ACROSS THE RADIOGRAPHY CURRICULUM
- TEXTBOOK LANGUAGE ANALYSIS
- COMPUTER AIDED INSTRUCTION
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DETERMINE WHICH TEACHING TECHNIQUE BEST SERVES THE OUTCOME

- Avoiding oversimplification
- Clarifying ideas
- Developing criteria for evaluation
- Evaluating arguments
- Generating, assessing solutions
- Distinguishing facts from ideas
- Distinguishing relevant from irrelevant facts
- Supplying evidence for a conclusion
- PROBLEM SOLVING
- COOPERATIVE LEARNING
- BRAINSTORMING
- CREATIVE DRAMA
- EXPLAINING OPINIONS
- INSTRUCTOR INITIATED QUESTIONS / DIRECTIONS

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DETERMINE WHICH TEACHING TECHNIQUE BEST SERVES THE OUTCOME

- DEVELOPING ONE’S PERSPECTIVE
- FOSTERING INDEPENDENT THINKING
- SUSPENDING JUDGEMENT
  - COOPERATIVE LEARNING
  - BRAINSTORMING
  - CREATIVE DRAMA
  - EXPRESSING OPINIONS
  - MORAL DILEMMAS / REASONING
  - VALUES CLARIFICATION

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Let's take a look at a few different activities that can foster critical thinking skill development in the Radiologic Technology classroom.
NOTING SIMILARITIES & RECOGNIZING CONTRADICTIONS

PRINCIPLES OF EXPOSURE -
- Compare techniques given to them by the RT's
- (use 15% / 30% rule to "re-work the techniques until they all appear similar")
- Why are they different? / Are they different?

PRINCIPLES & PRACTICE OF RADIATION THERAPY -
- Assess side effects and complications, to create interdisciplinary management strategies that foster prevention, healing and comfort

IMAGE EVALUATION / TREATMENT PLANNING -
- Assess outcomes (images or planning documents) for compliance with professional practice criteria:
  - Multiple images/documents of the same position or treatment
  - Classify criteria used
  - Analyze relationships in anatomy between treatments/images
  - Apply abstract principles
  - Note text verbiage utilized: similarities
- Work up to showing entire cases for critique

PATIENT CARE / CLINICAL -
- Group observation in clinical (each records the event)
- Assess the situation for areas of improvement
- Draw a conclusion about the activity.
- In class follow up (sharing results)
- Note similarities in what was observed
- Discuss why each found something different to be note worthy
- ID common issues that were assumed vs. observed
- Examine why assumptions were made
- Distinguish observations from conclusions
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**PROVIDING EVIDENCE FOR CONCLUSIONS**

**ORIENTATION:**
- Go over state law's regarding practice of RT.
- Have student's provide a rationale for the law
  (this also helps them, to transfer information to new contexts!)

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**PROVIDING EVIDENCE FOR CONCLUSIONS**

**CLINICAL / CLASS ORIENTATION:**
- Create scenario's, or use role play, to initiate discussion.

**ATTENDANCE POLICY:**
- Persuade your classmate to skip out tomorrow, to go to the beach.
- Non-argumentative persuasion.
- Avoid: ignoring, oversimplifying and dismissing weak arguments.

**After the activity:**
- Examine what the speaker accomplished (besides getting the claim accepted).
- Examine the reason for the claim (clarify issues, evaluating source credibility, raising questions and examining assumptions).

