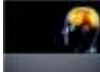


Slide 1

LEARNING ACTIVITIES
THAT FOSTER
CRITICAL THINKING
SKILLS




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Slide 2

Critical Thinking

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



Mindful learning
Active learning

Slide 3

Richard Paul's
35 Approaches
to Critical Thinking



Your handout has this web site listed:
<http://www.criticalthinking.org/resources/k12/TRK12-strategy-list.cfm>


Slide 4

| 21 Cognitive Strategies | 4 Affective Strategies | |
|--------------------------------------|---|--|
| Avoiding oversimplification | Distinguishing facts from ideals | Fostering independent thinking |
| Transferring ideas to new contexts | Integrating critical vocabulary | Fostering fair-mindedness and respect |
| Developing one's perspective | Distinguishing ideas | Exploring thoughts underlying feelings |
| Clarifying issues and claims | Refining generalizations | Suspending judgment |
| Clarifying ideas | Distinguishing relevant from irrelevant facts | |
| Developing criteria for evaluation | Making plausible inferences | |
| Examining assumptions | Supplying evidence for a conclusion | |
| Evaluating arguments | Recognizing contradictions | |
| Generating or assessing solutions | Exploring implications and consequences | |
| Clarifying or critiquing text | Evaluating source credibility | |
| Making interdisciplinary connections | | |

Slide 5

| | |
|--|---|
| Patient Care Courses: Radiography Cardiovascular & Vascular Nuclear Medicine | Making interdisciplinary connections Exploring implications and consequences Examining assumptions Exploring thoughts underlying feelings Developing one's perspective |
| Technical Courses: Positioning CMI procedures Nuclear Medicine Procedures | Making interdisciplinary connections Exploring implications and consequences Supplying evidence for a conclusion Clarifying or critiquing text Developing criteria for evaluation |
| Scientific Principles: Principles of Exposure Nuclear physics | Making interdisciplinary connections Exploring implications and consequences Supplying evidence for a conclusion Recognizing contradictions Clarifying or critiquing text |
| Quality Assurance | Transferring ideas to new contexts Fostering independent thinking Developing criteria for evaluation |

Slide 6

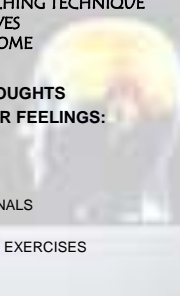
| | |
|--|---|
| LEARNING ACTIVITIES TO FOSTER CRITICAL THINKING: COMPARE & CONTRAST PROBLEM SOLVING CONTENT BASED JOURNALS BRAINSTORMING CREATIVE DRAMA INSTRUCTOR INITIATED QUESTIONS AND DIRECTIONS WRITING ACROSS THE CURRICULUM COOPERATIVE LEARNING LEARNING CONTRACTS MORAL DILEMMAS VALUES CLARIFICATION EXPRESSING OPINIONS TEXTBOOK LANGUAGE ANALYSIS COMPUTER AIDED INSTRUCTION |  |
|--|---|

Slide 7

**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



Slide 8

**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




Slide 9

**DETERMINE WHICH TEACHING TECHNIQUE
BEST SERVES THE OUTCOME**

- Clarifying issues & claims
- Clarifying ideas
- Examining assumptions
- Evaluating arguments
- 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




Slide 10

**DETERMINE WHICH TEACHING TECHNIQUE
BEST SERVES THE OUTCOME**

Avoiding oversimplification
Clarifying ideas
Developing criteria for evaluation
Evaluating arguments
Generating /assessing solutions
Distinguishing facts from ideals
Refining generalizations
Distinguishing relevant from irrelevant facts
Supplying evidence for a conclusion

- PROBLEM SOLVING
- COOPERATIVE LEARNING
- BRAINSTORMING
- CREATIVE DRAMA
- EXPRESSING OPINIONS
- INSTRUCTOR INITIATED QUESTIONS / DIRECTIONS



Slide 11

**DETERMINE WHICH TEACHING TECHNIQUE
BEST SERVES THE OUTCOME**

- DEVELOPING ONE'S PERSEPECTIVE
- FOSERING INDEPENDENT THINKING
- SUSPENDING JUDGEMENT

- COOPERATIVE LEARNING
- BRAINSTORMING
- CREATIVE DRAMA
- EXPRESSING OPINIONS
- MORAL DILEMMAS / REASONING
- VALUES CLARIFICATION



Slide 12

Let's take a look at
a few different activities
that can
foster
critical thinking skill development
in the
Radiologic Technology classroom



Slide 13

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.



Slide 14

NOTING SIMILARITIES & RECOGNIZING CONTRADICTIONS

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



Slide 15

NOTING SIMILARITIES & RECOGNIZING CONTRADICTIONS

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




Slide 16

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!)



Slide 17

PROVIDING EVIDENCE FOR CONCLUSIONS

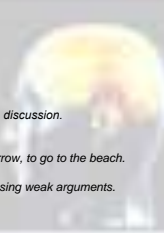
CLINICAL / CLASS ORIENTATION -
Create scenario's, or use role play, to initiate discussion.

ATTENDANCE POLICY:

- ✓ Persuade your classmates 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).



Slide 18

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 IN-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 STUDENT'S 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



Slide 19

CONTENT BASED JOURNALS

AFFECTIVE DOMAIN-

- ✓ Using the professional practice standards, faculty should first identify criteria for these standards, 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 perspective.
- ✓ Encourage Fair-Mindedness (blind acceptance and peer pressure discouraged).
- ✓ Presenting different view points 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.