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**PROVIDING EVIDENCE FOR CONCLUSIONS**

**PEN /PAPER TESTING:**

**SHORT ANSWER QUESTIONS**
- Do you include a WHY component?

**FILL IN BLANKS**
- INCLUDE A FOLLOW UP QUESTION (WHY/WHY NOT) SO THEY ARE FORCED TO PONDER THE STATEMENT IN LIGHT OF CLASS DISCUSSIONS

**TRUE FALSE**
- IF A STATEMENT IS FALSE, THE STUDENT SHOULD BE EXPECTED TO STATE WHY IT IS FALSE
  (THIS CAN BE EXTRA CREDIT OR PART OF THE TEST)

**CLINICAL & LAB EXPERIENCE**
- LISTEN TO STUDENTS IN CLINICAL
  - DO THEY OFFER EXCUSES OR REASONS AND RATIONALS (SHOW THEM THE DIFFERENCE)

**LAB CONCLUSIONS**
- WRITE OUT THE CONCLUSION BASED ON THE OBJECTIVE & THE ACTIVITY / RESULTS
CONTENT BASED JOURNALS

AFFECTIVE DOMAIN:
- Using the professional practice standards, faculty should first identify criteria for student learning, which reflects the cognitive level of learning your program expects: (ex. Receiving, Responding, Valuing, Organization or Internalizing)
- Divide up criteria between faculty, to match their course work objectives.
- When appropriate, integrate class discussions relevant to course work, to allow students to develop their own perspectives.
- Encourage fair-mindedness (blind acceptance and peer pressure discouraged).
- Presenting different viewpoints allows them to identify relationship between thoughts and underlying feelings.

Students can keep their own journals of these discussions, to chart their progress in the affective domain.

CONTENT BASED JOURNALS
INTEGRATION OF CRITICAL VOCABULARY:
ASSUME
INFER
CONCLUDE
CRITERIA
POINT OF VIEW
RELEVANCE
ISSUE
CONTRADICTION,
CREDIBILITY
EVIDENCE
DEFINITION

Journals on thoughts related to course requirements, can be shared during lab. Points to clarify can surface from these discussions and lab activities created on the spot to reinforce ideas, explain phenomenon or demonstrate points the students are making.

CONTENT BASED JOURNALS

CI's can keep content based journals of student progress, instead of doing daily reports on their own activities at clinical:
- An ongoing record of observed strengths and weaknesses in their students.
- Reviewing such a journal can help to make notes on developing a plan for intervention, when needed.

GOALS OF THIS ACTIVITY:
- Takes the focus off the goal, and puts it into the process.
- Empowers instructors by increasing their effectiveness in the area of both technical and professional core content delivery.
- CI's discuss their journal contents with the specific student, so the student can relate to an actual situations, rather than conceptual ideals.
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**BRAINSTORMING**

- Record a number of ideas/alternative solutions to a problem.
- Pushing yourself past the initial flood of ideas is critical.
- Helps students to differentiate between facts and ideals, by seeing things around them realistically.
- Independent thinking is encouraged when each student is trying to come up with the next idea on the list.

**During discussion**—
- Clarify ideas,
- Raise root questions,
- Evaluate actions,
- Examine assumptions,
- Recognize contradictions between solutions.
- Explore implications and consequences.
- Supply evidence for a conclusion.

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**BRAINSTORMING**

**STUDENT INPUT INTO PROGRAMMATIC PLANNING**:

- "Bagel breakfast" once a year—
  - Discuss progress from students’ perspective.
  - Discussion of problems, difficulties, challenges within the curriculum.

  Rather than faculty saying "we will consider their comments", we have them brainstorm ideas to solve the issues.

  - If the number of solutions we ask them to come up with is high enough... they often come around to ideas that solve the problem.
  - THEY are doing the work, instead of the faculty!

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**BRAINSTORMING**

**INFORMED CONSENT**:

- Groups are given different consent forms from our affiliates (names replaced with "NUKEM GENERAL HOSPITAL").
- They use the overall criteria for informed consent to determine inconsistencies on the form.
- They determine if the form meets the criteria for informed consent.