Slide 20

CONTENT BASED JOURNALS

INTEGRATION OF CRITICAL VOCABULARY:

ASSUME
INFER
CONCLUDE
CRITERIA
POINT OF VIEW
RELEVANCE
ISSUE
CONTRADICTION,
CREDIBILITY
EVIDENCE
DISTINGUISH

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.

Slide 21

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 competency development.
- ✓ CI's discuss their journal contents with the specific student, so the student can relate to an actual situations, rather than conceptual ideals.

Slide 22

BRAINSTORMING

- ✓ Record a number of ideas / alternative solutions to a problem.
 - ✓ Pushing yourself past the initial flood of ideas is critical.
 - ✓ Then explore each individually to determine the most effective solution.
 - ✓ Quota & deadlines are important
- ✓ 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,
 - ✓ raising root questions,
 - ✓ evaluate actions,
 - ✓ examine assumptions,
 - ✓ recognize contradictions between solutions,
 - ✓ Explore implications and consequences
 - ✓ supply evidence for a conclusion.

Slide 23

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!

Slide 24

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

Slide 25

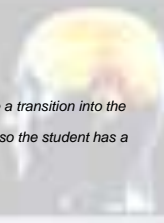
BRAINSTORMING

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



Slide 26

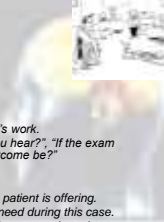
INSTRUCTOR INITIATED QUESTIONS & DIRECTIONS

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 this case.
- ✓ Identify as many problems with the particular approach as they are able to.



Slide 27

INSTRUCTOR INITIATED QUESTIONS & DIRECTIONS

IN THE CLASSROOM-

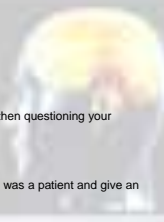
Asking if any one has questions, is different then questioning your students.

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?"

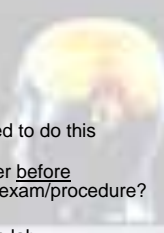


Slide 28

**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.

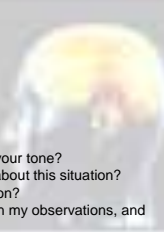


Slide 29

**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?



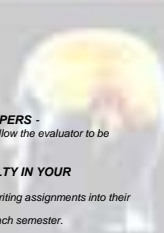
Slide 30

**WRITING ACROSS THE
CURRICULUM**

STANDARDIZE REQUIREMENTS FOR PAPERS -
 ✓ This evens the playing field and does not allow 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.



Slide 34

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 question was 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 conclusions 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.

Slide 35

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).

Slide 36


COOPERATIVE LEARNING

PATHOLOGY-
 ✓ Study groups formed early on 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 participation (averaged or weighted).

Slide 37

MORAL DILEMMAS



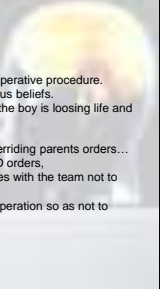
PATIENT CARE -

A VALUES CLARIFICATION EXERCISE TO EXAMINE ACADEMIC CHEATING:

- ✓ It is 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?

Slide 38

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.

Slide 39

VALUES CLARIFICATION

(Exploring thought underlying feelings)

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.



Slide 40

VALUES CLARIFICATION
(Exploring thought underlying feelings)

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

Slide 41

VALUES CLARIFICATION
(Exploring thought underlying feelings)

ETHICS -
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 constitute 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).

Slide 42

VALUES CLARIFICATION
(Exploring thought underlying feelings)

NUCLEAR MEDICINE- (practice standards):
Recognizes his or her strengths and uses them 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?

Slide 43

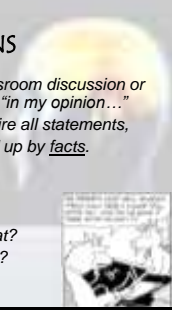
EXPRESSING OPINIONS

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?

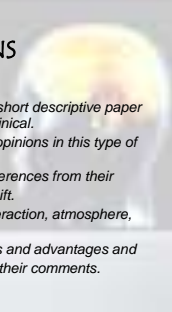


Slide 44

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.



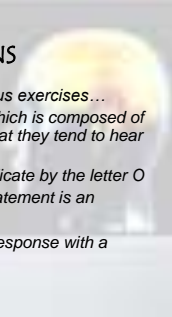
Slide 45

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.



Slide 46

TEXT BOOK
LANGUAGE ANALYSIS

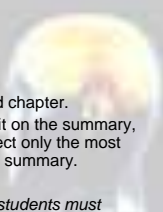


MEDICAL TERMINOLOGY-
Student must make two sentences using the same word, from a list of medical terminology.

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

Slide 47

TEXT BOOK
LANGUAGE ANALYSIS

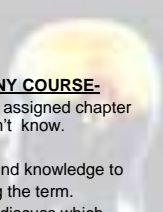


Students summarize an assigned chapter.
✓ The instructor puts a length limit on the summary, so the students are forced to select only the most important facts to present in their summary.

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.

Slide 48

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 back ground 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).

Slide 49

**TEXT BOOK
LANGUAGE ANALYSIS**

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.

Slide 50

**TEXT BOOK
LANGUAGE ANALYSIS**

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.

Slide 51

**TEXT BOOK
LANGUAGE ANALYSIS**

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 this topic.
- ✓ Write what you wish to learn in class.
- ✓ Formulate questions that will help you learn what you still wish to know about this topic.
- ✓ Hand these in at the start of the class.

After lecture, they must answer their own questions & submit:
They must comment on whether they were able to answer all their questions (including why or why not).

- ✓ 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?

Slide 52



Slide 53

SUMMARY

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

Slide 54

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**

Slide 55