  **Suggestions to improve the form are offered**, addressing:
  - Vocabulary
  - Assumptions
  - Inferences
  - Contradictions
  - Generalizations
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BRAINSTORMING

INTRO TO...
- Make weekly schedules to facilitate a transition into the study of medicine.
- Make monthly schedules after that so the student has a working schedule for the semester.
- Emphasis is on balancing
  - study life
  - clinical
down time
  - sleep
  - additional jobs
  - family obligations

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INSTRUCTOR INITIATED QUESTIONS & DIRECTIONS

CLINICAL-
- Observing your students as they watch RT’s work.
- Ask them, “what do you see?”, “what do you hear?”, “If the exam continues in this manner, what would the outcome be?”

HAVE THEM:
- Identify non-verbal communication that the patient is offering.
- List some of the supplies that the RT may need during the case.
- Identify as many problems with the particular approach as they are able to.

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INSTRUCTOR INITIATED QUESTIONS & DIRECTIONS

IN THE CLASSROOM –
Asking if any one has questions, is different than questioning your students.
- Try,
  - “when I said X – what did I mean?”
  - “The text says X - explain that to me as if I was a patient and give an example to clarify.”

Using a new term in class?
- Look for similarities.
- Ask, “What is another term you know, that means the same thing or sounds the same?”
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**INSTRUCTOR INITIATED QUESTIONS & DIRECTIONS**

**LAB**-
What equipment will we need to do this activity today?
What things will you consider before positioning a patient for “X” exam/procedure?
When tempted to tell facts in lab, stop yourself and form those facts into a question.

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**INSTRUCTOR INITIATED QUESTIONS & DIRECTIONS**

**STUDENT COMPLAINTS**-
Questions are used here to clarify:
- Am I hearing (anger/frustration) in your tone?
- Why are you so (angry/frustrated) about this situation?
- What do you think is a viable solution?
- Do you mind if I make comments on my observations, and offer suggestions?

A CONCLUSION SHOULD ALWAYS BE ENCOURAGED:
- What did you learn/observe/conclude from this situation?

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**WRITING ACROSS THE CURRICULUM**

**STANDARDIZE REQUIREMENTS FOR PAPERS**
- This evens the playing field and allows the evaluator to be distracted by different writing styles.

**WORK COLLABORATIVELY WITH FACULTY IN YOUR DEPARTMENT**
- Meet and determine who will incorporate writing assignments into their course and how.
- A formal research paper should be done each semester.
- Use progressive expectations.

**GETTING STUDENTS TO PUBLISH OR ENTER CONTESTS**
- Provides feedback outside the program faculty.
- Broadens students self esteem.
WRITING ACROSS THE CURRICULUM
JUNIOR FIRST SEMESTER
Write a letter to a legislator to persuade them to consider RADIOLOGIC TECHNOLOGY a profession, rather than a technical career.

- Become familiar with criteria government uses to determine technical AND professional careers
- Seek supporting evidence that we are a career based on the criteria
- Evaluate actions and practices that can affect such a decision
- Distinguish relevant from irrelevant facts
- Explore implications and consequences of such a shift in career designation (perhaps related to health care reform).

Then change the audience on them:
write similar letter to editor of newspaper (general public with limited knowledge of the issues).

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WRITING ACROSS THE CURRICULUM
(PATHOLOGY / POSITIONING / PRE)
Group assignment
They write a short paper addressing specific elements of a case presentation (as required by a grade rubric).

- Pair junior (first year or first half) and senior (second year or second half) together.
- Senior picks the case based on a pathology related to the case, and how they provided patient care while the Junior focuses on a critique of the technical aspects of performing such an exam (positioning & PRE).
- Collaboration is used in this writing assignment...as the two must make their writing styles mesh.
  - They can not alternate paragraphs or content.
  - It is a sentence by sentence meshing of ideas.

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WRITING ACROSS THE CURRICULUM
CLINICAL (Junior & Senior work together on this one)
Both observe an RT doing a case and write a narrative about it.

- One takes the patient's perspective
- The other takes the caregiver's perspective
- An educator can join in this activity and take the educator's perspective
- They may not collaborate, but must submit them together.
- This is an exercise in taking another's viewpoint.
- Student's switch scenarios in class and act out what was happening for the rest of the class to observe.
- Class must take notes on the words used, the perspective noted, thoughts that lead to feelings and actions, assumptions etc.

Class discusses issues that rise from these dramatic recreations.
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WRITING ACROSS THE CURRICULUM
PRE-PHYSICS

Student submit a list of possible essay questions at the onset of instruction on certain topics.

- What they need to know from that topic of lecture

As part of the course lecture, the class discusses these questions.

- Determines if the questions were asked in the best manner...

- Combine several similar questions into one new question.

Instructor assigns the final questions as homework assignments.

The instructor groups the homework answers by similarities & posts them on an overhead.

- The class works in groups to determine what the best possible answer would be.

- The class discusses the possible answers and comes to a conclusion to what would be criteria for correcting the essay question.

The exercise helps them to answer essay questions more thoughtfully in the future.

Discussion, thinking and organized writing skills are the outcome.

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COOPERATIVE LEARNING

INTRO-

Have the students critique their homework assignment (create weekly “schedules”).

- Tell them to find someone with the same free time as they have on their schedules.

- From these groups form smaller groups based on students learning styles, so there is a mix.

- All members then have something to contribute (different perspectives).

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COOPERATIVE LEARNING

PATHOLOGY –

- Study groups formed early in the program, are used to present a particular pathology to the class each week.

- Presentations are a maximum of 10 minutes in length (the shorter the better - makes them focus on identifying the MOST important information on that pathology).

- Each group must support their topic with images either from the internet or clinical.

- Students also grade each others participation.

- So the grade a student earns is part group score and part their own contribution (averaged or weighted).
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**MORAL DILEMMAS**

**PATIENT CARE -**

A VALUES CLARIFICATION EXERCISE TO EXAMINE ACADEMIC CHEATING:

- Is it a dishonesty against anyone other than the self?
- What criteria do we form to define cheating?
- Identify the good moral characteristics that a person entering the field of radiography should have.
- Discussion on whose characteristics these are, whose morals are followed (religious, social, cultural), whose morals are we stepping on?

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**MORAL DILEMMAS**

**ER PATIENT -**

Child involved in a trauma needs a life saving operative procedure. Parent prohibits blood transfusion due to religious beliefs. MD agrees and operates, but during operation the boy is losing life and requires a transfusion to save him.

- Discuss moral implications of the surgeon overriding parents orders...
- Implications of the nurse refusing to follow MD orders.
- Implications of the anesthesiologist who argues with the team not to hang the blood.
- Implications of the RT who walks out on the operation so as not to have a part in the deception.

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**VALUES CLARIFICATION**

(Exploring thought underlying values)

Students must have the opportunity to discover their own value system.
There must be Socratic discussions to discover what each student believes.
The instructors must include these discussions often during the first and second semester of the curriculum to offer the most benefit with the professional development plan.
One such activity to discover personal beliefs would be to review a list of people awaiting organ transplant. Descriptions should include folks who will generate conflict:

- an alcoholic who is a born again Christian
- a single mother of three who contracted hepatitis through IV drug use after her parents died
- a clergy person who is also a local artist
- an elderly woman who is active in her community
- Someone who is HIV +, married and a successful business person with a family

Specific exercises to initiate Socratic discussion can also include a list of scenarios which each student must review & determine which would be:

- wrongs punishable by severe penalty
- wrongs punishable by a less severe penalty

Before the start, class determines the criteria to use when determining a severe penalty and what constitutes a less severe penalty (examples: a monetary penalty is less severe and loss of freedom/life is a more severe penalty). This will help to demonstrate where the students' values are placed. After determining the punishment, a scenario is read and the punishment is imposed. The class discusses their difficulties in imposition (considerations used to make a change to their decision).

Recall his or her strengths and uses these to benefit patients, co-workers and the profession.

Students can take a self-evaluation type values clarification survey. Then discuss what they wish to, with a group.

After the group discussion they answer questions relative to their original survey:

- Did they change their beliefs after discussion, why not?
- Did they reaffirm their beliefs after discussion, why?
- What experiences in their lives helped to form their beliefs?
EXPRESSING OPINIONS

Students frequently start a classroom discussion or an essay monologue by stating “in my opinion…”

- therefore instructors can require all statements of this type, to be backed up by facts.

Ask them:
- What makes you say that?
- What makes you conclude that?
- What makes you suspect that?

EXPRESSING OPINIONS

Students can be assigned to write a short descriptive paper as part of their off hour rotations in clinical.

- Students feel free to express their opinions in this type of paper.
- They must note similarities and differences from their regular clinical shift, to this shift.
- They note and comment on RT interaction, atmosphere, work load, case type etc.
- They must also note disadvantages and advantages and give valid reasons to support their comments.

EXPRESSING OPINIONS

To follow through on the previous exercises, have the students take a test which is composed of both textual information and what they tend to hear in the clinical setting.

- The students are asked to indicate by the letter O or F as to whether the statement is an opinion or a fact.
- They must also defend their response with a short answer reply.
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**TEXT BOOK LANGUAGE ANALYSIS**

**MEDICAL TERMINOLOGY:**
Student must make two sentences using the same word, from a list of medical terminology.

“Some babies are fed with breast milk and some with formula. The formula for the inverse square law is...”

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**TEXT BOOK LANGUAGE ANALYSIS**

Students summarize an assigned chapter.

✓ The instructor puts a length limit on the summary, so the students are forced to select only the most important facts to present in their summary.

By paring down the information, students must contemplate what they read, determine what is important and pare down the information so it “fits” into the assignment length.

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**TEXT BOOK LANGUAGE ANALYSIS**

**MEDICAL TERMINOLOGY & ANY COURSE:**
Students must find 5 words in an assigned chapter whose precise definition they don’t know.

✓ They can not look up the term.
✓ They are to use their background knowledge to compose a sentence using the term.
✓ Students share sentences and discuss which ones seem to make the most sense.
✓ Then look up the term, to verify the meaning(s).
Students often transfer lecture notes to flash cards. We encourage them to color code their subjects to facilitate more organized study habits.

- Students must pare down information from notes/text/lab to the bare essentials.
- Instructors review the cards to be certain a minimalist approach is being taken.

The student with the most cards "wins" the less that is written -- the easier it is to remember what is on the card.

Students are given word problems to dissect.
- The student is told to begin by taking out the extraneous information (crossing it out).
- They must circle all directive words (ex. estimate, calculate etc.)
- Next the student must highlight the important facts needed to solve the problem.
- Lastly, the student identifies the formula or mathematical process needed to solve the problem.
- Finally the student rewrites the problem in their own words, then solve it.

Students are asked to preview assigned readings by answering some questions related to comprehension (before the class lecture).

Read the chapter/assigned reading:
- Think about what you already know about the topic.
- Write what you wish to learn in class.
- Formulate questions that will help you learn what you still wish to know about the topic.
- Hand these in at the start of the class.

After lecture, they must answer their own questions & submit:
- Did the chapter not provide enough info?
- Did lecture not clarify what they were confused about?
- Was the student unable to comprehend the terminology or was it the concepts that presented the problem?
WE ARE ONLY LIMITED BY OUR FEAR

SUMMARY

• CRITICAL THINKING IS cognitive accountability
• Everyone can learn critical thinking
• Educators model critical thinking through a variety of traits and characteristics

SUMMARY

• PLAN for infusing critical thinking (take it step by step)
• Identify what Critical Thinking skills you want your students to have (ref: Richard Paul / HANDOUT)
• Use Bloom’s Taxonomy (cognitive / affective domains) to form a progressive competency approach
• Select ideal Teaching Techniques
• Determine Evaluation tools
COOL!!
this lecture
is on the
AEIRS
web site!